

GOVERNMENT OF ASSAM

**DIRECTORATE OF TECHNICAL
EDUCATION, ASSAM**



**NEW CURRICULAR STRUCTURE & SYLLABI OF 3-YEARS
FULL TIME DIPLOMA COURSE**

IN

**ELECTRONICS AND TELECOMMUNICATIONS
ENGINEERING**

UNDER

**STATE COUNCIL FOR TECHNICAL EDUCATION : ASSAM
KAHILIPARA : GUWAHATI-781019**

PROGRAMME OUTCOME (PO)

PO1: To apply knowledge of basic sciences and mathematics to attain the solutions pertaining to problems associated with the discipline.

PO2: To analyse an engineering problem, formulate and implement solutions based on mathematical and engineering modeling.

PO3: To work effectively as an individual as well as in a group to provide technical and visionary leadership to others.

PO4: To apply ethical and legal principles of engineering practice in creating an awareness of social issues with appropriate responsibility.

PO5: To communicate effectively on engineering topics with a range of engineering community in particular and society in general.

PO6: Awareness of the requirement for and ability to engage in continuing professional development in the field of engineering in general and electronics and communication in particular.

PO7: To learn and use modern tools and techniques for computing practice.

PO8: To conduct investigation of complex problems using research based knowledge and techniques.

PO9: To understand the impact of electronics and communication engineering solutions to society and environment.

PO10: To apply management principles in multidisciplinary projects.



PROGRAMME SPECIFIC OUTCOME (PSO)

PSO1: The ability to absorb and apply fundamental knowledge of core Electronics and Communication Engineering subjects in the analysis and development of various types of integrated electronic systems as well as to interpret and synthesize the experimental data leading to valid conclusions.

PSO2: Acquire competence in using electronic modern IT tools (both software and hardware) for the study and analysis of complex electronic systems in furtherance to research activities.

PSO3: Develop individual adaptability to changing work environment, good interpersonal skills as a leader in a team in appreciation of professional ethics and societal responsibilities.

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THIRD SEMESTER

ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING



COURSE STRUCTURE OF ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING (3RD SEMESTER)

S/N	Subject Code	Subject	Study Scheme Contact hours/week			Evaluation Scheme									
						Theory					Practical			Total Marks (Theory +Practical)	Credit
			L	T	P	ESE	Sessional (SS)			Pass (ESE +SS)	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)		
						TA	HA	Total (TA+ HA)							
1	Co-301	Computer Application & Programming	3		3	70	10	20	30	33/100	25	25	17/50	150	4
2	Hu-302	Engineering Economics & Accountancy	3		-	70	10	20	30	33/100	-	-	-	100	3
3	Sc-303	Mathematics-III	3	1	-	70	10	20	30	33/100	-	-	-	100	3
4	El-304	Elements of Electrical Engineering	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
5	Et-305	Analog Electronics-I	3	-	3	70	10	20	30	33/100	25	25	17/50	150	5
6	Et-306	Electronic Workshop-I	-	1	6	-	-	-	-	-	100	50	50/150	150	4
7	Et-310	Professional Practice- I	1		2	-	-	-	-	-	25	25	17/50	50	2
			35			Total								850	25



1: Course Title–Computer Application& Programming (All Branches)

2: Course Code –Co-301

3: Semester- 3rd

4: Aim of the Course :

- To give basic concepts related to organisation of a computer
- To give fundamental terminologies in networking
- To develop simple programs in C.

5: Course Outcome:

On completion of the course students will be able to:

- Explain the basics of a computer hardware and software
- Solve problems related to number systems
- Define basics of Operating System
- Familiarize with networking components
- Write simple C programs

6: Prerequisites for the Course: Have basic idea about a computer and its functions.

7: Teaching Scheme (in hours):

Teaching Scheme			
L	T	P	Total hours per week
3	0	3	6

8: Examination Scheme :

	Theory (T)	Sessional (TS)	Practical (P)	Practical Sessional (PS)
Full Marks	70	30	25	25
Pass Marks	33		17	



9: Detailed Course Content:

Unit	Topic/Sub-Topics	Intended Learning Outcome	Hours
1	Computer Architecture: Brief history, Charles Babbage Machine, Von Neuman Architecture, block diagram, memory & its different types, I/O devices, Role of O.S., computer languages, translator software, editor. Data, different types of data, information and its characteristics	<ol style="list-style-type: none"> 1. Define a computer and identify its parts. 2. Define computer memory & describe its different types. 3. Define computer languages & translators. 4. Describe the characteristics of information. 	8
2	Number System and codes: Different number system- decimal, binary, octal, hexadecimal number system, their conversion, 1's and 2's Complement, subtraction using complements. Different codes- ASCII, BCD, Ex-3, Gray. Conversion from Gray to binary and vice-versa, BCD addition.	<ol style="list-style-type: none"> 5. Define decimal, binary, octal & hexadecimal number systems. 6. Convert between different number systems. 7. Define 1's & 2's complements. 8. Subtract using 1's & 2's complements. 9. Describe some different codes. 	8
3	Introduction to Operating System: Definition, single user and multi-user OS, different function performs by OS, various popular OS like DOS, Windows, UNIX/LINUX. DOS and UNIX commands.	<ol style="list-style-type: none"> 10. Define operating system. 11. Operate different commands of DOS, Windows & UNIX/LINU. 	5
4	Computer Network and the Internet: Definition, necessity of network, different types of network-LAN, MAN, WAN, network topology, transmission media, different network devices like NIC, hub, bridge, switch, gateway. Introduction to the internet, Internet services, browser, search engine.	<ol style="list-style-type: none"> 12. Define network. 13. Describe different types of network. 14. Define network topology. 15. Describe different network devices. 16. Define internet & describe different internet services. 17. Explain use of different browsers & search engines. 	6
5	Introduction to C programming: Fundamentals of programming- Algorithm & Flowchart, source code and object code, Basic structure of C programs, Executing a C program, Constants, Variables, and data types.	<ol style="list-style-type: none"> 18. Write algorithm and flow charts for simple programs. 19. Define basic terminology of C language. 20. Write small program using C language. 	15

	Operators and expression, Input Output function like printf, scanf, getchar, putchar, gets, puts, Decision making and branching using IF..Else, Switch, looping using for, while, and do-while, array.	21. Write diversified solutions using C language. 22. Differentiate between IF..Else and Switch statement.	
	Internal Assessment		3

Intellectual Skills :

- Logical reasoning
- Relating programming concepts in problem solving

Motor Skills :

- Learn to use and handle a computer and its peripherals.

List of Lab Exercises :

- I. **Basic commands for computer system maintenance.**
- II. **Preparation of Documents**

Introduction to Word processing, Opening a document, preparing documents, inserting diagrams and tables, Editing document- (a) Character, word and line editing, (b) Margin Setting, Paragraph alignment, (c) Block Operations, (d) Spell Checker, (e) Saving a document, (f) Mail merge.

III. Information Presentation through Spread Sheet

Application of Spread Sheet, Structure of spreadsheets, Preparing table for simple data and numeric operations, Using formulae and functions in excel operations, Creation of graphs, Pie charts, bar charts.

IV. Preparation of presentation

Creation of electronic slides on any topic, Practice of animation effect, presentation of slides.

V. Programming in C

Editing a C program, defining variables and assigning values to variables
Arithmetic and relational operators, arithmetic expressions and their evaluation
Practice on input/output function like get char, put char, gets, puts, scan, print etc.



Programming exercise on simple if statement, If else statement, switch statement

Programming exercise on looping with do-while, while, for loop and array.

10: Distribution of Marks:

Unit	Topic	Type of Question			Total Marks
		Objective	Short	Descriptive	
1	Computer Architecture	6	5	5	16
2	Number System and codes	4	2	8	14
3	Introduction to Operating System	4	2	4	10
4	Computer Network and the Internet	5	3	6	14
5	Introduction to C programming	6	3	7	16
		25	15	30	70

11: Table of specification :

Unit	Topics (a)	Time allotted in hours (b)	Percentage Weight age (c)	K	C	A	HA
1	Computer Architecture	8	19	✓			
2	Number Systems & Codes	8	19	✓		✓	
3	Introduction to Operating Systems	5	12	✓			
4	Computer Network & the Internet	6	15	✓		✓	
5	Introduction to C Programming	15	35	✓		✓	
Total		Σ b=42	100				

K = Knowledge C =Comprehension A=Application HA=Higher Than Application (Analysis, Synthesis, Evaluation)

$$c = \frac{b}{\Sigma b} * 100$$

Detailed Table Of Specifications

Unit	Topics	Objective				Short					Descriptive				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Computer Architecture	7			7	5				5	4				4
2	Number Systems & Codes	4			4	2				2	4		4		8



3	Introduction to Operating Systems	4			4	2				2	4				4
4	Computer Network & the Internet	5			5	3				3	3		4		7
5	Introduction to C Programming	5			5	3				3	3		4		7
Total		25			25	15				15	18		12		30

K = Knowledge C = Comprehension A = Application HA = Higher Than Application T = Total

12: Suggested Implementation Strategies:

- 1: As the subject is taught to the students of all branches, basic knowledge required to understand the computer hardware and software needs to be emphasised.
- 2: Too much of hardware details could be avoided.
- 3: Programming section theory could be taught side by side in the lab.

13: Suggested Learning Resources :

1. Fundamentals of Computer, Rajaraman, PHI
2. It Tools and Applications, DOEACC "O" Level, Firewall Media
3. Let us C by Y. Kanetkar, BPB
4. Programming in ANSI C / E. Balagurusamy / Tata McGraw-Hill



2: Course Title :ENGINEERING ECONOMICS AND ACCOUNTANCY

1. Course Code: **Hu – 302**

2. Semester: **III**

3. Aim of the Course:

1. To introduce the students to some important economic and accounting terms.

2. To acquaint the students with some economic laws and with the functions of money, bank etc.

3. To make the students capable of recording business transaction under double entry system.

4. To introduce the students about financial statements.

5. Course Outcomes:

On completion of the course on EEA, students will be able to

- CO₁ = Define some important economic and accounting terms.
- CO₂ = explain some basic economic laws.
- CO₃ = Describe overall economic environment.
- CO₄ = explain double entry system of book keeping.
- CO₅ = record business transactions under double entry system of book keeping
- CO₆ = define financial statements.

6. Teaching Scheme (in hours)

Lecture	Tutorial	Practical	Total
42hrs	3 hrs	--	45hrs

7. Examination Scheme:

Theory	Practical	Total
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Examination Full Marks	Sessional Full Marks	Total Marks	Pass Marks	Examination		Sessional		Marks
70	30	100	33	--	--	--	--	100

8. Detailed Course Content:

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
Part – A : Engineering Economics				21hrs
1.0	Introduction to Economics:	i) Definition of Economics, its utility and scope of study ii) Definition of Engineering Economics ii) Meaning and concepts of Utility, Consumption, Value, Price, Goods and National Income, inflation iii) Wants – Definition and characteristics iv) Wealth & Welfare– Definition, meaning and types	i) explain core economic terms concepts and theories	5
2.0	Demand and Supply :	i) Meaning and types of Demand ii) The Law of Demand, its limitations iii) Preparation of Demand Schedule iv) Meaning of Supply ii) The Law of Supply, its limitations iii) Preparation of Supply	Define the Laws of Demand and Supply	4



		Schedule		
3.0	Production :	i) Meaning and factors of production ii) Factors determining efficiency of labour iii) Savings, investment and capital formation iv) Meaning of production function	i) Define factors of production ii) Explain formation of capital	5
4.0	Money:	i) Meaning of money ii) Types of money iii) Functions of money	i) Understand meaning and functions of money	2
5.0	Banking Organisation:	i) Central Bank – its functions ii) Commercial banks – its functions	i) Distinguish the functions of different banks	3
6.0	Pricing	i) Objectives of pricing policy ii) price determinants iii) Price discrimination	i) explain pricing policy	2
Part – B : Accountancy				21hrs
7.0 (A)	Introduction to Book-Keeping and Accounting:	i) Definition & objectives of Book-keeping ii) Need and advantages of Book-keeping iii) Definition of	i) Define Double Entry System of Book Keeping ii) State its objectives, features merits and	3

		Accounting iv) Difference between Book-keeping and Accounting v) Double Entry System – main features vi) Advantages and disadvantages of Double Entry System	demerits	
(B)	Introduction to Computerised Accounting System:	i) Components of Computerised Accounting Software ii) Need for Computerised Accounting iii) Difference between Manual Accounting and Computerised Accounting	i) Identify components of computerized accounting software	2
8.0	Transaction:	i) Definition ii) Meaning of Account iii) Classification of Accounts: - Traditional Approach - Modern Approach iv) Meaning of Debit and Credit v) Rules of Debit and Credit	i) State the meaning and rules of Debit and Credit	2
9.0	Journal and Ledger	i) Meaning Journal ii) Recording of Transactions in Journal iii) Meaning of Ledger iv) Objectives and utility	i) Record business transactions under double entry system in books of accounts	4

		<p>of Ledger</p> <p>v) Posting and balancing of Ledger</p> <p>vi) Distinction between Journal and Ledger</p> <p>vii) Names of different Books of Accounts</p>		
10.0	Cash Book:	<p>i) Meaning and importance of Cash Book</p> <p>ii) Characteristics and advantages of Cash Book</p> <p>iii) Discount – Trade Discount and Cash Discount</p> <p>iv) Different types of Cash Book:</p> <ul style="list-style-type: none"> - Single Column Cash Book - Double Column Cash Book - Triple Column Cash Book <p>v) Bank Reconciliation Statement – Basic idea</p>	<p>i) Differentiate different types of Cash Book</p> <p>ii) Record transactions in Cash Book</p>	4
11.0	Trial Balance & Errors in Accounting:	<p>i) Meaning and objects of Trial Balance</p> <p>ii) Main features and advantages of Trial Balance</p> <p>iii) Preparation of Trial Balance</p> <p>iv) Types of errors in Accounting</p>	<p>i) Explain meaning and features of Trial balance</p>	3
12.0	Components of Final Accounts:	<p>i) Meaning and objectives of Trading</p>	<p>i) Identify different components</p>	3

		Account ii) Contents of Trading Account iii) Meaning and objectives of Profit and Loss Account iv) Contents of Profit and Loss Account v) Meaning of depreciation, revenue expenditure and capital expenditure vi) Contents of Balance Sheet	of Financial Statements	
	Class Test			3 hrs
	Total			45 hrs

(9) TABLE OF SPECIFICATIONS for Engineering Economics & Accountancy

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Compre-hension	Application	HA
1	Introduction to Economics	5	12	5	3	0	0
2	Demand & Supply	4	9	2	4	0	0
3	Production	5	12	6	2	0	0
4	Money	2	5	4	0	0	0
5	Banking Organisation	3	7	3	2	0	0
6	Pricing	2	5	2	2	0	0



7	(A) Introduction to Book-Keeping	3	7	5	0	0	0
	(B) Introduction to Computerised Accounting System	2	5	3	0	0	0
8	Transaction	2	5	2	1	0	0
9	Journal & Ledger	4	9.5	2	2	3	0
10	Cash Book	4	9.5	0	5	2	0
11	Trial Balance & Errors in Accy	3	7	5	0	0	0
12	Components of Final Accounts	3	7	2	3	0	0
Total		42hrs	100	41	24	5	0

K = Knowledge

C = Comprehension

A = Application

HA = Higher than Application (Analysis, Synthesis, Evaluation)

$$C = \frac{b}{\sum b} \times 100$$

9. Distribution of Marks:

DETAILED TABLE OF SPECIFICATIONS FOR EEA

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	Total
1	Introduce	3	1	0	4	2	2	0	0	4	0	0	0	0	0	8
2	Demand & Suppl	0	0	0	0	0	0	0	0	0	2	4	0	0	6	6
3	Production	1	0	0	1	2	0	0	0	2	3	2	0	0	5	8
4	Money	2	0	0	2	2	0	0	0	2	0	0	0	0	0	4
5	Banking Organis	1	0	0	1	0	0	0	0	0	2	2	0	0	4	5



6	Pricing	2	2	0	4	0	0	0	0	0	0	0	0	0	0	4
7	Introduce to B K	2	0	0	2	3	0	0	0	3	0	0	0	0	0	5
	Introduce to Compute	3	0	0	3	0	0	0	0	0	0	0	0	0	0	3
8	Transact	2	0	0	2	0	1	0	0	1	0	0	0	0	0	3
9	Journal & Ledge	1	0	0	1	0	0	0	0	0	1	2	3	0	6	7
10	Cash Book	0	2	0	2	0	0	0	0	0	0	3	2	0	5	7
11	Trial Balance	3	0	0	3	2	0	0	0	2	0	0	0	0	0	5
12	Compons F/Ac	0	0	0	0	0	0	0	0	0	2	3	0	0	5	5
	Total	20	5	0	25	11	3	0	0	14	10	16	5	0	31	70

K = Knowledge

C = Comprehension

A = Application

HA = Higher Than Application T = Total **Higher than Application (Analysis, Synthesis, Evaluation)**

10. **Suggested implementation Strategies:** Modified syllabus may be implemented with effect from July, 2018 (Starting with the present batch (2018) of 2nd Semester students)

11. Suggested learning Resource:

a. Book list

Sl. No.	Title of Book	Name of Author(s)	Publisher
1	Introductory Micro Economics	Sandeep Garg	Dhanpat Rai Publication Pvt. Ltd. New Delhi



2	Introductory Economics Macro	Sandeep Garg	Dhanpat Rai Publication Pvt. Ltd. New Delhi
3	Theory and Practice of Accountancy	B. B. Dam R. A. Sarda R. Barman B. Kalita	Capital Publishing Company, Guwahati – 5
4	Book-Keeping Accountancy &	Juneja, Chawla & Saksena	Kalyani Publisher, New Delhi - 110002
5	Tally. ERP 9 For Beginners	Tally Solutions Pvt. Ltd.	Sahaj Enterprises, Bangalore

- b. List of Journals
- c. Manuals
- d. Others



3: Course Title: Mathematics – III

1. **Course Code : Sc – 303**

2. **Semester : Third Semester**

3. **Aim of the course:**

- To learn about derivatives of functions having two or more variables.
- To learn about formation and solution of equations involving differential co-efficients.
- To learn how to collect, compile and tabulate similar or different types of large data and to draw valid conclusions from them.
- To learn the use of matrices for solving simultaneous equations.
- To learn method of solving two variable linear programming models by the graphical solution.

5. **Course Outcome:**

On completion of the course, students will be able to

- Recognize and differentiate functions having two or more variables.
- Form and solve first and higher order ordinary differential equations having differential coefficients.
- Calculate the measures of central tendency and measures of dispersion from statistical data.
- Determine the correlation co-efficient of bivariate distribution.
- Calculate the probability of occurrences of events under different conditions.
- Solve simultaneous equations using matrices and also solve two variable linear programming models by the graphical solution method.

6. **Teaching scheme(in hours):**

Teaching scheme(in hours)		
Lectures	Tutorial	Total (per week)
3	1	4



7. Examination Scheme:

Theory			Total Marks
ESE Full Marks	Sessional Full Marks	Pass Marks (ESE+Sessional)	
70	30	33	

8. Detailed Course Content:

Chapter No.	Chapter Title	Contents	Intended learning outcomes	hours
		GROUP-A: DIFFERENTIAL CALCULUS Hours: 2 Marks: 5		
A1	Partial differentiation	1.1.Function of two or more variables, Definition and meaning of partial derivatives (first order).	Understand functions having two or more variables.	2
		GROUP – B: DIFFERENTIAL EQUATION Hours: 21 Marks: 30		
B 1	Differential Equation	1.1.Definition, classification, order and degree of a Differential Equation.	Recognize and form differential equations.	3



		1.2. Formation of Ordinary Differential Equations.		
B 2	Ordinary differential equations of first order and first degree	2.1. Separation of variables. 2.2. Homogeneous equations. 2.3 Equations reducible to homogeneous form. 2.4. Exact equations. 2.5. Linear equations. 2.6. Bernoulli's equations. 2.7. Application of Differential Equations[Laws of voltage ,current related to EC,RC,LRC]	Solution of different types of first order and first degree ordinary differential equations and their application in solving different types of circuit related problems.	7
B 3	Differential Equations of first order and higher degree	3.1. Left hand side resolved into factors, 3.2. Equations solvable for x, 3.3. Equations solvable for y, 3.4. Clairaut's equations.	Solution of different types of first order and higher degree ordinary differential equations.	4



B 4	Differential Equations of second order	<p>4.1. Differential Equations of second order with constant co-efficient and right hand side zero.</p> <p>4.1.1. Operator D, Auxiliary equation.</p> <p>4.1.2. Rules for real and equal, real and unequal and complex roots. Complete solution.</p> <p>4.2. Differential Equations of second order with constant co-efficient and right hand side a simple function of x.</p> <p>[Exponential , Trigonometric and algebraic function].</p>	To know about Complementary function, particular integral, General solution, particular solution, complete solution of different types of second order differential equations.	7
		<p>GROUP – C:</p> <p>STATISTICS AND PROBABILITY</p> <p>Hours: 13</p> <p>Marks: 18</p>		
C 1	Measures of Central Tendency	Mean, Median, Mode.	Basic measures of central tendency	3
C 2	Measures of Dispersion	<p>2.1. Range, Quartile Deviation.</p> <p>2.2. Mean Deviation (from mean, median, mode).</p>	Different types of measures of dispersion	5



		2.3. Standard Deviation, Variance, Co-efficient of variation.		
C 3	Correlation	3.1. Definition of Bivariate distribution, scatter diagram. 3.2. Determination of Karl-Pearson's co-efficient of Correlation.	Correlation in bivariate distribution	2
C 4	Probability	4.1. Classical definition of probability 4.2. Addition and multiplication laws, related examples (simple cases).	Definition and uses of probability.	3
		GROUP – D: Graphics, Matrix, Linear Programming problems. Hours: 9 Marks: 17		
D1	Graphics	1.1. Graphs of Trigonometric functions.	Tracing of curves (trigonometric)	2
D2	Matrix	2.1. Transpose of a matrix, 2.2. Adjoint of a square matrix 2.3. Inverse of a matrix 2.4. Solution of Simultaneous Linear equations. 2.5. Characteristic	1. Use of matrices for solving simultaneous equations. 2. Computation of determinants and Eigen values of a matrix.	4



		Equations.		
D3	Linear Programming Problems(Basics)	<p>3.1. Introduction of system of Linear In equations involving two variable and graphical solution of the system.</p> <p>3.2. Mathematical formulation of LPP (two variables).</p> <p>3.3.Unique optimal feasible solution of LPP with two variables by graphical method.[Infinite no. of solutions, unbounded solutions and no solution cases may be discussed but not for the examination point of view)</p>	Method of solving two variable linear programming models by the graphical solution procedure.	3

8. Distribution of Marks:

Chapter No.	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short questions	Descriptive questions	
A1	Partial Differentiation		2	3	
B1	Differential Equation	1+1+1=3	2		
B2	Diff. Equation of first ord.	1+1+1+1=4	2	3	



	first degree				70
B3	Diff. Equation of first ord. higher degree	1+1+1=3	2	3	
B4	Diff. Equation of second order	1+1+1=3	2	3	
C1	Measures of Central Tendency	1+1=2	2		
C2	Measures of Dispersion	1+1=2	2	3	
C3	Correlation			3	
C4	Probability	1+1=2	2		
D1	Graphics	1+1=2		3	
D2	Matrix	1+1=2	2	3	
D3	LPP	2		3	
		25	18	27	70

9. Suggested implementation strategies: The syllabus can be completed by taking regular classes along with tutorial classes. Audio-Visual aids also can be used.

10. Suggested Learning Resources:

- 1. Applied Mathematics (vol. I&II) by R . D. Sharma**
- 2. Engineering Mathematics by H .K. Das**
- 3. Mathematics for Polytechnics by S.P. Deshpande.**
- 4. An Introduction to polytechnic mathematics Vol-II by Parbin Ahmed, Ajanta Choudhury, Geetali Das .**



Annexure-I

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
1	DIFFERENTIAL CALCULUS	2	4.4	2	0	3	
2	DIFFERENTIAL EQUATION	21	46.7	9	16	5	
3	STATISTICS AND PROBABILITY	13	28.9	4	6	8	
4	GRAPHICS, MATRIX, LPP	9	20	4	7	6	
Total		Σ b=45	100				

K = Knowledge

C = Comprehension

A = Application

HA = Higher Than Application (Analysis, Synthesis, Evaluation)

$$c = \frac{b}{\Sigma b} \times 100$$

DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	DIFFERENTIAL CALCULUS					2				2			3		3
2	DIFFERENTIAL EQUATION	7	6		13	2	4	2		8		6	3		9
3	STATISTICS AND PROBABILITY	4	2		6		4	2		6			6		6
4	GRAPHICS, MATRIX, LPP	4	2		6			2		2		3	3+3		9

K = Knowledge, C= Comprehension, A = Application, HA = Higher Than Application, T=Total

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4: Course Title: Elements of Electrical Engineering

1. Course Code: EI - 304

2. Semester: 3rd

3. Rationale of the Subject:

Technology integration is the main characteristic of present engineering development. Now a day, it is necessary to possess basic knowledge of various engineering discipline. The main objective of this subject is to enhance the knowledge and skill level in inter disciplinary area. This course is designed to impart basic knowledge of Electrical Engineering to the students of other disciplines like Civil, Mechanical etc.

4. Aim:

1. To impart basic knowledge of electrical engineering and preliminary idea of DC machine and transformer to the student of branches other than electrical.

2. To enhance the knowledge and skill level of electrical engineering in interdisciplinary area.

5. Objective:

The student will be able to

1. Know circuits with series and parallel resistances, power, energy.

2. Know AC wave form and its various quantities.

3. Interpret the response of R, L, C to AC supply.

4. Know calculation of various parameters of AC series circuit.

5. Know construction, working principle and use of DC machine, transformer.

6(a) COURSE OUTCOMES:-

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

CO 1: Define conductor, insulator, current, voltage. Understand Ohm's law, work, power, energy and solve numerical problem.



CO 2: Explain construction, working principle, application, starting and operation of DC generator and motor.

CO 3: Develop emf equation of single phase ac system, analyze R, L, C, R-L, R-C and R-L-C circuit and know the use of j operator.

CO 4: Understand the construction and working principle of transformer.

CO 5: Know construction, working principle and starting of induction motor.

7. Pre-Requisite:

1. Resistance, inductance, capacitance.

2. Simple differential calculus & integral calculus, matrix.

8. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	1hrs	3hrs	7hrs/week

9. Examination Scheme:

Theory Theory			Pass marks (ESE+SS)	Practical		Pass marks(PT+ PA)	Total mark s (Th+P r)	Cred it
ESE	Sessional (SS)		33/100	P T	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			



10. Detailed Course Content:

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Introduction	1.1 Conductor and Insulator --- Type, Properties and Uses 1.2 Definitions – Current, Voltage, Resistance	1
2.0	Work, Power, Energy and DC Circuit	2.1 Work, Power, Energy – definitions and units, relations, simple problems 2.2 Resistance and resistivity, Conductance and conductivity, Factors on which resistance depends, Effect of temperature on resistance 2.3 Ohm's law, resistance in series, Voltage division rule, Resistance in parallel, Current division rule, Simple problems 2.4 Network terminology – Circuit, parameter, Linear circuit, Non-linear circuit, Bilateral circuit, Unilateral circuit, Electric network, Active and passive element, Active and passive network, Node, Junction, Branch, Loop, Mesh. 2.5 Kirchhoff's point law, Voltage law and problems	9
3.0	D. C. Generator	3.1 Faraday's laws of electromagnetic induction 3.2 Fleming's right hand rule 3.2 Principle of D. C. Generator, Construction, types, Emf equation, Uses and simple problems	5
4.0	D. C. Motor	4.1 Lenz's law 4.2 Fleming's left hand rule 4.2 Principle of D. C. motor, Construction, types, Back Emf, Uses and simple problems	5



5.0	A.C. Fundamentals	5.1 Definitions, Equations, Cycle, Time period, Frequency, Amplitude, Phase, Phase difference, RMS value, Average value, Maximum values, form factor, Crest factor, Simple problem	3
6.0	A.C. Series Circuit	6.1 Definitions – Inductance, Inductive reactance, Capacitance, Capacitive reactance, impedance 6.2 A. C. through pure resistance, pure inductance and pure capacitance 6.3 A. C. through R—L, R—C and R—L – C series circuit and their problems 6.4 Resonance and problems	8
7.0	Phasor Algebra	7.1 J operator 7.2 Rectangular, polar and trigonometrical form of phasor. 7.3 Addition, subtraction, multiplication and division of phasor	2
8.0	Transformer	8.1 Working principle, Construction, types, Emf equation, Transformation ratio, Ideal transformer, their problems 8.2 Losses of transformer, Rating of transformer 8.3 C. T. and P.T., Auto transformer,	5
9.0	Induction Motor	9.1 3 phase induction motor – Principle, Construction, Uses, Synchronous speed, full load speed, Slip, Percentage of speed	4
CLASS TEST			3



11. TABLE OF SPECIFICATION FOR THEORY

Sl no	Topics (a)	Time allotted in Hrs (b)	Percentage Weightage (c)	Modified % Weightage (d)	K	C	A	HA
1	Introduction	1	3	3	5		0	
2	Work, Power, Energy and DC circuit	9	21	21	6	1	4	
3	D.C generator	5	12	12	3	1	5	
4	D.C motor	5	12	12	3	0	7	
5	A.C fundamentals	3	6	6	5	1	4	
6	A.C Series circuit	8	20	20	7	2	4	
7	Phasor Algebra	2	4	4	3		0	
8	Transformer	5	12	12	2		4	
9	Induction motor	4	10	10	1		2	
	Total	42	100	100	35	5	30	

12. DETAILED TABLE OF SPECIFICATIONS FOR THEORY EXAM

Sl. no.	Topics	Objective type				Short answer type					Essay type				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Introduction	1			1	1					3				3
2	Work, Power, Energy and D.C circuit	2	1	2	5			2		2	4				4
3	D.C generator	1	1		2	2		2		2			3		3
4	D.C motor	1		1	2	2		2		2			4		4
5	A.C fundamental	2	1		3			2		2	3		2		5



6	A.C Series circuit	1	2		3	2		2		2	4		2		6
7	Phasor algebra	1			1						2				2
8	Transformer	2			2								4		4
9	Induction motor	1			1								2		2

13. Suggested Implementation Strategies:

This is a fundamental subject. It is necessary to handle the subject carefully so that students can develop clear understanding of principles and concepts and develop skill in their application in solving related problems. Teacher may give emphasis on laboratory experiments and give lot of home assignments.

14. Suggested Learning Resources:

Book List: 1.Fundamentals of Electrical Engineering by Tarlok Singh, S. K. Kataria & Sons,

2. Electrical Technology Vol.-I & Vol.-II by B. L. Thereja & A. K. Thereja, S. Chand & Co.

3. Basic Electrical Engineering by V. K. Mehta & Rohit Mehta, S. Chand & Co.

4. Fundamentals of Electrical & Electronics Engineering by S. Ghosh, PHI

5. Electrical Technology Vol.-I by J. B. Gupta, S. K. Kataria & Sons

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5 Course Title: : ANALOG ELECTRONICS - I

1.Course Code : Et-305
2.Semester : 3rdSemester

3. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	3hrs	6 hrs/week

4. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	5
	TA	HA						
70	10	20		25	25			

5. Rationale:

This is the fundamental subject of every electronic engineer. This is a core group subject and it develops cognitive and psychomotor skills. By studying this subject, students will be skilled in handling all types of electronic devices and able to apply the skill in electronics system. Electronics and its application play important role in our day to day life. Electronic components and circuits are used in most of the present day gadgets. Concept on analog electronics will pave easy way to understand operations and functioning of these gadgets also this subject is the basis of advance electronics. It starts with the idea of semiconductor materials, PN junction diodes which will enable the students to follow the functioning of all semiconductor devices.

6.CO's and ILOs

ET-305	Analog Electronic- 1	CO	ILO
		CO-1 To study the semiconductor materials: atomic theory, electron-hole pair, energy bands, types of semiconductor, semiconductor characteristics.	For CO1:- Through this course , the student – 1) Explain the Atomic structure, Insulator, Conductor and semiconductor. 2) Explain the Insulator, semiconductor and Conductor with

		<p>CO-2 To study the Characteristic of semiconductor diodes: P-N junction diodes, depletion layer, V-I curve of both forward and reverse biasing, avalanche and zener breakdown etc. Also study the various semiconductor diode such as Zener diode, Varactor diode, Schokly diode, LDR, LED, LCD etc.</p> <p>CO-3 To Study the uses and application of the semiconductor diode such as- rectifier circuit: Half wave & full wave, filter circuits.</p> <p>Also Clipping circuit and Clamping circuit using Diode</p> <p>CO-4 To study the transistor basics: Construction, configuration circuit, Input and output characteristics, biasing, different modes of transistor, transistor as an amplifier, load line analysis.</p> <p>CO-5 To study the JFET, MOSFET, UJT,- Their construction, input output characteristic and as amplifier.</p> <p>CO-6 To study different types of transistor amplifier: -Class A, B, C &AB, push – pull amplifier, R-C coupled, transformer coupled amplifier etc.</p> <p>Also study the single stage , multistage amplifier and their relation with gain, frequency and bandwidth</p>	<p>reference to the energy band.</p> <p>3) Explain the atomic bonding in semiconductors</p> <p>For CO-2</p> <p>Through this course , the student –</p> <ol style="list-style-type: none"> 1) Understand the PN Junction Diode and their Characteristics. 2) Acquire basic knowledge on Forward bias and reverse bias 3) Familiarize with the various types of Diode. <p>CO-3</p> <ol style="list-style-type: none"> 1) Develop the ability to application and analyze the semiconductor Diode. 2) Design , construct & the measurement of half wave and Full wave Rectifier. 3) Can observed and analyse the input and output waveform of Rectifier circuit. 4) Design and construction of the Clipping and Clamping circuit using Diode. <p>CO-4</p> <ol style="list-style-type: none"> 1) The student able to explain the Construction of PNP and NPN bipolar junction transistor. 2) Explain the different types of transistor biasing and configuration. 3) Draw the input/output characteristic of BJT, AC/ DC Load line etc. <p>CO-5:</p> <ol style="list-style-type: none"> 1) Classify the FET types. 2) Draw input and output characteristic curve of FET 3) Can compare the BJT with the JFET 4) Describe the working principle of the FET as amplifier. 5) Explain the construction, working with V-I characteristics of UJT. <p>CO-6</p> <p>Explain and understand different types of amplifier.</p> <ol style="list-style-type: none"> 1) Can understand and explain and
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			<p>ability to construct the Direct Couple, R-C Couple and transformer Coupled amplifier</p> <p>2) Can interpret between class A, Class B, Class C and Class AB amplifier.</p> <p>3) Can study and built Single stage and multistage amplifier and can observed their input and output waveform.</p> <p>4) Can observe and acquire knowledge the amplitude, frequency response and their bandwidth of common amplifier circuit.</p>
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7. Detail Course Content:

Chapter	Chapter Title	Content	Duration
1.0	Semiconductor Devices	<p>1.1 Electrical properties of semiconductor materials, Energy level diagrams of conductor, semiconductor and Insulator.</p> <p>1.2 Formation of P-Type and N-Type materials and their properties. Formation and behavior of PN junction diode.</p> <p>1.3 Zener diode, Zener breakdown & Avalanche Breakdown. Varactor diode, Schottky diode.</p> <p>1.4 Diode wave shaping circuits – clipper and clamper circuits</p> <p>1.5 Opto-electronic devices-LDR, LED, LCD, photovoltaic cell, solar cells, their construction, operation and applications.</p>	9



2.0	Rectifier and PowerSupply	2.1 HalfWave and Full-Wave Rectifiers: Average voltage–R.M.S. voltage, efficiency and ripple factor, Percentage voltage regulation 2.2 Function of filter circuits, Capacitor input filter, Inductive filter. 2.3 Voltage Multiplier: Voltage doublers–Tripler–Quadrupler –Their applications	4
3.0	Bipolar Junction Transistor	3.1 Formation and properties of PNP and NPN Transistor 3.2 Transistor configurations, input and output characteristics α , β and γ factors 3.3 Comparison of CB, CE and CC configurations	4
4.0	Transistor Biasing	4.1 AC and DC load-lines Concept of Q-point, 4.2 Stabilization and stability factor 4.3 Biasing: Base bias—Collector feedback bias—Emitter feedback bias, Potential divider bias. 4.4 Bias compensation circuits using diode and thermistors, Current mirror bias	5
5.0	JFET, MOSFET AND UJT	5.1 Difference between BJT, FET and MOSFET 5.2 Symbol and basic structure, Basic operation, VI characteristics and biasing of JFET, MOSFET—depletion and enhancement modes. 5.3 Relation among drain resistance, amplification Factor and mutual conductance 5.3 Basic structure and Basic operation, VI characteristics of UJT, Application of UJT	6



6.0	Signal Stage Transistor Amplifiers	6.1 Concept of amplification, classification criteria of Amplifiers and their classifications 6.2 CB, CE and CB amplifiers, their characteristics, comparison and uses. 6.3 FET amplifiers – Common Source JFET amplifiers, working, advantages and uses.	5
7.0	Multistage Amplifier	7.1 RC coupled – Direct coupled – Transformer-Coupled amplifiers – 7.2 Effect on Gain & Bandwidth and Frequency response for cascading 7.3 Comparison of different types of cascading	4
8.0	Power Amplifier	8.1 Characteristics of Class A, Class B, Class C and Class AB amplifier 8.2 Difference between Voltage and Power Amplifier 8.3 Transformer Coupled Class A Power Amplifier: Circuit operation 8.4 Class B Push Pull Amplifier : Circuit operation, Cross over distortion – Advantages and disadvantages – Complementary symmetry and quasi-complementary symmetry Class B Push Pull Amplifier 8.5 Noise in amplifier circuits	5

7. Suggested Books:

- a) Principles of Electronics- VK Mehta
- b) Basic Electronics (Solid state) – B L Theraja
- c) Electronic Principles- Malvino
- d) Electronic Devices and Circuits- David A. Bell
- e) Electronics Devices and circuits- Anil K. Maini



- f) Electronic Devices and Circuits-S. Salivahanan
- g) Electronic Devices and Circuits– Milman & Halkias
- h) Electronic Devices and Circuits–Allen Mottershead
- i) Integrated Electronics- Millman & Halkias

8. Marks Distribution

Chapter	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	Semiconductor Devices	3	4	8	15
2	Rectifier and	4	4	-	8
3	Bipolar Junction Transistor	3	-	4	7
4	Transistor Biasing	5	-	3	8
5	JFET, MOSFET AND UJT	2	3	6	11
6	Signal Stage Transistor Amplifiers	2	-	4	6
7	Multistage Amplifier	2	4	-	6
8	Power Amplifier	4	-	5	9



5: Course Title: ANALOG ELECTRONICS-ILAB

1. To study the VI characteristics of a forward and reverse biased pn junction Diode
2. To study the VI characteristics of reverse biased Zener diode
3. Study of diode Clipper and Clamper Circuits.
4. To study the rectifier with and without capacitor filter for: —
 - (a) Half-wave rectifier,
 - (b) Full-wave rectifier,
 - (c) Bridge rectifier
5. To study the input and output characteristics of BJT for: —
 - (a) C-E configuration,
 - (b) C-C configuration,
 - (c) C-B configuration
6. To study the FET characteristics
7. To study the MOSFET characteristics
8. To determine frequency response characteristics of RC coupled amplifier circuit and calculation of band width, mid band gain, input impedance and output impedance for:
 - (a) Single-stage amplifier,
 - (b) Double-stage amplifier
9. To study the output wave form of push-pull amplifier for Class-A, Class-B&
Class-A B operations
10. To study the V-I characteristics of UJT



6. Course Title : Electronic Workshop-I

1. Course Code : Et-306

2. Semester : 3rd Semester

3. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
0	1	6hrs	7hrs

4. Examination Scheme:

Theory	Practical		Pass marks (PT+PA)	Total marks	Credit
0	PT	PA	50/150	150	5
	100	50			

5. Rationale of the Subject/Course:

This course gives the basic introduction of electronic hardware systems and provides hands- on training with familiarization, identification, testing, assembling, dismantling, fabrication and repairing such systems by making use of the various tools and instruments available in the Electronics Workshop.

6. Detail Course Contents

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	Workshop Tools	Familiarization with different tools like screw drivers, pliers, cutters et.	3
2.0	Laboratory Instruments & Equipments	Familiarization with different Instruments & Equipments like Multimeters, Bench Power Supply, Signal / Function Generators, Oscilloscopes	6
3.0	Passive Components	Familiarization, Handling & Testing of Passive components like Resistors, Inductors, Capacitors, Transformers etc.	6



4.0	Miscellaneous Components	Familiarization, Handling and Testing of Cells, Batteries, Switches, Relays, Cables & Connectors etc.	6
5.0	Soldering/De-soldering Practice.	Soldering/De-solderingPractice.	9
6.0	Printed Circuit Board	Layout –consideration in proper component layout, making component layout from a circuit diagram. PCB fabrication from copper-clad Sheet by printing diagram, etching, washing and drilling holes.	12

7. Suggested Learning Resources:**Suggested Books:**

- a) Electronic Component & Materials–Madhuri Joshi
- b) Electrical Engineering Materials-Indulkar and Tiruvenkadam
- c) Electrical Engineering Materials- M. L. Gupta.
- d) Printed Circuit Board Design & Technology–Walter C Boshart

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7. Course Title: PROFESSIONAL PRACTICE I

L T P

1 0 2

Curri. Ref. No: Et-310

Total Contact hrs.: 30

Total marks: 50

Practical: = PA:25, PT=25

Theory : 06

Pass Mark : 17/50

Practical : 24

Credit : 2

Rational :

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

Aim

The Student will be able to:

- Acquire information from different sources.
- Prepare notes for given topic.
- Present given topic in a seminar.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture.

1. INDUSTRIAL VISITS :

10

Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form part of the term work.

Visits to **any two** of the following:

- i) Power supply/UPS/SMPS/Inverter manufacturing unit
- ii) Electronics Instruments calibration laboratories
- iii) Electronic security systems for Residential building
- iv) Small hydro power station
- v) Wind mill



2. GUEST LECTURE (S)

6

Lectures by Professional / Industrial Expert / Student Seminars based on information search to be organized from any THREE of the following areas:

- Non conventional energy sources
- Pollution control.
- Recent innovations of electronic gadgets in daily life
- Fire Fighting / Safety Precautions and First aids.
- Computer Networking and Security.
- Topics related to Social Awareness such as - Traffic Control System, Career opportunities, Communication in Industry, Yoga Meditation, Aids awareness and health awareness.

3. GROUP DISCUSSION:

6

The students should discuss in a group of six to eight students and write a brief report on the same as a part of term work. Two topics for group discussions may be selected by the faculty members. Some of the suggested topics are -

- i. Sports
- ii. Current news items
- iii. Discipline and House Keeping
- iv. Current topics related to Electronics & Telecommunication Engg. field.

4. STUDENT ACTIVITIES:

8

The students in a group of 3 to 4 will perform any one of the following activities (others similar activities may also be carried out)

- I. Collect information such as ISI standard specifications of various electronic tools & equipments.
- II. Collecting information and study on specifications of industrial electronics security systems.

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FOURTH SEMESTER

ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING



COURSE STRUCTURE OF ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING (4TH SEMESTER)

S/N	Subject Code	Subject	Study Scheme Contact hours/week			Evaluation Scheme									
						Theory					Practical			Total Marks (Theory +Practical)	Credit
			L	T	P	ESE	Sessional (SS)			Pass (ESE +SS)	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)		
							TA	HA	Total (TA+ HA)						
1	Et-401	Electrical Circuit & Network	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
2	Et-401	Communication Engineering-I	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
3	Et-402	Electronics Test & Measurements	3	-	-	70	10	20	30	33/100	-	-	-	100	3
4	Et-403	Digital Electronics	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
5	Et-404	Electronic Workshop-II	-	-	6	-	-	-	-	-	50	50	33/100	100	4
6	Et-405	Analog Electronics-II	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
7	Et-410	Professional Practice-II	1	-	2	-	-	-	-	-	25	25	17/50	50	2
			36			Total								850	25



1. Course Title: Electrical Circuit & Network

1. Course Code: EI - 401

2. Semester: 4th

3. Rationale of the Subject : Electrical circuit analysis helps in finding voltage drop across and current through any component in the network. There are theorems and techniques for finding these values. This subject contains the basic of network analysis, introduction to various network elements, various networks for with DC, single phase AC and 3 phase AC for finding voltage and current. This subject helps to understand the concept in other electrical subjects like electrical power system, electrical measurement, electrical machine instrumentation etc.

4. Aim:

1. To enable the student to have a grasp on basic principles of electric circuit.

2. To help the student in understanding the concept in electrical subjects like Power System, AC Distribution and Utilization, Electrical Measurement and Measuring Instrument etc.

4. COURSE OUTCOMES (COs) : The student will be able to –

1. Know and define electric circuit terminology, different energy sources used in electric circuit.

2. Know various network theorems and application of these theorems in solving problems of both DC and AC network.

3. Interpret the performance of AC parallel circuit.

4. Know relationship between phase and line voltage and current in three phase system.

5. Understand the behavior of circuit in transient condition.

6. Develop the concept of application of MATLAB in network analysis.

5(a) COURSE OUTCOMES:-

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

CO 1: Understand different network theorems and apply them on dc dependent source as well as independent source, solve numerical problem.

CO 2: Comprehend the theorems of AC network.

CO 3: Analyze the AC parallel circuits and apply Matlab in Ac series and parallel circuit.

CO 4: Understand the AC poly phase circuit and solve numerical.

CO 5: Know AC transient.



6. Pre-Requisite:

1. Current and voltage.
2. Resistance in series and parallel, cells in series and parallel.
3. Inductance, capacitance, inductive reactance, capacitive reactance.

7. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs		3hrs	6 hrs/week

8. Examination Scheme:

Theory			Pass marks(ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	5
	TA	HA						
	70	10	20	25	25			

9. Detailed Course Content:

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	D. C Network Theorem (With dependent Source)	1.1 Network Terminology – Parameters, active, passive element, active and passive network, linear, nonlinear, bilateral, unilateral circuit, node, branch, loop, mesh 1.2 Super position theorem, Thevenin's theorem, Norton's theorem, reciprocity theorem, maximum power transfer theorem, Star delta transform.	9
2.0	D. C Network Theorem (With independent Source)	2.1 Super position theorem, Thevenin's theorem, reciprocity theorem, Norton's theorem	4
3.0	A. C Network Theorem	3.1 Mesh analysis, Node analysis, Super position theorem, Thevenin's theorem,	8

		Norton's theorem, maximum power transfer theorem,	
4.0	Single phase AC parallel circuit	4.1 Solving parallel circuit by vector method, admittance method and complex algebra method 4.2 Resonance in parallel circuit	7
5.0	Three phase circuit	5.1 Importance of 3 phase circuit, generation of three phase power, phase sequence, balanced load 5.2 Relation between voltage, current of line and phase values in star and delta connection, problems in balanced loads of star and delta connection	5
6.0	Transients	6.1 Introduction and types of transient 6.2 Transient in R-L circuits (DC), R-C circuits(DC) 6.3 Transient in R-L circuits (AC), R-C circuits(AC)	4
7.0	Application of Mat lab	7.1 Introduction to Mat lab 7.2 Application in series and parallel R – L, R – C & R- L –C circuits	5
CLASS TEST			3

TABLE OF SPECIFICATIONS FOR THEORY (Electrical circuit and network)

Sr. No	Topic (a)	Time allotted in hours(b)	Percentage Weight age (c)	Modified Percentage Weightage(d)	K	C	A	HA
1	DC network theorem	9	21	21	2	0	9	
2	DC network theorem (with independent source)	4	10	10	3	0	8	
3	AC network theorem	8	18	18	4	0	6	
4	Single phase AC parallel circuit	7	17	17	7	1	2	
5	Three phase circuit	5	12	12	6	1	7	
6	Transient	4	10	10	1	0	2	
7	Application of Mat lab	5	12	12	1	1	9	
	Total	42	100	100	24	3	43	
	Class test	3						



11. DETAILED TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	DC network	2		2	4			2		2			5		5
2	DC network(with independent source)	2		2	4	1		1		2			5		5
3	AC network theorem	2		1	3			2		2	2		3		5
4	Single phase AC parallel circuit	2	1		3			2		2	5				5
5	Three phase circuit	2	1	2	5	1		1		2	3		4		7
6	Transient	1		1	2			1		1					
7	Application of MAT lab	1	1	2	4			2		2			5		5
	Total				25					13					32

12. Suggested Implementation Strategies:

This subject contains various theorems. Teacher may give more home assignments which will help the student in developing skill and concept to solve the network problem using these theorems. Laboratory experiments will also help the students to understand the theorem as well as single phase and three phase AC circuit.

13. Suggested Learning Resources:

- Book List:
1. Circuit Theory by A. Chakrabarti
 2. Circuits& Network by A. Sudhakar, Shyammohan S. Palli
 3. Electrical Circuit Analysis by H. Chandragupta
 4. Electrical Circuit by Nilsson J. W, Riedel S. A.
 5. Electrical Technology Vol.-I by B. L. Thereja & A. K. Thereja.
 6. Basic Electrical Engineering by V. K. Mehta & Rohit Mehta.
 7. Getting Started with Matlab : A quick Introduction for Scientist and Engineers : Rudra Pratap



1: Course Title: ELECTRICAL CIRCUIT AND NETWORK LABORATORY

4th Semester

CODE No. EI – 401P

Practical: Full Marks: 50, Practical test/viva = 25 Sessional (TA+HA) Marks: 25, Pass Marks: 17/50

Skills to be developed:-

a) Intellectual Skills:-

1. Interpret results
2. Calculate values for various components for given circuit.
3. Select instruments.

b) Motor Skill:

1. Connect the instrument properly.
2. Take accurate results.
3. Draw phasor diagram and graph.

List of practical

1. Verification of Kirchhoff's Laws.
2. Verification of Super-position theorem.
3. Verification of Thevenin's theorem.
4. Verification of Maximum power transfer theorem.
5. Verification of Reciprocity theorem.
6. To find out the voltage-current relationship in a single phase R-L, R-C and R-L-C series AC circuit, draw their impedance triangle and determine the power in each case.
7. Study of AC parallel circuit.
8. To find out resonance frequency in an RLC circuit.
9. Measurement of power and power factor in a single phase RLC circuit and to calculate active and reactive power.
10. Measurement of 3 phase power.



Reference Book:

Lab manual on basic Electrical Engineering and Electrical Measurement by S K Bhattacharjee, K M Rastogy

Lab Course in Electrical Engineering by S G Tarnekar, P K Kharbandha

A Text Book of Practical in Electrical Engineering by Dr. N. K. Jain

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2. Course Title : Communication Engineering-I

1. Course Code : Et - 401

2. Semester : 4th Semester

3. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	3hrs	6 hrs/week

4. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

5. Rationale of the Subject/Course:

One of the major fields of application of electronics is the Electronic Communication. Communication plays vital role in our lives. Radio Communication, TV, Mobile telephones have become inevitable part of our day to day life. This is the 1st part of the Communication Engineering course by which basic electronic communication knowledge is to be imparted.

6. COs and ILOs:

ET-401	Communication Engineering-I	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Identify the block diagram of communication systems and distinguish between various types of signals and their frequency spectra.	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Define analog signals and digital signals.</p> <p>ILO2: Draw the block diagram of a basic communication system and explain each block.</p> <p>ILO3: Explain electromagnetic wave and</p>



		<p>CO-2 Understand the need of modulation in communication engineering and the different types of modulation techniques and their uses.</p>	<p>its spectrum.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Define modulation.</p> <p>ILO2: Explain the necessity of modulation.</p> <p>ILO3: Name the various types of modulation techniques.</p> <p>ILO4: Explain Amplitude modulation along with its frequency spectrum.</p> <p>ILO5: Derive the power relation for single tone AM wave.</p> <p>ILO6: Differentiate between DSB and SSB modulation techniques.</p> <p>ILO7: Explain the need of suppression of carrier.</p> <p>ILO8: Distinguish between suppression of carrier by balance modulator and ring modulator.</p> <p>ILO9: Explain vestigial side band (VSB) modulation technique and its significance.</p> <p>ILO10: Write the application of AM circuit.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Explain ground wave propagation with neat diagram.</p> <p>ILO2: Explain space wave propagation with neat diagram.</p> <p>ILO3: Discuss in detail sky wave propagation.</p> <p>ILO4: Explain the role of ionosphere in propagation of wave and the occurrence of reflection and refraction</p>
		<p>CO-3 Explain wave propagation and the parameters affecting the propagation of waves in various layers of the</p>	

		<p>CO-5 Design various antennas for wave propagation considering the antenna parameters.</p> <p>CO-6 Analyze different types of microwave devices and their application in Electronic appliances and communication devices.</p>	<p>ungrounded antenna.</p> <p>ILO6: Draw the radiation pattern of 4-isotropic element fed in phase and spaced half wavelength apart.</p> <p>ILO7: Discuss the advantages and uses of folded dipole antenna.</p> <p>ILO8: Discuss the characteristics of different types of practical antennas used for communication.</p> <p>ILO9: Write short note on Yagi-Uda antenna.</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1: Discuss the TE and TM modes in rectangular waveguides.</p> <p>ILO2: Write short notes on Directional couplers.</p>
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7. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	Introduction	<p>1.1. Introduction to communication systems- Information, Transmitter, Channel-noise and receiver Electromagnetic wave and spectrum, frequency spectra of non-sinusoidal waves, radio frequency bands.</p> <p>1.2. Types of signals, analog and digital signals, spectrum of signals, Telecommunication services, Transmission paths</p>	4



2.0	Modulation	<p>2.1. Introduction, description and concept of modulation, necessity and definition of modulation. Types of modulation : analog modulation (AM, FM and PM) and pulse modulation. High and low level modulation.</p> <p>2.2. Amplitude Modulation(AM):</p> <p>2.2.1 Definition and frequency spectrum of the AM wave, representation of AM, power relations in the AM wave</p> <p>2.2.2 Generation of AM: Basic requirements-</p> <p>Comparison of levels, Grid modulated class C amplifier, Plate modulated class C amplifier, Modulated transistor amplifiers</p> <p>2.2.3 Double and Single sideband techniques: Need for suppression of carrier, Evolution and description of DSB and SSB, suppression of carrier by the balanced modulator, ring modulator, suppression of the unwanted sideband: The filter system, the phase shift method, the “third” method, Comparison between DSB and SSB</p> <p>2.2.4 Extensions of SSB: Carrier reinsertion-Pilot carrier systems, Independent sideband (ISB) systems, Vestigial side band transmission</p> <p>2.2.5 Application of AM circuit.</p> <p>2.3. Frequency modulation(FM):</p> <p>2.3.1. Theory of frequency and phase modulation, their definition and descriptions of systems</p>	15
		<p>2.3.2. Mathematical representation of FM, Frequency spectrum of the FM wave, Phase modulation, intersystem comparisons</p> <p>2.3.3. Generation of frequency modulation : FM methods, direct methods, stabilized reactance modulator-AFC, indirect method</p> <p>2.3.4. Phase modulation and modulation circuits, Application of AM and FM circuits.</p>	



3.0	Radiation and Propagation of Waves	<p>3.1. Electromagnetic radiation- Fundamentals of Electromagnetic waves, effects of the environment, reflection/refraction of radio waves</p> <p>3.2. Propagation of waves-Ground(surface)waves- Atmosphere icabsorption, troposphere icscatter, sky wave propagation-The ionosphere–ionospheric</p>	7
4.0	Transmission Lines	<p>4.1. Basic principles-Fundamentals of transmission lines, open qirelines, coaxial cables, Characteristic impedance, losses in transmission lines.</p> <p>4.2. Standing waves, standing wave ratio, quarter and half wave length lines, impedance matching, reactance properties of transmission lines</p>	6
5.0	Antennas	<p>5.1. he radiation mechanism, elementary doublet</p> <p>5.2. Resonant antennas and non-resonant antennas</p> <p>5.3. Terms and definitions : Antenna gain ,Directive gain, Directivity and Power gain, Antenna resistance, Radiation resistance, Bandwidth, Beam-width and polarization</p> <p>5.4. Effects of ground on antennas: Ungrounded antennas, grounded antennas, grounding systems, effects of antenna height</p> <p>5.5. Dipole arrays, Folded dipole antennas and applications</p> <p>5.6. Types of practical antenna and their application fields</p>	6
6.0	Microwave Devices and Systems	<p>6.1. Introduction to micro wave, fields of application.</p> <p>6.2. Rectangular waveguide theory, calculation of rectangular waveguides, TE modes in rectangular wave guide, TM modes in rectangular wave guide, waveguide couplers, directional couplers.</p>	4



8. Distribution of Marks:

Chapter No.	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	Introduction	1	3	3	7
2	Modulation	4	5	15	24
3	Radiation and Propagation of Radio Waves	8	4	-	12
4	Transmission Lines	2	3	5	10
5	Antenna	6	-	4	10
6	Microwave Devices and Systems	4	-	3	7
	Total	25	15	30	70

9. Suggested Books:

- a) Communication Engineering—A. Kumar
- b) Principles of Communication Engineering- Anokh Singh
- c) Electronic Communication- Kennedy
- d) Electronic communication- Roddy and Coolen

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2: Course Title: COMMUNICATIONENGINEERING –ILAB

1. Study of tuned circuits.
2. Study of DSB-FC modulator
3. Study of DSB-SC modulator
4. Study of SSB modulator
5. Study of FM Modulator
6. Study of Transmission Lines.
7. Study of different types of Antennae.
- 8.Studyof Microwave Devices

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1.Course Title : ELECTRONIC TEST & MEASUREMENTS

2. Course Code :Et-402
3. Semester :4th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			

6. Rationale of the Subject/Course:

Test and Measurements are the basis of any Engineering field. So, this course is designed to train the students in the area of Test and Measurements. The topics covered are Measurement standards, Measuring instruments, Electrical& Electronic meters and Electronic measuring equipment

7. COs and ILOs:

ET-402	Electronic tests and measurements	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Understand the basic terms used in the measurement of substances and the concept of units and different type of units in measurement.	For CO1: After completion of this course students will be able to- ILO1: Define the terms accuracy, precision, sensitivity and resolution.

		<p>CO-2 Analyze the working of electronic voltmeter and multimeter in various measuring purposes.</p>	<p>ILO2: Explain in detail the response and repeatability of measuring instrument showing the variation in graphs.</p> <p>ILO3: Explain the significance of “units” in measurements and describe the seven fundamental units.</p> <p>ILO4: State the differences between fundamental units and derived units.</p> <p>ILO5: Define error in measurements and discuss the different types of errors present in measurement systems.</p> <p>ILO6: Distinguish between primary and secondary standards.</p> <p>ILO7: Give the significance of calibration of an instrument before used for measurement of a substance.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: List the limitations of ordinary Volt-ohm Meter over electronic voltmeter.</p> <p>ILO2: Explain the construction and operation of bridge type electronic multimeter using vacuum triode.</p> <p>ILO3: Differentiate between BJT and FET.</p> <p>ILO4: Define Electronic multimeter (EMM) and give its characteristics.</p> <p>ILO5: Discuss the schemes of measuring</p> <p>ILO6: Compare VOM and EMM.</p> <p>ILO7: Describe the principle of operation of chopper type Electronic DC voltmeter.</p> <p>ILO8: Draw the block diagram and explain the working principle of Digital</p>
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		<p>CO-3 Learn about various types of oscilloscopes, the use of CRO and its working principle and applications.</p>	<p>Multimeter (DMM).</p> <p>ILO9: Compare analog multimeter with digital multimeter in tabular form.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Draw the block diagram of Cathode Ray Oscilloscope (CRO) and explain the working principle.</p> <p>ILO2: List the features of Cathode Ray Oscilloscope.</p> <p>ILO3: Give the block schematic description of vertical amplifier, time base generator, trace synchronization, triggering modes, front panel controls and probe characteristics.</p> <p>ILO4: Write the characteristics of dual trace oscilloscope.</p> <p>ILO5: State the differences between chopper beam switch and alternate beam switch.</p> <p>ILO6: Analyze the block schematic description of digital storage oscilloscope.</p> <p>ILO7: Explain the techniques of measurement of amplitude, frequency, time period, phase angle and delay time by CRO.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Explain the construction and working principle of AF & RF signal generator.</p> <p>ILO2: Discuss the amplitude and frequency modulation techniques for RF & AF signal generator.</p> <p>ILO3: Give the specifications of AF & RF</p>
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		<p>signal generator.</p> <p>ILO4: List some applications of signal generator.</p> <p>ILO5: Draw the block diagram of pulse generator and explain its working principle.</p> <p>ILO6: List the specifications and applications of pulse generator.</p> <p>ILO7: Explain the working principle of function generator with a neat block diagram.</p> <p>ILO8: Give the specifications and applications of function generator.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Discuss the working principle of Heterodyne wave Analyzer.</p> <p>ILO2: Give the block schematic description of Harmonic Distortion Analyzer.</p> <p>ILO3: Explain the block schematic description of Spectrum analyzer.</p> <p>ILO4: List some of the uses of Spectrum analyzer.</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1: Explain the difference in Heterodyne and Resonance methods of measurement of frequency.</p> <p>ILO2: Draw the block diagram of digital frequency meter and explain its working principle.</p> <p>ILO3: Discuss the use of frequency counters in the measurement of frequency, time period and time</p>
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		<p>interval.</p> <p>CO-5 Analyze the signals using various signal analyzers</p> <p>CO-6 Implement various measurement methods for time and frequency measurement.</p> <p>CO-7 Learn the techniques used for power measurement at AF and RF.</p> <p>CO-8 Implement automated measurement system and data acquisition system for the purpose of measurement of substances.</p>	<p>For CO-7: After completion of this course students will be able to-</p> <p>ILO1: Explain the principle of operation of audio power meter for measurement of power at audio frequency.</p> <p>ILO2: List the applications of audio power meter.</p> <p>ILO3: Discuss the measurement of power at radio frequency by bolometer and calorimetric methods.</p> <p>For CO-8: After completion of this course students will be able to-</p> <p>ILO1: Write a brief note on automated tests and measurements.</p> <p>ILO2: Explain with a neat block diagram the automated measurement system.</p> <p>ILO3: Give the characteristics and uses of switching matrices.</p> <p>ILO4: List the specifications of IEEE-488 interface bus of the data acquisition system.</p> <p>ILO5: Explain the working of Data Acquisition system.</p> <p>ILO6: Mention the advantages and application of computerized data acquisition.</p>
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8. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	MEASUREMENT FUNDAMENTALS	1.1 Explanation of accuracy, precision, sensitivity, resolution, dynamic range, response and repeatability of measuring instruments. Role of Units in measurements and different types of units, Definition of Errors and type of errors, Definition of Primary and Secondary Standards, Concept of Calibration.	4
2.0	ELECTRONIC VOLTMETER & MULTI METER	Disadvantages of ordinary Volt-Ohm Meter (VOM); Construction and operation of bridge type electronic multi meter using Vacuum triode, BJT and FET, measurement of DC and AC Voltage and current and resistance on EMM; comparison of ordinary VOM and EMM; Basic principle of operation of chopper type Electronic DC Voltmeters.	8
		Block diagram and principle of operation and working of different types of Digital Multimeter (DMM); DMM specifications, errors in DMM measurements, comparison of DMM & analog multimeter.	
3.0	CATHODE RAY OSCILLOSCOPE (CRO)	3.1 Block diagram of CRO, constructional Features of CRT and principle of operation. 3.2 Block schematic description of: (a) Vertical Amplifier, (b) Time Base Generator, (c) Trace Synchronization, (d) Triggering Modes, (e) Front Panel Controls, (f) Probe Characteristics. Features of dual trace oscilloscopes, chopper beams witch, alternate beam switch. Block schematic description of digital storage oscilloscope. Measurement of amplitude, frequency, time period, phase angle and delay time by CRO.	8



4.0	SIGNAL GENERATORS	<p>4.1 AF & RF signal generators—construction and Working principle, amplitude and frequency modulation their specification and application.</p> <p>4.2 Block diagram, working, specifications and applications of pulse and function generators.</p>	6
5.0	SIGNAL ANALYSIS	<p>5.1 Basic working principle of Heterodyne Wave Analyzer.</p> <p>5.2 Block schematic description of Harmonic Distortion Analyzer.</p> <p>5.3 Block schematic description of Spectrum Analyzer and its use.</p>	4
6.0	TIME AND FREQUENCY MEASUREMENT	<p>6.1 Measurement of frequency by resonance And heterodyne methods.</p> <p>Block diagram and working principle of digital frequency counter, measurement of frequency, time period and time interval using frequency counters.</p>	4
7.0	AF AND RF POWER MEASUREMENT	<p>7.1 Measurement of power at audio frequency— Principle of operation and applications of audio power meter.</p> <p>7.2 Radio frequency power measurements.</p> <p>Bolometer and calorimetric methods</p>	4
8.0	AUTOMATED MEASUREMENT AND DATA ACQUISITION SYSTEM	<p>8.1 Concept of automated test and measurements, block diagram of automated measurement system, characteristics and use of switching matrices.</p> <p>8.2 Introduction to Data Acquisition system— An overview of IEEE-488 interface bus specification, advantages and application of computerized data acquisition</p>	4



9. Distribution of Marks:

Chapter No.	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1.0	MEASUREMENT FUNDAMENTALS	4	3	-	7
2.0	ELECTRONIC VOLTMETER &MULTI METER	4	2	8	14
3.0	CATHODERAYOSCILLOSCOPE (CRO)	4	2	8	14
4.0	SIGNALGENERATORS	2	3	4	9
5.0	SIGNALANALYSIS	4	2	-	6
6.0	TIMEAND FREQUENCY MEASUREMENT	4	-	3	7
7.0	AFANDRF POWER MEASUREMENT	3	-	4	7
8.0	AUTOMATEDMEASUREMENT AND DATAACQUISITION SYSTEM	-	3	3	6
	Total	25	15	30	70

10. Suggested Learning Resources:**Book List**

- i) Electrical and Electronic Measurements and Instrumentation–A.K. Sawhney
- ii) Electronic Measurements & Measuring Instruments–Helfrick & Cooper
- iii) Electronic Instruments and Measurements-Larry Jones& Foster Chin
- iv) Electrical and Electronic Measurements and Instrumentation-S. Ramabhadran
- v) Electronic Instrumentation and Measuring Techniques–Cooper



1. Course Title : Digital Electronics

2. Course Code : Et-403
3. Semester : 4th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	3hrs	6 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

5. **Rationale of the Subject/Course** : To be taught as the basic course for knowledge of digital electronic devices and circuits to cater the need of modern electronics industries.

7. COs and ILOs:

ET-403	Digital Electronics	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 To have a thorough understanding of the fundamental concepts of digital representation of information along with the analog representation.	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Define analog and digital signals.</p> <p>ILO2: Differentiate analog and digital signals with examples.</p> <p>ILO3: Explain logic levels with suitable sketch.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Define Logic gates.</p>



		<p>CO-2 To interpret logic functions, circuits, truth tables, and Boolean algebra expressions.</p>	<p>ILO2: State basic Logic gates and Universal gates with their truth tables.</p> <p>ILO3: Describe the significance of universal logic gates.</p> <p>ILO4: Classify logic families.</p> <p>ILO5: Compare the characteristics of RTL, DTL, ECL, & CMOS</p> <p>ILO6: Explain IC gates- Quad NAND, Quad NOR, Hex Inverter, Tristate Buffer.</p> <p>ILO7: Explain IC gates- Quad NAND, Quad NOR, Hex Inverter, Tristate Buffer.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Define Boolean algebra & Boolean constant.</p> <p>ILO2: State the rules of Boolean Algebra.</p> <p>ILO3: State the De- Morgan's theorem with examples.</p> <p>ILO4: Realize the Boolean expression using logic gates.</p> <p>ILO5: Simplify Boolean expression using Algebraic method.</p> <p>ILO6: Define K-map</p> <p>ILO7: Simplify Boolean expression using K-map</p> <p>For CO-4: After completion of this course students will be able to-</p>
		<p>CO-3 To apply the laws of Boolean algebra to simplify circuits for a cost effective solution.</p>	



		<p>CO-4 To understand, analyze and design various combinational and sequential circuits.</p>	<p>ILO1: Explain Combinational Logic Systems.</p> <p>ILO2: Define Binary Adders: Half Adder, Full Adder with their circuit diagram & truth table.</p> <p>ILO3: Define Binary Subtractors: Half Subtractor, Full Subtractor with their circuit diagram & truth table.</p> <p>ILO4: Explain Digital Comparator with examples.</p> <p>ILO5: Define Parity bit.</p> <p>ILO6: Explain Parity checker & Generator</p> <p>ILO7: Compare Decoder & Encoder with suitable diagram.</p> <p>ILO8: Compare Multiplexer & Demultiplexer with suitable diagram.</p> <p>ILO9: Describe Seven segment display with diagram.</p> <p>ILO10: Explain BCD to seven-segment Decoder with diagram.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Define Flip-flops.</p> <p>ILO2: Define clock, Preset and clear.</p> <p>ILO3: Explain the operation of S-R flip flop.</p> <p>ILO4: Explain the operation of J- K flip flop.</p> <p>ILO5: State the Race around condition.</p> <p>ILO6: Explain the operation of Master</p>
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			<p>Slave J-k.</p> <p>ILO7: Explain the operation of D-type & T-type flip flops.</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1: Define Registers and Counters.</p> <p>ILO2: Explain the types of Shift registers with suitable diagram.</p> <p>ILO3: Explain the types of counters.</p> <p>ILO3: Explain Ripple Counter, Ring counter, Up/Down counter & Decade Counter with suitable diagrams.</p> <p>For CO-7: After completion of this course students will be able to-</p> <p>ILO1: State the Characteristics of memories.</p> <p>ILO2: Classify the types of memories.</p> <p>ILO3: Explain the structure of memory organization.</p> <p>ILO4: State the application of memories.</p> <p>For CO-8: After completion of this course students will be able to-</p> <p>ILO1: Explain the general principle of A/D and D/A conversion.</p> <p>ILO2: Explain the types of network methods of D/A conversion.</p> <p>ILO3: State the application of A/D and D/A conversion.</p> <p>ILO4: Define the types of ADC</p>
		<p>CO-5 To learn about various types of flip-flops and their functions.</p>	
		<p>CO-6 To understand the use of registers and counters.</p>	
		<p>CO-7 To become familiar with memory devices to properly incorporate into a circuit design.</p>	
		<p>CO-8 To understand the interfacing of digital circuits with converters (ADC, DAC)</p>	



8. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	Logic Levels	1.1. Concepts of analog and digital signals, their comparison. 1.2. Logic levels, positive and negative logic.	1
2.0	Logic Gates	2.1. Concept of basic Logics & their definition; Logic gates: truth table of OR, AND, NOT, NOR, NAND, X-OR, X-NOR Gates. 2.2. Universal logic gates, Tristate gates, buffers. 2.3. Logic families: RTL, DTL, TTL, ECL and CMOS. 2.4. Classification and characteristics of Digital IC's, TTL and CMOS –Series, then comparison. 2.5. IC gates: Quad NAND (7400), Quad NOR (7402), Hex-Inverter (7404), Tristate Buffer (74125, 6882).	7
3.0	Boolean Algebra	3.1. Principles of Boolean Algebra: Definition of Boolean constant, variable and function, the rule of Boolean Algebra, De-Morgan's theorem, analysis of the operation of Logic gates, Realization of Boolean expression with logic gates. 3.2. Simplification of compound Boolean expression: Algebraic and K-Map method of simplification, don't care condition.	8



4.0	Combinational Logic Systems	<p>4.1. Binary Adders & Sub tractors : Half Adder, Full Adder, Half Sub tractor, Full Sub tractor.</p> <p>4.2. Digital Comparator, Parity checker/Generator, Error code.</p> <p>4.3. Decoder/De-multiplexer, Data selector/Multiplexer, Encoder.</p> <p>4.4. Seven segment display, BCD to seven-segment decoder (7447).</p> <p>4.5. IC Comparator (7485), IC Decoder (74138), IC Multiplexer (74151)</p>	6
5.0	Flip-flops	<p>5.1.Flip-flops: latch, 1-bit memory cell, S-R flip-flop, concept of clock, Preset and clear.</p> <p>5.2.J-k flipflop, Race around condition, Master-Slave J-k, D-type, T-type flip flops.</p> <p>5.3. Dual-JK (7474), Hex D flip-flop (74174)</p>	6
6.0	Registers and Counters	<p>6.1. Shift Register: Serial in Serial out (SISO), Serial in Parallel out (SIPO), Parallel in Serial out (PISO), Parallel in Parallel out (PIPO) mode.</p> <p>6.2. Counters: synchronous, asynchronous counter, Ripple Counter, Ring counter, Up/Down counter, Decade Counter.</p> <p>6.3. IC Shift Register (74194), IC Ripple Counter (74293), Decade Counter (74290)</p>	5
7.0	Memory Devices	<p>7.1. Introduction: Classification and Characteristics of memories</p> <p>7.2. Structure and application of memories.</p> <p>7.3. Memory Expansion and organization.</p> <p>7.4. Various memory IC's.</p>	5



8.0	Converters	<p>8.1. General principle of A/D and D/A conversion and brief idea of their applications.</p> <p>8.2. Digital to Analog converters : Binary resistor network and resistor ladder network methods of D/A conversion.</p> <p>8.3. Analog to Digital Converters : Dual slope and successive approximation types of ADC.</p> <p>8.4. IC Converters: ADC0800, DAC0801.</p>	4
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9. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type	Short	Descriptive	
1	Logic Levels	2	-	-	2
2	Logic Gates	4	4	4	12
3	Boolean Algebra	4	4	4	12
4	Combinational Logic	1	4	4	9
5	Flip-flops	3	3	6	12
6	Registers and Counters	4	-	4	8
7	Memory Devices	6	-	2	8
8	Converters	1	-	6	7
	Total	25	15	30	7

10.Suggested Learning Resources

Suggested Books:

- Modern Digital Electronics—R P Jain
- Digital Principles & Application—Malvino & Leach
- Digital System-Ronald Tocci
- Digital Fundamentals- Thomas L. Floyd
- Digital Electronics- Douglas V. Hall



Course Title :DIGITALELECTRONICSLAB

1. Realization of basic gates
2. Experiments on Flip Flops
3. Experiments on Registers & Counters
4. Experiment on Adder/Subtractor
5. Experiments on Multiplexer/Demultiplexer
6. Experiment on Decoder/Encoder
7. Experiment on Seven Segment Display
8. Experiment on Digital to Analog Converter
9. Experiment on Analog to Digital Converter
10. Experiment on Memory ICs.



1. Course Title : Electronic Workshop-II

2. Course Code :Et-404

3. Semester :4th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
0	0	6 hrs	6 hrs/week

6. Examination Scheme:

Theory	Practical		Pass marks (PT+PA)	Total marks	Credit
0	PT	PA	33/100	100	3
	50	50			

6. Rationale of the Subject/Course:

This is the second part of Electronic Workshop. It covers the advance knowledge of electronic hardware systems and provides hands-on training with familiarization, identification, testing, assembling, dismantling, fabrication and repairing of such systems by making use of the various tools and instruments available in the Electronics Workshop.

6. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	Special Test Instruments	Familiarization and operation of Logic Probes, Pulsar and IC testers.	3
2.0	Active components	Familiarization, Handling and Testing of components like Diodes, BJTs, FETs etc. Optoelectronic devices like LED, LDR, Photodiode, Photo Transistor etc.	6



3.0	Circuit Design	Design, construction and testing of different electronic circuits on simulation software.	9
4.0	Circuit Fabrication	Building and testing of simple circuits on Bread-boards /Vero- boards and on PCBs	9
5.0	Transformer Fabrication	Construction of Transformers using coil winding machine	12



1. Course Title : ANALOG ELECTRONICS - II

2. Course Code : Et-405

3. Semester : 4th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	3hrs	6 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

5. Rationale of the Subject/Course:

This course is the second part of the 'Analog Electronics', where the students will learn advanced electronic circuits used in electronic equipments. It will give knowledge of practical electronic circuits and also knowledge of recent trends in electronic industries.

6. COs and ILOs:

ET-405	Analog Electronics-II	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Understand the circuitry of tuned amplifiers.	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Explain the basic principle of single tuned amplifiers.</p> <p>ILO2: Explain the circuit operation of double tuned amplifiers.</p> <p>ILO3: Explain the circuit operation of</p>

		<p>CO-2 Learn the working and applications of feedback amplifiers.</p>	<p>stagger tuned amplifiers.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Explain the working of positive and negative feedback amplifiers.</p> <p>ILO2: Describe the effect of negative amplifier on gain, gain stability, distortion, noise, bandwidth, phase shift, and input and output impedances.</p> <p>ILO3: Define voltage and current feedback amplifiers.</p> <p>ILO4: Differentiate between series and shunt feedback amplifiers.</p> <p>ILO5:Analyse the performance of emitter follower circuit for negative feedback.</p> <p>ILO6: Calculate the gain, input and output impedances for emitter follower circuit and Darlington pair.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Describe the circuit operation of single and double ended differential amplifier.</p> <p>ILO2: Explain the inverting and non inverting mode of operational amplifiers.</p> <p>ILO3: Define common mode rejection ratio, bias current, offset voltage and current, open loop and closed loop gain, input and output impedance, frequency response and virtual ground.</p> <p>ILO4: Describe the application of and OPAMP as an adder, subtractor, Voltage follower, Integrator, Differentiator, Comparator, Schmitt trigger, Voltage limiter, Clipper and Clamper.</p>
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		<p>CO-3 Describe the working principle, circuitry and applications of operational amplifiers.</p>	<p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Explain Barkhausen criteria of oscillation.</p> <p>ILO2: Describe the working principle of Tuned collector, Hartley oscillator, Colpitt oscillator, Wein bridge oscillator, Phase shift oscillator and Crystal oscillator.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Explain the operation of monostable, astable and bistable multi vibrators with their respective waveforms.</p> <p>ILO2: Discuss Schmitt trigger circuits.</p> <p>ILO3: Describe the internal block diagram, pin function and construction of different multivibrators with IC-555.</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1: Differentiate between voltage time base generator and current time base generator.</p> <p>ILO2: Discuss the operation of Miller and Bootstrap circuit.</p> <p>ILO3: Write applications of Sweep circuits.</p> <p>For CO-7: After completion of this course students will be able to-</p> <p>ILO1: List some advantages of ICs over discrete elements.</p> <p>ILO2: Distinguish between Linear and Digital ICs.</p>
		<p>CO-4 Understand the operations of an oscillator.</p>	



		<p>CO-5 Explain the operation of Relaxation oscillators and their waveforms.</p> <p>CO-6 Learn the fundamentals of Sweep Circuits.</p> <p>CO-7 Analyze various types of microelectronic technology.</p>	<p>ILO3: Differentiate between Monolithic and Hybrid ICs.</p> <p>ILO4: Explain the terms Crystal growth of Wafer, Epitaxial growth, Oxidation, Photolithography, Chemical etching, Diffusion, Ion implantation and Metallisation related to Planar Technology.</p> <p>ILO5: Discuss the techniques involved in the fabrication of BJT, Diode, resistor, capacitor, CMOS, PMOS and NMOS.</p>
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7. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	Tuned Amplifier	1.1Circuitoperationofsingle tuned,double tuned And stagger tuned amplifiers	2
2.0	Feedback Amplifier	2.1Basicideaofpositiveandnegativefeedback– Effect of negative feedback on gain, gain stability, distortion, noise, bandwidth, phase shift, input and output impedances 2.2Voltageandcurrent,series and shunt feedback 2.3Performanceof emitter follower circuit– Calculation of gain and input & output impedances– Darlington pair	7



3.0	Operational Amplifier	<p>3.1 Circuit operation of differential amplifier–single & double ended operation.</p> <p>3.2 INTRODUCTION TO OPERATIONAL AMPLIFIER: Inverting and non-inverting mode, Common mode rejection ratio, Bias current, Offset voltage and current, Open loop and closed loop gain, Input and output impedance, Frequency response and virtual ground</p> <p>3.3 APPLICATIONS OF OPAMP: Adder, Subtractor, Voltage Follower, Integrator, Differentiator, Comparator, Schmitt Trigger, Voltage Limiter, Clipper, Clamper etc.</p>	10
4.0	Oscillator	<p>4.1 Concept of oscillation–Barkhausen criteria</p> <p>4.2 Operation of following oscillators:— a) tuned collector, b) Hartley, c) Colpitt d) Wein-bridge, e) Phase Shift, and, f) Crystal.</p>	4
5.0	Relaxation Oscillator	<p>5.1 Operation of mono stable, astable and bi stable Multi vibrator with waveforms</p> <p>5.2 Schmitt trigger circuits</p> <p>5.3 IC-555, internal block diagram and pin function, construction of different multivibrators with IC-555</p>	7
6.0	Sweep Circuits	<p>6.1 Fundamentals of sweep circuit operation– Difference between voltage time base generator and current time base generator</p> <p>6.2 Operation of Miller and Bootstrap circuits – Applications of Sweep Circuits.</p>	6
7.0`	Microelectronics Technology	<p>7.1 Advantages of ICs over discrete elements</p> <p>7.2 TYPES OF ICs: Linear and Digital–Monolithic and Hybrid</p> <p>7.3 PLANAR TECHNOLOGY: Crystal growth of wafer– Epitaxial growth– Oxidation – Photolithography– Chemical etching–Diffusion–Ion implantation and metallization (ideas only)</p> <p>7.4 Fabrication of BJT, diode, resistor and capacitor (salient features), Fabrication of NMOS, PMOS & CMOS</p>	6



8. Distribution of Marks:

Chapter No.	Chapter Title	Type of Question			Total Marks
		Objective Type	Short Questions	Descriptive Questions	
1.0	Tuned Amplifier	1	3	-	4
2.0	Feedback Amplifier	6	3	3	12
3.0	Operational Amplifier	6	2	8	16
4.0	Oscillator	4	-	4	8
5.0	Relaxation Oscillator	2	4	6	12
6.0	Sweep Circuits	2	2	5	9
7.0	Microelectronics Technology	2	3	4	9
	Total	25	15	30	70

9.Suggested Learning Resources**Suggested Books:**

- i) Electronic Principles- Malvino
- ii) Electronic Devices& Circuits-Robert Boylestad
- iii) Electronic Devices & Circuits- Allen Mottershead
- iv) Integrated Electronic – Millman Halkias
- v) Electronic Devicesand Circuits– S. Salivanan, SureshKumar, Vallavaraj
- vi) Microelectronics Circuits- Sedra & Smith
- vii)Electronic Devicesand Circuits- JB Gupta
- viii)Electronic Devicesand Circuits- AnilK.Maini

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ANALOG ELECTRONICS–II LAB

1. To determine the frequency response characteristics of a tuned amplifier.
2. To determine the frequency characteristics of a negative feedback amplifier and compare with that of an amplifier without feedback.
3. To study the wave form and measure the frequency of:—
 - a) Wien bridge, b) Hartley, c) Colpitt, d) tuned collector, e) RC phase shift, and, f) crystal oscillator circuit.
4. To study the characteristics of IC555 timer connected as:
 - a) a stable multi vibrator, b) monostable multivibrator.
5. To observe the wave form at the input and output of clipping circuits in different clipping configuration.
6. To study the operation of positive and negative clamper circuit.
7. To study the characteristic parameters of differential amplifier in single ended and double ended versions:
 - a) input impedance, b) common mode voltage gain, c) differential mode voltage gain, d) CMRR.
8. To determine the following characteristics of op-amp: —
 - a) non-inverting gain, b) inverting gain, c) CMRR
9. To study the following applications of op-amp using IC741: —
 - a) adder, b) subtractor, c) differentiator, d) integrator, and, e) voltage follower

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7: Course Title: PROFESSIONAL PRACTICE II

L T P**1 0 2****Curri. Ref. No: Et-410****Total Contact hrs.: 30****Total marks: 50****Practical:= PA:25, PT=25****Theory: 6****Pass Mark: 17/50****Practical: 24****Credit: 2****Rational :**

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

Aim

Student will be able to:

- Acquire information from different sources.
- Prepare notes for given topic.
- Present given topic in a seminar.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture

1. INDUSTRIAL VISITS**8**

Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work.

Two industrial visits may be arranged in the following areas / industries:

- i) Electronic equipment manufacturing unit
- ii) Industrial automation unit
- iii) Shops using electronic billing system
- iv) Telephone Exchange



2. Lectures by Professional / Industrial Expert be organized from ANY THREE of the following areas:

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- i) Telephone Exchange Switching
- ii) Fiber optics communication system
- iii) Nano Technology
- iv) Use of signal for Telephone, television, internet
- v) Industrial Safety
- vi) Ethical Hacking
- vii) Any other suitable topic

3. INDIVIDUAL ASSIGNMENTS:

6

Any one of the following activities to be conducted through active participation of students and a report is to be prepared by the student. Conduct **any one** of the following activities through active participation of students and write report

- i. Rally for energy conservation / tree plantation.
- ii. Survey for local social problems such as mal nutrition, unemployment, cleanliness, illiteracy etc.
- iii. Conduct aptitude , general knowledge test , IQ test
- iv. Arrange any one training in the following areas :
 - a) Yoga. B) Use of firefighting equipment and First aid
 - b) Maintenance of Domestic appliances.

4. MODULAR COURSES (OPTIONAL):

10

A course module should be designed in the following areas for max. 12 hrs. Batch size - min. 15 students.

Course may be organized internally or with the help of external organizations.

- a) Repair and maintenance of electronic equipment.
- b) MATLAB OR LABVIEW related software.
- c) Soldering techniques.
- d) Personality development.
- e) Entrepreneurship development.

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FIFTH SEMESTER

ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING



COURSE STRUCTURE OF ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING(5THRD SEMESTER)

S/N	Subject Code	Subject	Core/ Elective	Study Scheme			Evaluation Scheme									
				Contact hours/week			Theory					Practical			Total Marks (Theory +Practical)	Credit
				L	T	P	ESE	Sessional(SS)			Pass (ESE +SS)	Practical Test (PT)	Practical Assessment (PA)	Pass (PT+PA)		
								TA	HA	Total (TA+ HA)						
1	Et-501	Communication Engineering-II	C	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
2	Et-502	Microprocessors	C	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
3	Et-503	Power Electronics	C	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
4	Et-504	PC System Technology	C	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
5	Et-505	Electronic Circuit Troubleshooting	C	-	-	6	-	-	-	-	-	50	50	33/100	100	4
6	Et-510	Professional Practice-III	C	1	-	2	-	-	-	-	-	25	25	17/50	50	2
7	-	Elective (Any One)		3	-	-	70	10	20	30	33/100	-	-	-	100	3
A	Et-506	Computer Aided Electronic Design	E													
B	Et-507	Electronic Instrumentation	E													
C	Et-508	PCB Technology	E													
D	Et-509	Control Systems	E													
				36			Total								850	25

1. Course Title : Communication Engineering-II

2. Course Code :Et-501

3. Semester :5th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	3hrs	6 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

6. Rationale of the Subject/Course:

This is the second part of the Communication Engineering course. In this course students will learn the advanced communication techniques used in the practical communication systems. Also the recent trends in communication fields are included.

7. COs and ILOs:

ET-501	Communication Engineering-II	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Understand the various types of demodulation techniques and their significance.	For CO1: After completion of this course students will be able to- ILO1: Explain the envelope detection technique used for practical diode



		<p>detector.</p> <p>ILO2: Draw the circuit diagram of Foster Seeley discriminator and explain its principle of operation.</p> <p>ILO3: Differentiate between AM and FM detectors.</p> <p>ILO4: Discuss the demodulation of DSB/SSB waves by synchronous detector or Phase Locked Loop (PLL).</p> <p>ILO5: Explain the demodulation of PM waves with a neat circuit diagram and waveforms.</p> <p>ILO6: Write short note on VSB demodulator.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Explain the working of low level and high level transmitters.</p> <p>ILO2: Draw the block diagram of AM broadcast transmitter and explain the function of each block.</p> <p>ILO3: Explain the working principle of FM transmitter with a suitable block diagram.</p> <p>ILO4: Differentiate between AM and FM systems.</p> <p>ILO5: Draw the block diagram of SSB transmitter and explain the working principle.</p> <p>ILO6: Define noise and classify them into different categories.</p> <p>ILO7: Discuss pre-emphasis and de-emphasis circuits with diagrams.</p> <p>For CO-3: After completion of this</p>
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CO-2 Compare various transmitting systems and their functions.



		<p>CO-3: Explain various types of receivers, their block diagrams and their functions.</p>	<p>course students will be able to-</p> <p>ILO1: Draw the block diagram of a super heterodyne receiver and explain the function of each stage.</p> <p>ILO2: Explain the working of an AM broadcast receiver.</p> <p>ILO3: Discuss the working principle of FM super heterodyne receiver.</p> <p>ILO4: State the advantages of super heterodyne receivers over TRF receivers.</p> <p>ILO5: With the help of a block diagram explain the working principle of SSB receiver.</p> <p>ILO6: Compare AM and FM receivers.</p> <p>ILO7: Draw the block diagram of a space diversity receiving systems and explain how it can be used to overcome fading.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Discuss the elements of a digital communication system.</p> <p>ILO2: Write the characteristics of data transmitter circuits.</p> <p>ILO3: Explain the various types of pulse modulation with suitable waveforms.</p> <p>ILO4: Draw the block diagram of PCM transmitter and receiver and also give its application.</p> <p>ILO5: Write short notes on ASK, FSK and</p>
		<p>CO-4 Understand the fundamentals of Digital communication and various schemes used in digital communication.</p>	



		<p>PSK.</p> <p>ILO6: Explain FDM and TDM systems and give their advantages.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Define intelligent network.</p> <p>ILO2: Discuss the evolution of mobile radio communication.</p> <p>ILO3: Explain the concept of cellular networks in detail.</p> <p>ILO4: Draw the GSM architecture and explain the working principle.</p> <p>ILO5: Describe the GSM radio characteristics.</p> <p>ILO6: Explain the process of handoff and differentiate the types of handoff.</p> <p>ILO7: Compare the CDMA, EDGE and DECT technologies.</p> <p>ILO8: Write short notes on IRIDIUM System and Global star communication.</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1: Explain the working principle of the RADAR system.</p> <p>ILO2: Compare the characteristics of A-scope RADAR, Plan Position Indicator (PPI) RADAR and Search RADAR.</p> <p>ILO3: Discuss the operation of Moving Target Indicator (MTI) to analyze Doppler Effect of RADAR signals.</p>
	<p>CO-5 Implement various techniques in mobile communication in real time environment.</p>	<p>CO-6 Analyze the RADAR system and its significance in navigation.</p>



6. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	Demodulation	1.1. AM Detectors- envelope detection, practical diode detector 1.2. FM detectors; Ratio Detector, Foster Seeley Discriminators, PLL Discriminators 1.3. VSB Demodulator 1.4. Demodulation of DSB/SSB waves: Synchronous detector, Phase Locked loop (PLL) 1.5. Demodulation of PM waves	5
2.0	Transmitting Systems	2.1. Introduction to radio transmission systems Low level and high level transmitters 2.2. AMB road cast transmitters-Block diagram and functions of each stage; MO circuits, Buffer amplifier, Harmonic generators; Power amplifiers; Neutralization; Power Supply; cooling of transmitter tubes 2.3. FM transmitter-Block diagram and functions of each stage 2.4. SSB transmitter-Block diagram and functions of each stage 2.5. Noise and its effect on transmission of AM and FM signals 2.6. Pre-emphasis and de-emphasis circuits 2.7. Comparison between AM and FM systems	9



3.0	Receiving Systems	<p>3.1. Types of receivers-TRF, Super heterodyne, Communication receivers, etc</p> <p>3.1.1. Block diagram and functions of each stage of super heterodyne receivers</p> <p>3.1.2. Extension of the super heterodyne principle</p> <p>3.1.3. Special features of the communication receivers</p> <p>3.2. AM broadcast receivers- RF amplifier, frequency changers, IF amplifier, detector, AGC tone control</p> <p>3.3. Communication receivers-variables electivity, noise limiter, squelch, AFC, tuning indicator, volume expander</p> <p>3.4. FM receivers-Block diagram and functions of each stage of FM receiver</p> <p>3.5. SSB receiver-Block diagram and functions of each stage of SSB receiver</p> <p>3.6. Comparison between AM and FM receivers</p> <p>3.7. Diversity reception-Space and frequency diversity reception</p>	9
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4.0	Digital Communication	<p>4.1. Concepts- Digital fundamentals, Elements of digital communication system</p> <p>4.2. Data communication fundamentals, characteristics of data transmission circuits, data transmission speeds, noise, digital codes, binary and ASCII codes</p> <p>4.3. Pulse modulation- PAM, PWM, PPM, PCM Advantages and application of PCM, Advantages of digital transmission, sampling, encoding</p> <p>4.4. Pulse modulation schemes-ASK, Coherent ASK detector, Non-coherent ASK detector, FSK, Demodulation of Binary FSK wave, Detection of FSK using PLL, PSK, Detection of binary PSK wave, DPSK, QPSK</p> <p>4.5. Multiplexing-Frequency and time division multiplexing, advantages of FDM and TDM systems</p>	9
5.0	Mobile Communication	<p>5.1. Intelligent network, Evolution of Mobile Radio Communication</p> <p>5.2. Cellular concepts, Cellular systems operation, AMPS operation</p> <p>5.3. Digital cellular mobile system, GSM standard and Service aspects, GSM architecture, GSM function partitioning, GSM radio characteristics, security aspects.</p> <p>5.4. CDMA systems, power control & soft handoff in CDMA, DECT, EDGE technology.</p> <p>5.5. Concepts of IRIDIUM and Global Star communications.</p>	6



6.0	RADAR and Navigation	6.1. Basic RADAR system, RADAR range pulsed RADAR system. 6.2. A-scope, plan position indicator (PPI), Search RADAR. 6.3. Moving target indicator (MTI)-Doppler effect.	4
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8. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	Demodulation	5	-	5	10
2	Transmitting Systems	6	4	5	15
3	Receiving Systems	8	2	5	15
4	Digital Communication	6	3	5	14
5	Mobile Communication	-	4	5	9
6	RADAR and Navigation	-	2	5	7
	Total	25	15	30	7

9.Suggested Learning Resources**Suggested Books:**

- i) Electronic Communication System–Kennedy.
- ii) Communication Systems-Taub & Schilling.
- iii) Principles of Communication Systems- Anokh Singh
- iv) Electronic Communication–Terman

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COMMUNICATION ENGG LAB-II

1. Study of AM detector
2. Study of DSB -SC Detector
3. Study of SSB Detector
4. Study of FM Detector
5. Study of Pulse Amplitude Modulation (PAM).
6. Study of Pulse Width Modulation (PWM).
7. Study of Pulse Position Modulation (PPM).
8. Study of Pulse Code Modulation (PCM).
9. Study of AM Receiver.
10. Study of FM Receiver.



1. Course Title : Microprocessors

2. Course Code :ET-502

3. Semester :5thSemester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	3hrs	6 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

6. Rationale of the Subject/Course:

Micro processor is the most commonly used component used in all intelligent electronic equipments. The course will give knowledge of the device and its operation. Starting with the 8-bit processor, the students will get knowledge of 16-bit processor and their interfacing also.

7. COs and ILOs:

ET-603	Microprocessor	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 To become familiar with microprocessor and various Computer languages	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Define microprocessor.</p> <p>ILO 2: State different generations of microprocessor.</p> <p>ILO 3: Explain the Block diagram of</p>



		<p>CO-2 To become familiar with the architecture and Instruction set of Intel 8085 microprocessor.</p>	<p>Micro Computer system.</p> <p>ILO 4: Define Machine language, Assembly</p> <p>Language & High-level languages.</p> <p>ILO 5: State the memory structure of microprocessor</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO 1: Describe 8085 Architecture with its functional components.</p> <p>ILO 2: Explain various types of buses.</p> <p>ILO 3: Describe registers of 8085 along with their functions.</p> <p>ILO 4: Classify the flags of 8085 along with their functions.</p> <p>ILO 5: Describe the functions of pins in Pin diagram of 8085 with suitable sketch.</p> <p>ILO 6: State the importance of Demultiplexing of AD0-AD7 bus.</p> <p>ILO 7: State the functions of Read and Write control signals.</p> <p>ILO 8: Define Timing diagram and machine cycles.</p> <p>ILO 9: Classify various instructions of 8085.</p> <p>ILO 10: Describe the Addressing modes of 8085 with examples.</p> <p>ILO 11: Identify Addressing modes of 8085 for given examples.</p> <p>For CO-3: After completion of this course students will be able to-</p>
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		<p>CO-3:To provide practical hands on experience with Assembly Language Programming.</p>	<p>ILO 1: Write Assembly language programs for Addition, subtraction, Multiplication, division.</p> <p>ILO 2: Write Assembly language programs for Logic Operations, Block data transfer.</p> <p>ILO 3: Write Assembly language programs for Comparison of numbers.</p> <p>ILO 4: Describe Handling of carry and using flags in programs.</p> <p>ILO 5: Define Subroutine.</p> <p>ILO 6: Describe the operation of Subroutine.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO 1: Describe 8086 Architecture with its functional components.</p> <p>ILO 2: Describe registers and flags of 8086 along with their functions.</p> <p>ILO 3: Explain Special purpose registers.</p> <p>ILO 4: Describe memory segmentation of 8086 microprocessor.</p> <p>ILO 5: State 8086 instructions for Data transfer operation, Arithmetic operation, Logical operation, Branching operation, Machine control operation and String operation.</p> <p>ILO 6: Write simple programs using assemblers</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO 1: Explain the concept of Interfacing I/O Devices.</p>
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		<p>CO-4: To understand the architecture and instruction set of Intel 8086/8088 to utilize it in programming.</p> <p>CO-5: To familiarize with interfacing of various peripheral devices with 8085 microprocessor.</p>	<p>ILO 2: Define Direct I/O & Memory mapped I/O techniques.</p> <p>ILO 3: Describe Modes of operation of Programmable peripheral interface (PPI) 8255 IC with Pin diagram.</p> <p>ILO 4: Describe Programmable DMA controller 8257 with Pin diagram.</p> <p>ILO 5: Explain the DMA operations and DMA channels with suitable sketch.</p> <p>ILO 6: Describe the operation of Programmable Interrupt Controller 8259 with Pin diagram.</p> <p>ILO 7: Explain the internal block diagram of Programmable Interrupt Controller 8259 with suitable sketch.</p>
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8. Detail Course Content:

Chapter	Chapter Title	Content	Duration
1.0	Introduction	<p>1.1.Introduction to microprocessor, Different Generations of microprocessor.</p> <p>1.2. Block diagram of Micro Computer system, description of each block.</p> <p>1.3. Computer languages-Machine language, Assembly language, High-level languages.</p> <p>1.4. Memory revisit, memory structure, memory expansion, memory organization</p>	3
2.0	8-bit Microprocessor Architecture	<p>2.1. Introduction to 8085 microprocessor, Different Types of bus and their functions.</p> <p>2.2. Microprocessor operations, descriptions of different control signals.</p>	10



		<p>2.3. Programmable registers of 8085, Accumulator, General-purpose registers, Program counter and stack pointer, Using the stack</p> <p>2.4. 8085 flags and their utilities.</p> <p>2.5. Pin diagram of 8085, description of the pins.</p> <p>2.6. De-multiplexing of AD0-AD7 bus.</p> <p>2.7. Generation of Read/Write control signals.</p> <p>2.8. Timing diagram and machine cycles.</p>	
3.0	Instructions and Programming	<p>3.1. 8085 instructions and their classification; Data transfer, Arithmetic, Logical, Branching and looping, Machine control instructions.</p> <p>3.2. Writing Assembly language programs for Addition, subtraction, Multiplication, division, Logic operations, Block data transfer, Comparison of numbers, Rotate.</p> <p>3.3. Handling carry and using flags in programs, Writing programs to use stacks.</p> <p>3.4. Subroutines, Writing subroutines and calling it in the main program, delay subroutines.</p> <p>3.5. Addressing modes</p>	10
4.0	16 bit Microprocessor 8086	<p>4.1. Introduction to 8086 microprocessor; modes of operations.</p> <p>4.2. Internal registers of 8086, General purpose registers, Index registers, Pointer registers, Special purpose registers, segment registers and flags.</p> <p>4.3. Understanding memory segmentation and using register values.</p> <p>4.4. 8086 instructions for Data transfer operation, Arithmetic operation, Logical operation, Branching operation, Machine control operation and String operation</p> <p>4.5. Writing simple programs, using assemblers.</p>	10
5.0	Interfacing	5.1. Basic Interfacing concepts, Interfacing I/O devices.	9



	Peripherals	<p>5.2. Input/ Output techniques, Direct I/O and memory mapped I/O.</p> <p>5.3. Programmable peripheral interface (PPI) 8255 IC, different ports, Modes of operation, Control word register.</p> <p>5.4. Programmable DMA controller 8257, DMA channel and DMA operations.</p> <p>5.5. Programmable Interrupt Controller 8259, pin diagram, internal block diagram, operations.</p>	
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9. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	Introduction	-	-	4	4
2	8 bit Microprocessor Architecture	8	4	5	17
3	Instruction sand Programming	7	4	6	17
4	16bit Microprocessor 8086	6	4	7	17
5	Interfacing Peripherals	4	3	8	15
	Total	25	15	30	70

10. Suggested Learning Resources

Suggested Books:

- i) Micro processors Architecture Programming and Applications-Gaonkar
- ii) Intel Peripheral Users manual-INTEL.
- iii) Microprocessors & Interfacing to 8085 Introduction to- Douglas VHall
- iv) Introduction to Microprocessors- Lance A Leventhal
- v) Introduction To Microprocessors- A.P. Mathur



MICROPROCESSOR LAB

- 1.0** Study of a typical micro processor trainer kit and its operation
- 2.0** Simple programming examples using 8085 instruction set. To understand the use of various instruction sand addressing modes-Monitor routines- at least 20 examples to be completed.
- 3.0** Analog to Digital converter interface.
- 4.0** Analog to Digital converter interface.
- 5.0** Interfacing of different types of EPROM & SRAM.
- 6.0** Keyboard interface.
- 7.0** Serial interface using 8251.
- 8.0** Parallelinterfaceusing8255.
- 9.0** Seven segment display interface.
- 10.0** Interfacing 8255 port to high power devices.



1 Course Title : POWER ELECTRONICS

2. Course Code :Et-503
3. Semester :5th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	3hrs	6 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional(SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

6. Rationale of the Subject/Course:

This course is designed to deal with the application of semiconductor devices in the electrical power field. The course covers power semiconductor devices, such as diode thyristor and power transistors and their applications

7. COs and ILOs:

ET-503	Power Electronics	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Understand the use Power devices.	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Differentiate between power devices and ordinary devices</p> <p>ILO2: Describe the characteristic principles of power semiconductor devices</p> <p>ILO3: Describe the construction, operation, V/I characteristics and</p>



		<p>features of Power diode, Fast recovery diodes, Power BJT, MOSFETs and IGBT</p> <p>ILO4: Classify and explain the features of Thyristor family of devices and hence describe the construction, operation and V/I characteristics of SCR, DIAC and TRIAC</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Describe the mounting techniques of power devices and heat sinks</p> <p>ILO2: Explain different power circuit hazards, selection of proper devices</p> <p>ILO3: Explain the use of power protecting devices for overload, short circuit etc</p> <p>ILO4: Explain the use of RC Networks, Zener, Metal Oxide resistors, Turn ON and OFF snubbers, transient voltage suppressors in Power circuits</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Describe the basics of controlled rectifiers and classify different rectifiers</p> <p>ILO2: Draw circuit diagrams of different controlled rectifiers (Single Phase, Three Phase, Half Controlled, and Full Controlled) and hence describe its operations</p> <p>ILO3: Differentiate between the outputs of rectifiers with resistive and inductive load and hence explain the use of free wheel diode.</p> <p>For CO-4: After completion of this</p>
	<p>CO-2 Understand the requirement of cooling and protection of Power devices</p> <p>CO-3:Learn Controlled Rectifier Circuits</p>	

			<p>course students will be able to-</p> <p>ILO1: Differentiate between self-oscillating and driving inverter</p> <p>ILO2: Draw simple circuits of self-oscillating and driven inverters and hence describes its operations</p> <p>ILO3: Differentiate between voltage driven and current driven inverter and its uses</p> <p>ILO4: Describe the principle of operation of voltage driven, current driven, half bridge and full bridge inverter</p> <p>ILO5: Describe briefly about three-phase inverter using block diagram</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Explain the need of DC voltage regulators and causes DC voltage fluctuations</p> <p>ILO2: Describe the basic principles of series and shunt DC Voltage Regulators</p> <p>ILO3: Draw circuit diagrams of transistorised series and shunt regulators and hence explain its operations</p> <p>ILO4: Draw circuit diagrams of series and shunt regulators using Op-Amp and hence explain its operations</p> <p>ILO5: List some commonly used linear IC regulators and classify them as Fixed, Variable, Positive, Negative & Dual</p>
		<p>CO-4 Understand the principles of DC to AC inverters</p>	
		<p>CO-5 Acquire a thorough knowledge of DC Regulated Power Supply</p>	

		<p>tracking regulators and explain their features</p> <p>ILO6: Explain the block diagram principle of operation of Switching Regulator (SMPS)</p> <p>ILO7: Draw and explain simple circuit diagram and PWM control circuit of switching regulator.</p> <p>ILO8: Explain principle of operation of buck converter, boost converter and buck-boost converter.</p> <p>ILO9: Bring out a comparison of Linear and Switching regulators with merits, demerits and uses</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1: Explain the basic principle of operation of UPS and list different types and compare their features</p> <p>ILO2: List and explain typical disturbances in commercial power supplies and their remedies</p> <p>ILO3: Explain the significance and use of Isolation Transformer</p> <p>ILO4: Draw and explain simple circuit for EMI and RFI</p> <p>ILO5: Explain the requirement of AC Voltage regulators and explain the circuit of a Auto Transformer</p> <p>ILO6: Explain the operation of Manually controller regulators with tap changers</p> <p>ILO7: Write brief notes on Solid state tap-changes. Servo-Regulators and Constant Voltage Transformer (CVT)</p>
		<p>CO-6 Understand Power Line Disturbances and Conditioners & UPS</p>



		CO-7 Learn about Stepper motor and its control	<p>For CO-7: After completion of this course students will be able to-</p> <p>ILO1: Explain the principle of operation of stepper motor.</p> <p>ILO2: Draw and the circuits for Stepper Drives like Dual Voltage Drive and Chopper Drive</p>
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8. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	POWER SEMICONDUCTOR DEVICES	<p>1.1 Switching characteristics of power diodes and Fast recovery diodes and their specifications.</p> <p>1.2 Power BJT: Structure of vertical power transistor, Principle of operation, its VI and switching characteristics</p> <p>1.3 Construction, operating principle and switching characteristics of power MOSFET.</p> <p>1.4 Construction, operating principle and features of IGBT.</p> <p>1.5 Thyristors–Construction, working and characteristics of SCR, DIAC and TRIAC</p>	8
2.0	PROTECTION OF POWER SEMICONDUCTOR DEVICES	<p>2.1 Mounting techniques and heat sinks of power semiconductor devices</p> <p>2.2 Selection of devices, overload protection, Fuse protection Circuit breakers, Transient protection,</p> <p>2.2 RC Networks, Zener, Metal Oxide resistors, Turn ON and OFF snubbers, transient voltage suppressors.</p>	4



3.0	CONTROLLED RECTIFIERS	<p>3.1 Single phase half wave and full wave control Rectifier circuit–Principle of operation with resistive and inductive load. Use of freewheel diode.</p> <p>3.2 Three phase half wave and full wave control rectifier– Operation with inductive and resistive load, Use of free-wheel diode.</p> <p>3.3 Concept of full control and half control rectifier</p>	5
4.0	INVERTERS	<p>4.1 Principle of operation of self-oscillating and driving inverter</p> <p>4.2 Principle of operation of voltage driver, current driver, half bridge and full bridge inverter; Inverter loads.</p> <p>4.3 Three-phase inverter.</p>	5
5.0	DC REGULATED POWER SUPPLIES	<p>5.1 Linear Regulators-Series and shunt regulator Using transistors and Op-Amps</p> <p>5.2 IC Voltage Regulators: Positive & Negative, their specifications, Dual tracking regulators.</p> <p>5.3 Switching Regulator (SMPS) principle of operation, Block diagram, circuit diagram and PWM control circuit of switching regulator.</p> <p>5.4 Principle of operation of buck converter, boost convert errand buck-boost converter.</p> <p>5.5 Comparison of linear and switching regulator</p>	8
6.0	POWER CONDITIONERS And UPS	<p>6.1 Basic principle, types of UPS : Off-line, On Line And Line Interactive, their comparison.</p> <p>6.2 Typical disturbances in commercial power supplies, Isolation Transformer, EMI and RFI suppression.</p> <p>6.3 AC Voltage regulators- Manually controlled regulators, Tap changing; Auto-Transformer</p> <p>6.4 Solid state tap-changes. Servo-Regulators.</p> <p>6.5 Constant Voltage Transformer (CVT)</p>	8



7.0	STEPPER MOTOR	7.1 Types and principle of operation of stepper motor. 7.2 STEPPER MOTOR CONTROL: Stepper Drive – Dual Voltage Drive–Chopper Drive	4
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9. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1.0	POWER SEMICONDUCTOR DEVICES	5	3	6	14
2.0	PROTECTION OF POWER SEMICONDUCTOR DEVICES	5	2	-	7
3.0	CONTROLLED RECTIFIERS	4	-	4	8
4.0	INVERTERS	2	2	4	8
5.0	DC REGULATED POWER SUPPLIES	4	3	6	13
6.0	POWER CONDITIONERS and UPS	5	3	5	13
7.0	STEPPER MOTOR	-	2	5	7
	Total	25	15	30	70

9. Suggested Learning Resources

Suggested Books:

- i) Power Electronics P.C. Sen
- ii) Modern power Electronics-P.C. Sen
- iii) Power Electronics : Converters, Application & Design–Mohan, Undeland, Robbins
- iv) Industrial Electronics-S.N. Biswas
- v) Power Electronics : Devices, Drivers, applications & passive Components-B. W. Williams

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POWER ELECTRONICSLAB

1. Study of SCR characteristics.
2. Study of DIAC characteristics.
3. Study of TRIAC characteristics.
4. Study of protection circuits
5. Study of single phase controlled rectifiers.
6. Study of inverter circuits.
7. Study of UPS.
8. Study of Switched Mode Power Supply (SMPS).
9. Study of Stepper motor speed control

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1. Course Title : PC SYSTEM TECHNOLOGY

2. Course Code : Et-504

3. Semester : 5th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3 hrs	0	3 hrs	6 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

4. Rationale of the Subject/Course:

PC systems (both Desktops and Laptops) are being used every wherein our daily life. So, its maintenance and servicing has become a need of the hour which is to be mainly carried out by field technicians preferably with electronics back ground. This course is designed to cover the basics of PC system hardware and software so that the students will be able to maintain the PC systems. Also, it covers the topics on laptop systems.

5. COs and ILOs:

ET-504	PCST	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Acquire an overall knowledge of IBM-PC	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1 Draw the block diagram of IBM-PC and explain the functions of each block</p> <p>ILO2 Explain IBM-PC evolution of PC, PC-XT, PC-AT etc referring hardware</p>



			<p>and software features</p> <p>ILO2 List various components of PC motherboards and explain their uses</p> <p>ILO3 Explain the concept of Chipset and list different standard chipset generations with their features</p> <p>ILO4 Define and list various types of add-on cards and compare their slot standards</p> <p>ILO5 State different generation of Microprocessors giving reference to its features</p> <p>ILO6 Name different sockets and slots of Microprocessors used in PC motherboards and their features</p> <p>ILO7 List and compare various types of RAM technology and modules used in IBM-PCs.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1 Explain and differentiate the concept of hardware, firmware, software and hence define BIOS and EFI</p> <p>ILO2 Explain different concepts of BIOS like POST, CMOS setup, bootstrap loader and Device Driver</p> <p>ILO3 Explain the booting procedure of computers</p> <p>ILO4 List different Microsoft Operating Systems and compare their features</p> <p>ILO5 Specify important system files used by Microsoft OS and their significance</p>
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CO-2 Acquire a thorough knowledge of Operating System features and standards.



		CO-3:Classify and Identify different categories of storage devices, their uses and features	<p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1 List different technologies used for storage devices and compare their features</p> <p>ILO2 Explain the construction and operation of optical drives</p> <p>ILO3 State different optical medias in use and compare their features</p> <p>ILO4 Describe the construction and operation of Hard Disk Drives (HDD)</p> <p>ILO5 Explain the concepts of HDD data organizations like cylinder, sector etc.</p> <p>ILO6 List different HDD interfacing and compare their features, merits and demerits</p> <p>ILO7 State and explain HDD hardware and software limitations</p> <p>ILO8 Describe HDD software installation like Partitioning, Formatting etc and explain the concepts of MBR, VBR, boot sector etc</p> <p>ILO9 Explain GPT Partitioning</p> <p>ILO10 List various Microsoft File Systems and compare their features</p> <p>For CO-4: After completion of this</p>
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		CO-4 Define and differentiate various types of Input / Output devices and their interfacing	course students will be able to- ILO1 List different types of I/O interfacing ports and compare their features, merits and demerits ILO2 Explain the construction and operation of Keyboards ILO3 List and compare different types of Keyboards with reference to key-switches ILO4 List various types of pointing devices used like Mouse, Track-ball, Joystick etc with their features ILO5 Explain the construction and operation of Optical Mouse ILO6 Draw and explain the generic block diagram of a Printer ILO7 List and compare different print mechanisms like Dot-Matrix, Ink-Jet, LASER etc ILO8 Specify and explain the printer features like speed, resolution etc ILO9 Explain the operation of scanners, their types and features ILO10 Explain the various features of Video Display Unit (VDU) i.e., Monitor like pixel, resolution etc. ILO11 Compare different monitor types like CRT, LCD, LED etc. ILO12 Explain the components and
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		<p>features of display cards</p> <p>ILO13 Explain the features of different display interfacing with special reference to AGP</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1 Explain general power supply issues like AC, DC, Line, Neutral, Earth and specify their safe voltage levels</p> <p>ILO2 Explain the requirement of Switched Mode Power Supply (SMPS) and its functions</p> <p>ILO3 Specify and compare different types of SMPS used in PCs with reference to form-factor, voltage levels, connectors and their features</p> <p>ILO4 State and explain various power line disturbances and conditioners used their off</p> <p>ILO5 Define UPS, list different types and compare their features</p> <p>ILO6 Explain PC Power Management and state their standards</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1 Differentiate between a desktop and a laptop computer with reference to components and features</p> <p>ILO2 List various components of a laptop motherboard</p>
	<p>CO-5 Understand electrical power supply requirements for computers.</p>	
	<p>CO-6 Differentiate various aspects of desktop and laptop computers</p>	



6. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	PC ARCHITECTURE	<p>1.1 Block diagram of Computer, Personal Computer history; the IBM PC; PC, PC-XT, PC-AT.</p> <p>1.2 Microprocessor types & specification used in IBM PCs, processor sockets & Slots.</p> <p>1.3 Different supporting chips & their functions; Concepts of DMA & Interrupts, Chipset.</p> <p>1.4 Motherboard: architecture of PC-XT & PC-AT systems, motherboard form factors; peripheral interfacing, concept of bus system & types; Expansion Slots.</p> <p>1.5 Different types of memory used in a computer: SRAM, DRAM, FPRAM, EDORAM, SIMM, DIMM, RIMM, DDR etc.</p>	8
2.0	OPERATING SYSTEMS	<p>2.1 Booting procedure, concept of BIOS & POST; CMOS setup, EFI firmware</p> <p>2.2 Introduction to Operating Systems: DOS, Windows, their comparisons</p> <p>2.3 Different version of Microsoft Windows – their features.</p> <p>2.4 Description of the system & configuration files.</p>	6



3.0	STORAGE DEVICES	<p>3.1 General concepts of storage device; different technologies, their comparison</p> <p>3.2 Optical Drive construction & operation, specifications, different types.</p> <p>3.3 Hard Disk Drive construction & operation, different types; Concepts of cylinders, sectors, seek time etc., disk hardware & software limitations.</p> <p>3.4 Other types of storage devices like Blu-Ray, DVD, Tape Drive, MO Drive, SSD storage</p> <p>3.5 Interfacings: features of parallel AT attachment (PATA), Serial ATA (SATA), ATA devices jumper selections: Master, slave, cable select, ATA cables</p> <p>3.6 Hard disk partitioning, concepts of FAT, MBR, VBR etc. GPT partition</p> <p>3.7 Types of file systems, their comparison.</p>	10
4.0	I/O INTERFACINGS	<p>4.1 I/O Ports: Legacy ports - Serial & Parallel communication ports, their standards, use</p> <p>4.2 New generation ports-USB, Fire-Wire etc.</p>	2
5.0	INPUT DEVICES	<p>5.1 Keyboards: Basic construction, different Key Switches, their features.</p> <p>5.2 Pointing devices: Mouse types & specifications, Joystick, Light Pen, Track balls etc, operation of Optical mouse.</p>	3
6.0	OUTPUT DEVICES	<p>6.1 Printers: Generic block diagram. Types of printers-Dot Matrix, Inkjet, Laser, line printer, MFP (Multi Function Printer), Features</p> <p>6.2 Scanner: Flat bed, sheeted, Handheld : Specifications, OCR, TWAIN, Resolution</p> <p>6.3 Video Display: Basics - pixel, resolution, H/V Frequency etc.</p> <p>6.4 Display Types: CRT Display, Panel Displays-LED, LCD and TFT Displays their features and comparisons</p> <p>6.5 Display cards – different components, types, AGP bus.</p>	6



7.0	POWER SUPPLY	7.1 General power supply issues & overview of Switched Mode Power Supply 7.2 Power Supply (SMPS): SMPS types and their comparison, Mother board integrated power supply. 7.3 Power Line Disturbances, Power conditioners 7.4 UPS–types and features 7.5 Power Managements	4
8.0	LAPTOP COMPUTERS	8.1 Difference between laptop and desktop-Types of laptops, power settings – SMD components. 8.2 Laptop components: Adapter – types, Battery– types, RAM–types, CPU–types, Laptop Mother Board- block diagram, 8.3 Laptop Keyboard –Mouse and Touchpad - Ports.	3

7: Distribution of Marks

Chapter	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1.0	PC Architecture	4	3	5	12
2.0	Operating Systems	4	2	4	10
3.0	Storage Devices	5	-	9	14
4.0	I/O Interfacings	2	3	-	5
5.0	Input Devices	2	1	3	6
6.0	Output Devices	4	2	4	10
7.0	Power Supply	2	2	3	7
8.0	Laptop Computers	2	2	2	6
	Total	25	15	30	70

8. Suggested Learning Resources**Suggested Books:**

- i) IBMPC & Clones–Govindarajalu
- ii) Upgrading & Repairing PCs–Scott Muller
- iii) Maintenance & Repairing PCs–Mark Minasi
- iv) Troubleshooting, Maintenance & Repairing PC–Bigelow
- v) Complete guide to upgrading & repairing PC–Peter Norton

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PC SYSTEM TECHNOLOGY LAB

- 1.0** Study of various parts, connections & ports of a Personal Computer
- 2.0** Familiarization with DOS & Windows operating systems.
- 3.0** Assembling/Disassembling & familiarizations with different parts of PC-XT&PC-AT systems.
- 4.0** Study of different types of motherboards.
- 5.0** Installation & configuration of FDDs, HDDs & CD-ROM Drives.
- 6.0** Hard disk partitioning & formatting.
- 7.0** Installation of DOS & Windows.
- 8.0** Hardware & Software troubleshooting.
- 9.0** Study of various output voltage level and signals of SMPS & UPS.
- 10.0** Up-gradation/Installation & configuration of a new peripheral in an existing system.

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1. Course Title : **ELECTRONIC CIRCUIT TROUBLESHOOTING**

2. Course Code : **Et-505**

3. Semester : **5th Semester**

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
0	0	6 hrs	6 hrs

5. Examination Scheme:

Theory	Practical		Pass marks (PT+PA)	Total marks	Credit
0	PT	PA	33/100	100	4
	50	50			

4. **Rationale:** This course is designed to help the students to understand the functioning of the analog and digital equipments at the circuit level. The students could be also able to locate faulty part when a system fails. The main purpose is to relate faulty system operation to faulty part that caused the problem.

5. Detail Course Content

Chapter No.	Title	Content	Duration (in hours)
1	Component familiarization & Testing	1.1 Familiarization and testing of display devices like 7-segment display, LCD Display etc. 1.2 Familiarization and testing of power devices, Various ICs and any other latest component.	6



2	Study & Testing of commercial A/V systems	2.1 Study & testing of different types of microphones. 2.2 Study and testing of different types of speaker systems 2.3 Study and testing of different blocks of a typical CD/MP3 audio systems. 2.4 Study and testing of different blocks of LED/LCD display used in Computer and TV.	6
3	Circuit Troubleshooting	3.1 Use of simulation software for Troubleshooting 3.2 Troubleshooting of simple Analog Circuits 3.3 Troubleshooting of simple Digital Circuits	15
4	Equipment Testing and Troubleshooting	6.1 Square-Wave testing of amplifiers. 6.2 Comparison of estimated & measured values of dc voltages in laboratory DC regulated power supplies & hence the adjustments to obtain the nominal output. 6.3 Comparison of estimated & measured values of dc voltages and ac waveforms in laboratory signal / function generators & hence the adjustments to obtain the nominal output. 6.4 Study, testing and troubleshooting of commercial equipment like AC Voltage Stabilizer, SMPS, UPS etc.	15

6. Suggested Learning Resources

Suggested Books:

- i) Troubleshooting of Electronic Equipment by Dr. R.S. Khandpur



PROFESSIONAL PRACTICE III

L T P

1 0 2

Curri. Ref. No: Et-510

Total Contact hrs. : 45

Total marks: 50

Practical : PT=25, PA=25

Theory : 10

Pass Mark : 17/50

Practical : 35

Credit : 2

Rational :

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

Aim

Student will be able to:

- Acquire information from different sources
- Prepare notes for given topic
- Present given topic in a seminar
- Interact with peers to share thoughts
- Prepare a report on industrial visit, expert lecture

1. INDUSTRIAL VISITS**12**

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. The industrial visits may be arranged in the following areas / industries: Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant.

- i) Data Acquisition System
- ii) Sugar Mill, Paper Mill, Cement Industry
- iii) Satellite Earth Station
- iv) Railway Station Control Room
- v) Industry where Digital Drives are used

2. LECTURES BY PROFESSIONAL / INDUSTRIAL EXPERT LECTURES TO BE ORGANIZED FROM ANY TWO OF THE FOLLOWING AREAS: **10**

- i) Operating System “UNIX” an Overview: Hands-on demonstration of Linux (ubuntu)
- ii) Applications of Sensors and Transducers
- iii) Digital Inverters
- iv) Laptop & Tablet Repair
- v) Total Quality Management

3. INFORMATION SEARCH: **10**

Information search can be done through manufacturer's catalogue, websites, magazines, books etc. and submit a report **any one** topic.

Following topics are suggested:

- i. Computer Peripherals
- ii. High Power Uninterruptible Power Supplies
- iii. Commonly used ICs

4. SEMINAR: **13**

Seminar topic shall be related to the subjects of fourth semester. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time - 10 minutes)

Mini Project / Activities: (any one)

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1 Course Title : Computer Aided Electronic Design

2. Course Code : Et-506
3. Semester : 5th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional(SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			

6. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	INTRODUCTION TO COMPUTER AIDED DESIGN	1.1 Computer as design medium-Hardware/Software requirements. 1.2 Representation of images-Scan conversion of primitive objects-Text in graphics. 1.3 Transformation -Viewing and modeling transformation in 2D and 3D-Matrix representation. Segmentation, Geometric modeling, Database management for CAD.	5



2.0	COMPUTER SIMULATION OF ELECTRONIC NETWORKS	<p>2.1 Mathematical Review:-Solution of simultaneous Linear equations – exploiting the sparsity in matrices</p> <p>2.2 DC Analysis of Linear networks-Review of Nodal and loop analysis,</p> <p>2.3 DC Analysis of Non-Linear networks</p> <p>2.4 Transient Analysis of Linear circuits</p> <p>2.5 Transient Analysis of Non-Linear circuits</p>	15
3.0	SEMICONDUCTOR DEVICE MODEL	<p>3.1 Low frequency models for semiconductor devices:-Models for pn-junction Diodes, AC Ebers Moll model, AC and DC transport model for BJT, Noise Modeling</p> <p>3.2 Introduction to SPICE models</p>	6
4.0	LOGIC SIMULATION	<p>4.1 Introduction to Hardware Description, Testing for design and manufacturing, Oscillations and other problems-Fault Simulation.</p> <p>4.2 Mixed-mode Simulation:- Relaxation method for transient analysis-Wave form relaxation.</p>	6
5.0	COMPUTER AIDED PCB DESIGN	<p>5.1 Computer Aided setup-Input Packages-Job setup- Libraries, Schematic Capture, Interface techniques Layout and Component Placement- General consideration- Manual, Assisted and Automatic Placement.</p> <p>5.2 Conductor routing –The routing problem-Surface Organization.</p> <p>5.3 Documentation.</p>	10



7. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	INTRODUCTION TO COMPUTER AIDED DESIGN	4	4	-	8
2	COMPUTER SIMULATION OF ELECTRONIC NETWORKS	5	4	15	24
3	SEMICONDUCTOR DEVICE MODEL	4	2	5	11
4	LOGIC SIMULATION	3	2	5	11
5	COMPUTER AIDED PCB DESIGN	9	2	5	16
	Total	25	15	30	70

8. Suggested Learning Resources**Suggested Books:**

- i) C.S Krishnamoorthy and S Rajeev (Narosa), "Computer Aided Design-Software and analytical tool
- ii) R Raghuram, "Computer Simulation of Electronic circuits", Wiley Eastern
- iii) Gerald L Ginsberg, "Printed circuit design", MGH
- iv) M. M Shah, "Design of electronic circuits and computer aided design", WE

XXXXXXXX



1 Course Title : Electronic Instrumentation

2. Course Code : Et-507

3. Semester : 5th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional(SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			

6. COs and ILOs:

ET-507	Electronic Instrumentation	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Understand the working principle of an instrumentation system and the function of a transducer.	<p>ILO1: Explain the operation of an instrumentation system with the help of a block diagram.</p> <p>ILO2: Give example of an instrumentation system used for household or commercial purpose.</p> <p>ILO3: Describe the working of a transducer as a system component.</p> <p>ILO4: Discuss the input and output specifications for a transducer.</p> <p>ILO5: Classify the various types of transducers and explain their functional operations.</p> <p>ILO6: Analyze the factors affecting the selection of a transducer for a particular</p>

		<p>CO-2 Implement various methods for measurement of displacement, pressure, velocity, acceleration, temperature, flow, liquid level and humidity.</p>	<p>operation.</p> <p>ILO1: Explain the method for measurement of displacement by a potentiometric transducer.</p> <p>ILO2: Explain the working of strain gauge for measuring displacement.</p> <p>ILO3: Describe the working principle of an LVDT for the measurement of displacement.</p> <p>ILO4: Analyze the working of inductive transducer and capacitive gauge for measuring displacement and comment on their precision.</p> <p>ILO5: Discuss the working of piezo electric and photoelectric transducer for the measurement of displacement.</p> <p>ILO6: Explain the working of synchros transducer.</p> <p>ILO7: List the significance of elastic deformation elements in the measurement of pressure.</p> <p>ILO8: Differentiate between primary electrical transducers and secondary electrical transducers.</p> <p>ILO9: Describe the working of Pirani gauge and ionization gauge as a low pressure measuring device.</p> <p>ILO10: Discuss the differences in moving coil type and moving magnet type methods for measuring velocity.</p> <p>ILO11: Explain the working of an AC and DC tachometer for measuring the angular velocity or the rotational speed of a machine.</p> <p>ILO12: Analyze the working of drag type cup tachometer/eddy current tachometer.</p> <p>ILO13: Explain with a diagram the working of photoelectric tachometer.</p>
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			<p>ILO14: Give the significance of stroboscopic method of speed measurement.</p> <p>ILO15: Write short notes on capacitive tachometers and tachogenerators.</p> <p>ILO16: Explain the basic principle behind measurement of acceleration.</p> <p>ILO17: Give the characteristics of potentiometric type accelerometer along with its structure.</p> <p>ILO18: Discuss the working principle of piezo electric and seismic accelerometer.</p> <p>ILO19: Explain the construction and working principle of a resistance thermometer.</p> <p>ILO20: Discuss the basic operation of a thermocouple and thermistor and their characteristics.</p> <p>ILO21: Give the sensitive properties of a semi conductor thermometer.</p> <p>ILO22: Describe the working of radiation pyrometer and optical pyrometer used as non contact type measuring instrument for temperature.</p> <p>ILO23: Explain the construction and working of an electromagnetic flow meter.</p> <p>ILO24: Explain the mechanism of turbo magnetic flow meters.</p> <p>ILO25: Discuss the working of hot wire air flow meter.</p> <p>ILO26: Write short notes on anemometer and ultrasonic flow meter.</p> <p>ILO27: List the differences between capacitive and resistive liquid level detectors.</p> <p>ILO28: Explain the mechanism used by crystal hydrometer for measuring the</p>
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		<p>density of liquid.</p> <p>ILO29: Describe the working principle of microwave refract meter for the measurement of moist in air.</p> <p>ILO30: Explain briefly the capacitive and resistive methods of humidity level measurement.</p> <p>ILO31: Write short notes on crystal hygrometer and microwave refract meter for humidity measurement.</p> <p>ILO1: Explain the need for transducer signal conditioning.</p> <p>ILO2: List the differences between AC and DC signal conditioning systems.</p> <p>ILO3: Implement DC and AC bridges for calculation of signal conditioning elements.</p> <p>ILO4: Describe the instrumentation amplifier with a circuit diagram and mention its uses in tests and measurements.</p> <p>ILO5: Give the specifications and characteristics of a chopper amplifier.</p>
		<p>CO-3:Analyze various signals and implement techniques for signal conditioning in many applications in engineering</p>

7: Detail Course Content

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	INTRODUCTION	<p>1.1. Concept of instrumentation system – exploration with block diagram and examples.</p> <p>1. 2. 1Transducer as a system component, input/output specifications for a transducer, classification of transducer; factors affecting choice of transducers.</p>	4



2.0	MEASUREMENT OF PHYSICAL QUANTITIES	<p>2.1. Displacement–Potentiometric, strain gauge, LVDT, Inductive transducer, capacitive gauge, Piezoelectric, photo electric transducer, Synchros.</p> <p>2.2. Pressure –Elastic deformation elements, electrical transducers as secondary transducers; low- pressure measurement – Pirani gauge, Ionization gauge.</p> <p>2.3 Velocity–Moving magnet type, Moving coil type, AC and DC tachometer, Drag–cup tachometer, Photoelectric tachometer, stroboscopic method, capacitive tachometer, tachogenerator.</p> <p>2.4 Acceleration –basic principle, potentiometric type, Piezo-electric type and seismic accelerometer.</p> <p>2.5 Temperature–Resistance thermometer, thermo couple, thermistor, semiconductor thermometer; noncontact type temperature measurement –radiation pyrometer, optical pyrometer, optical pyrometer.</p> <p>2.6 Flow – Electromagnetic, Turbo magnetic, Hot-wire, anemometer and ultrasonic flow meter.</p> <p>2.7 Liquid level–Resistive, capacitive and crystal hygrometer, micro wave refractometer.</p> <p>2.8. Humidity–Resistive, capacitive and crystal hygrometer, microwave refractometer.</p>	
3.0	SIGNAL CONDITIONING	<p>3.1 Need for transducer signal conditioning; DC and AC signal conditioning system, DC and AC Bridges as signal conditioning elements.</p> <p>3.2 Instrumentation Amplifiers, Chopper Amplifier, their specification and characteristics applications.</p>	



8. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	INTRODUCTION	3	-	4	7
2	MEASUREMENT OF PHYSICAL QUANTITIES	14	15	20	49
3	SIGNAL CONDITIONING	8	-	6	14
	Total	25	15	30	70

9. Suggested Learning Resources**Suggested Books:**

- i) Electrical and Electronic Measurements & Instrumentation—A.K. Sawhney
- ii) Electronic Instrumentation & Measurement Techniques—Helfrick & Cooper
- iii) Instrumentation Measurements & Analysis—Nakra & Choudhury
- iv) Electronic Instruments & Measurements—Larry Jones & A. Foster Chin

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1 Course Title: Printed Circuit Board (PCB) Technology

2 Course Code: ET-508

3 Semester: 5th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			



6: CO & ILOs

ET-509	PCB Technology	Course Outcome (CO)	Intended Learning Outcome (ILO)
		<p>CO-1 Understand the basic block diagram for manufacturing of PCB and the requirements of a PCB.</p> <p>CO-2 Learn about the Copper Clad Laminates (CCL), its properties and manufacturing process.</p> <p>CO-3 Plan the layout for designing a PCB.</p> <p>CO-4 Identify the placing of electrical traces via holes in a PCB.</p>	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Explain the requirements of a PCB.</p> <p>ILO2: Classify the different types of PCB.</p> <p>ILO3: Describe the manufacturing of a PCB with the help of a block diagram.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: List the properties of CCL.</p> <p>ILO2: Discuss the different types of CCL.</p> <p>ILO3: Explain the process of manufacturing CCL.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Scale a PCB layout for a given ratio.</p> <p>ILO2: Discuss the grid system and board sizes to be used for PCB layout.</p> <p>ILO3: Describe the various layout approaches for PCB.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Describe briefly the basic approaches for PCB artwork.</p> <p>ILO2: List the guidelines for tapping process involved in PCB design.</p> <p>ILO3: Explain the general artwork rules to be followed in PCB design.</p> <p>For CO-5: After completion of this course students will be able to-</p>

		<p>CO-5 Implement the rules for designing different types of circuit in a PCB.</p>	<p>ILO1: Explain the design rules for analog circuits in a PCB.</p> <p>ILO2: List the design rules for digital circuits in a PCB.</p> <p>ILO3: Discuss the design rules for power circuits in a PCB.</p> <p>ILO4: Explain the design rules for high frequency circuit in a PCB.</p>
		<p>CO-6 Prepare the Master film for a PCB design.</p>	<p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1: Explain the emulsion parameters for a film master preparation.</p> <p>ILO2: List the factors affecting film dimensional stability.</p> <p>ILO3: Describe the two types of Reprographic cameras used in PCB design.</p> <p>ILO4: Give a pictorial representation of Direct material flow in Dark room operation.</p> <p>ILO5: Discuss the sequential processes involved in film processing of PCB.</p> <p>For CO-7: After completion of this course students will be able to-</p> <p>ILO1: Describe the board cleaning process before pattern transfer.</p> <p>ILO2: Explain the different categories of coils used for pattern transfer.</p> <p>ILO3: Differentiate between manual cleaning process and machine cleaning process.</p>



		<p>CO-7 Analyse the processes involved in Pattern transfer from film to PCB and photo printing in PCB.</p>	<p>ILO4: List the desired features of photo resist.</p> <p>ILO5: Write short note on wet film resists.</p> <p>ILO6: Write the basic processes for double sided PCBs.</p> <p>ILO7: Explain the process of exposure to UV light for photo printing.</p> <p>ILO8: Discuss the developing processes in photo printing.</p> <p>For CO-8: After completion of this course students will be able to-</p> <p>ILO1: List the factors to be observed while selecting a screen fabric for screen printing in PCB.</p> <p>ILO2: Explain the use of Monofile Polyester fabric and Stainless steel fabric for screen printing in PCB.</p> <p>ILO3: Describe the processes involved in screen and frame preparation for screen printing in PCB.</p> <p>ILO4: Discuss in detail the step by step processes involved in Direct Method and Indirect method of pattern transfer in screen printing in PCB.</p> <p>ILO5: List the steps for reclamation of the screen fabrics after the completion of screen printing.</p> <p>For CO-9: After completion of this course students will be able to-</p> <p>ILO1: List the different types of etchant used in the etching process.</p> <p>ILO2: Describe the machine etchant system.</p> <p>For CO-10: After completion of this</p>
		<p>CO-8 Implement screen printing in PCB.</p>	



		<p>CO-9 Implement the process of etching in the designing of PCB.</p> <p>CO-10 Perform plating in PCB by different chemical processes and by the process of electroplating.</p> <p>CO-11 Learn the process of Drilling in PCB.</p> <p>CO-12 Understand the use of software in PCB technology for the design of PCB for a circuit.</p>	<p>course students will be able to-</p> <p>ILO1: Describe the chemical process used in plating of PCB.</p> <p>ILO2: Discuss the process of electroplating in PCB.</p> <p>For CO-11: After completion of this course students will be able to-</p> <p>ILO1: Discuss the drilling bit geometry.</p> <p>ILO2: Explain drilling angle and its significance.</p> <p>ILO3: Describe the drill speed feed and its withdrawal rate.</p> <p>For CO-12: After completion of this course students will be able to-</p> <p>ILO1: Implement the PCB software for PCB design.</p> <p>ILO2: Explain the processes involved for taking printout of the circuit for PCB design.</p> <p>ILO3: Write short note on photo plotter and CNC machine.</p>
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7: Detail Course Contents

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	Introduction	1.1 Requirement of a PCB, classification of different types of PCB, brief description of PCB manufacturing with block diagram.	2
2.0	Copper Clad Laminates (CCL)	2.1 Properties of CCL, different types of CCL, manufacturing of CCL	3



3.0	Layout Planning	3.1 Layout scale, grid system, board sizes, layout approaches and documentation	5
4.0	Artwork	4.1 Basic approaches, taping guidelines and general artwork rules	5
5.0	Design Rules	5.1 Design rules for – analog circuits, digital circuits, power circuits and high frequency circuits	5
6.0	Film Master preparation	6.1 Emulsion parameters, Film emulsion dimensional stability of film master reprographic cameras, dark room and film processing	3
7.0	Pattern transfer	7.1 Board cleaning before pattern transfer, categories of coils, manual cleaning process and machine cleaning processing 7.2 Photo printing – photo resist. Wet film resists, exposure with UV light, further processing and developing.	5
8.0	Screen Printing	8.1 Screen fabrics, screen and frame preparation, pattern transfer, screen reclamation of the screen fabrics and printing.	5
9.0	Etching	9.1 Different types of etchant, machine etchant system, minimizing pollution.	3
10	Plating and PTH	10.1 Chemical process and electroplating.	2
11	Drilling	11.1 Drill bit geometry, drilling angle, drill speed feed and withdrawal rate.	2
12	Computer in PCB Technology	12.1 Introduction to PCB designing software, Printout taking, photo plotter and CNC machines.	2

8: Distribution of Marks

Chapter No.	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1.0	INTRODUCTION	1	3	-	4
2.0	COPPER CLAD LAMINATES	2	-	3	5
3.0	LAYOUT PRINTING	3	-	5	8
4.0	ARTWORK	3	-	5	8
5.0	DESIGN RULES	3	-	5	8

6.0	FILM MASTER PREPARATION	2	3	-	5
7.0	PATTERN TRANSFER	3	2	5	10
8.0	SCREEN PRINTING	3	-	5	8
9.0	ETCHING	1	2	2	5
10	PLATING AND PTH	-	3	-	3
11	DRILLING	3	-	-	3
12	COMPUTER IN PCB TECHNOLOGY	1	2	-	3
	Total	25	15	30	70

9SuggestedLearning Resources

Suggested Books:

PCB Design and Technology by Walter Bosh art

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1 Course Title : Control Systems

2. Course Code : Et-509
3. Semester : 5th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			

6. COs and ILOs:

ET-509	Control System	Course Outcome (CO)	Intended Learning Outcome (ILO)
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		<p>CO-1 Implement the elementary forms of control devices, Laplace transformation technique, block diagram representation of control systems, Mason's gain etc.</p>	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Draw the block diagram of open and closed control systems and explain with examples.</p> <p>ILO2: Explain the operation of position control system and on-off control system.</p> <p>ILO3: Define and list the differences between continuous control system and discrete control system.</p> <p>ILO4: Implement Laplace transformation technique to solve differential equations with an example.</p> <p>ILO5: Give the significance of state space presentation for a control system and explain with suitable examples.</p> <p>ILO6: Discuss the block diagram representation of a control system in a sequential manner.</p> <p>ILO7: Draw a pictorial representation from a given equation.</p> <p>ILO8: Write the steps to draw the block diagram for given differential equation.</p> <p>ILO9: Draw block diagram of a control for the equation</p> <p>ILO10 : List the rules for block diagram reduction technique used to find transfer function in control systems.</p> <p>ILO11: Using block diagram reduction technique find the transfer function of a control system for given block diagram</p> <p>ILO12: Identify the nodes and branches for a given signal flow graph</p> <p>ILO13: Construct a signal flow graph for a given algebraic equations.</p> <p>ILO14: Convert a given block diagram to its equivalent signal flow graph.</p> <p>ILO15: Write the Mason's gain formula and explain the terms "path", "forward path", "forward path gain", "loop", "loop gain", and "non-touching loop".</p> <p>ILO16: Calculate the transfer function from a signal flow graph using Mason's gain formula.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Compute the transfer function of a DC motor and a DC generator using Laplace transform technique.</p> <p>ILO2: Derive the transfer function for an AC motor and AC servomotor.</p>
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		<p>ILO3: Explain the need for compensation in control system in detail.</p> <p>ILO4: Describe the various methods of compensation in control system.</p> <p>ILO5: Draw the circuit diagram for phase lead compensation and draw the pole zero plots for the same.</p> <p>ILO6: Give the advantages and disadvantages for the phase lead compensation.</p> <p>ILO7: Compute the transfer function for the phase lag compensation and draw the pole zero plot.</p> <p>ILO8: List the advantages and disadvantages for the phase lag compensation.</p> <p>ILO9: Mention the effects of phase lead and phase lag compensation.</p> <p>ILO10: Compute the transfer function for a gear train.</p> <p>ILO11: Derive the transfer function for an AC tachometer.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Describe the use of synchro potentiometer as an error measuring system.</p> <p>ILO2: Explain the use of null devices for error measurement.</p> <p>ILO3: Discuss the role of motor and power amplifiers and their use in error measurement.</p> <p>ILO4: Comment on the statement “magnetic amplifiers are phase sensitive detectors”.</p> <p>ILO5: Explain the use of servo elements in control system engineering.</p> <p>ILO6: Define steady state error in control system.</p> <p>ILO7: Compute the steady state error for a unity feedback system using suitable block diagram.</p> <p>ILO8: Calculate the steady state error for a non-unity feedback system.</p> <p>ILO9: Give the steady state error and error constant for a unit step signal, unit ramp signal and unit parabolic signal.</p> <p>ILO10: Mention the significance of steady state error coefficient.</p>
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CO-2 Calculate transfer function for various motors, generators, tachometers, amplifiers etc.

		<p>CO-3: Understand the significance of servo elements in control systems and the need of error measurement devices.</p> <p>CO-4: Analyze different stability criterion for open loop and closed loop control system.</p>	<p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Explain the working of an open loop control system with the help of an example and compute the transfer function and open loop gain for the system.</p> <p>ILO2: Explain the working of a closed loop control system with the help of an example and compute the transfer function for the system.</p> <p>ILO3: List the characteristics of an open loop and closed loop control system.</p> <p>ILO4: Derive the characteristic equation for an open loop and closed loop control system.</p> <p>ILO5: Discuss the Routh's stability criterion and give its significance.</p> <p>ILO6: Illustrate the algorithm for applying Routh's stability criterion.</p> <p>ILO7: Considering a characteristic equation analyze the stability of the system using Hurwitz stability criterion.</p> <p>ILO8: Considering a characteristic equation analyze the stability of the system using Routh's stability criterion.</p>
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7. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	ELEMENTARY FORMS OF CONTROL SYSTEM	<p>1.1 Elementary control devices, open and closed control system, position control system, on-off control system, and continuous control system.</p> <p>1.2 Laplace transformation technique, system representation by equation, block diagram representation, and block diagram reduction technique, single flow graph, Mason's gain.</p>	10
2.0	TRANSFER FUNCTION	<p>2.1 Transfer function of D.C. motor, generator, A.C. motor, servomotor, amplifiers & compensating networks, gear trains, A.C. tachometers.</p>	8



3.0	SERVO-ELEMENTS	3.1 Error measuring system, synchros, potentiometers, null devices, motor and power amplifiers, magnetic amplifiers phase sensitive detectors. 3.2 Steady state errors, constants and examples of error calculation, error co-efficient, types of mechanisms.	14
4.0	STABILITY ANALYSIS	4.1 Closed loop and open loop transfer function, Characteristics equation, Routh stability criterion, Hurwitz stability criterion.	10

8. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type	Short	Descriptive	
1	ELEMENTARY FORMS OF CONTROL SYSTEM	2	4	10	16
2	TRANSFER FUNCTION	4	5	5	14
3	SERVO-ELEMENTS	10	6	8	24
4	STABILITY ANALYSIS	9	-	7	16
	Total	25	15	30	70

9. Suggested Learning Resources

Suggested Books:

- i) Ogata K, "Modern Control Engineering", Prentice Hall
- ii) Kuo B. C, "Automatic Control System", Prentice Hall
- ii) Nagarath & Gopal, "Control System Engineering", Wiley Eastern



SIXTH SEMESTER

ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING



COURSE STRUCTURE OF ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING (6TH SEMESTER)

S/ N	Subject Code	Subject	Core /Electiv e	Study Scheme Contact hours/week			Evaluation Scheme									
							Theory					Practical			Total Marks (Theory +Practical)	Credit
				L	T	P	ESE	Session I (SS)			Pass (ESE +SS)	Practical Test (PT)	Practical Assessme nt (PA)	Pass (PT+PA)		
								TA	HA	Total (TA+ HA)						
1	Hu-601	Industrial Management & Entrepreneurship	C	3	-	-	70	10	20	30	33/100	-	-	-	100	3
2	Et-601	Consumer Electronics	C	4	-	-	70	10	20	30	33/100	-	-	-	100	4
3	Et-602	Data Communication & Networking	C	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
4	Et-603	Microcontroller & Embedded Systems	C	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
5	Et-611	Project & Seminar	C	-	1	6	-	-	-	-	-	100	50	50/150	150	3
6	Et-612	General Viva	C	-	2	-	-	-	-	-	-	50	-	17/50	50	2
7	Et-610	Professional Practice-IV	C	1	-	2	-	-	-	-	-	25	25	17/50	50	2
8	-	Elective (Any One)		3	-	-	70	10	20	30	33/100	-	-	-	100	3
A	Et-604	Medical Electronics	E													
B	Et-605	Modern Communication Systems	E													
C	Et-606	Microwave Techniques	E													
D	Et-607	Industrial Electronics	E													
E	Et-608	Digital Signal Processing	E													
F	Et-609	Advanced Microprocessor	E													
				34			Total								850	25



Course Title : Industrial Management and Entrepreneurship

1. Course Code: **Hu – 601**

2. Semester: **VI**

3. **Aim of the Course:**

1. To acquaint the students with managerial activities
2. To provide introductory knowledge of Cost Accounting
3. To introduce students with industrial legislation
4. To explain the scope for self-employment
5. To compare and contrast different forms of business organization
6. To identify the opportunities to start a small scale industry

4. **Course Outcomes:**

On completion of the course on IME, students will be able to

- CO₁ = explain managerial activities.
- CO₂ = describe leadership qualities and decision making process.
- CO₃ = state the elements of costs.
- CO₄ = explain important industrial laws.
- CO₅ = define different forms of business organisations
- CO₆ = identify entrepreneurial abilities for self employment through small scale industries.

5. **Teaching Scheme (in hours)**

Lecture	Tutorial	Practical	Total
42 hrs	3 hrs	--	45 hrs

6. **Examination Scheme:**

Theory				Practical				Total Marks
Examination Full Marks	Sessional Full Marks	Total Marks	Pass Marks	Examination		Sessional		
70	30	100	33	--	--	--	--	100



7. Detailed Course Content:

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
				42 hrs
1.0	Introduction to Management :	i) Meaning and Concept ii) Functions of Management iii) Principles of Management	i) Explain functions and principles of management	3
2.0	Leadership Decision Making & Communication :	i) Definition of Leader ii) Functions of a leader iii) Decision making – Definition iv) Decision making process v) Communication – definition, importance & types	i) Develop leadership qualities ii) Demonstrate decision making abilities	4
3.0	Introduction to Cost :	i) Definition and classification of Cost ii) Elements of Cost iii) Break Even Analysis	i) State elements of costs ii) Explain Break Even Analysis	3
4.0	Human Resource Management:	i) Meaning of manpower planning ii) Recruitment and Selection procedure iii) Payment of wages – factors determining the wage iv) Methods of payment of wages – Time rate and Piece rate v) Labour Turnover – definition, its causes, impact and remedy	i) State selection procedure of employees ii) Distinguish Time rate and Piece rate system of wage payments iii) Explain causes and impact of labour turnover	5

5.0	Industrial Legislation :	i) Need of Industrial legislation ii) Indian Factories Act – 1948 – Definition of Factory, main provisions regarding health, Safety and Welfare of Workers iii) Industrial Dispute Act – 1947 – Definition of Industrial dispute, Machineries for settlement of Industrial dispute in India	i) Identify the needs and importance of industrial laws	5
6.0	Production Management :	i) Meaning of Production ii) Production Management – definition, objectives, functions and scope iii) Inventory Management, Basic idea	i) State the objectives and functions of Production management	3
7.0	Marketing Management:	i) Meaning and functions of marketing ii) e- Commerce iii) Channels of distribution iv) Wholesale and retail trade	i) state the functions of wholesalers and retailers	2
8.0	Entrepreneur and Entrepreneurship:	i) Definition of Entrepreneur and Entrepreneurship ii) Qualities required by an entrepreneur iii) Functions of an entrepreneur iv) Entrepreneurial	i) State the qualities and functions of an entrepreneur	3



		motivation		
9.0	Forms of Business Organisation:	i) Sole Trader – meaning, main features, merits and demerits ii) Partnership – definition, features, merits and demerits iii) Joint Stock Company – Definition, types, features, merits and demerits	i) Differentiate different forms of Business organization ii) compare and contrast features, merits and demerits of different business organizations.	5
10.0	Micro and Small Enterprises:	i) Definition of Micro & Small enterprises ii) Meaning and characteristics of Micro and Small enterprise iii) Scope of SSI with reference to self-employment iv) Procedure to start SSI – idea generation, SWOT analysis v) Selection of site for factories	i) Define micro and small enterprises ii) Explain the procedure to start a small enterprise	4
11.0	Support to Entrepreneurs	a) Institutional support: i) Introduction ii) Sources of information and required application forms to set up SSIs iii) Institutional support of various National & State level organizations – DICC, NSIC, IIE, MSME - DI, Industrial Estates	i) identify the supporting agencies to entrepreneurs ii) Explain the role of financial support organisations	5



		b) Financial support: i) Role of Commercial banks, RRB, IDBI, ICICI, SIDBI, NEDFi, and State Financial Corporations ii) Special incentives and subsidies for Entrepreneurship Development in the North East		
	Class Test			3 hrs
	Total			45 hrs

(9) TABLE OF SPECIFICATIONS for Industrial Management & Entrepreneurship

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Comprehension	Application	HA
1	Introduction to Management	3	7	2	3	0	0
2	Leadership & Decision Making	4	9.5	3	4	0	0
3	Introduction to Cost	3	7	3	2	0	0
4	Human Resource Management	5	12	6	2	0	0
5	Industrial Legislation	5	12	4	4	0	0
6	Production Management	3	7	3	2	0	0
7	Marketing Management	2	5	4	0	0	0
8	Entrepreneur & Entrepreneurship	3	7	3	2	0	0



9	Forms of Business Organisation	5	12	3	5	0	0
10	Micro & Small Enterprises	4	9.5	4	3	0	0
11	Support to Entrepreneurs	5	12	4	4	0	0
Total		42	100	39	31	0	70

K = Knowledge C = Comprehension A = Application HA =
Higher Than Application (Analysis, Synthesis, Evaluation)

$$C = \frac{b}{\sum b} \times 100$$

10. Distribution of Marks:

DETAILED TABLE OF SPECIFICATIONS FOR IME

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand Total
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
1	Management	1	0	0	1	1	0	0	0	1	0	3	0	0	3	5
2	Leader & Decisi	1	0	0	1	2	1	0	0	3	0	3	0	0	3	7
3	Cost	1	1	0	2	2	1	0	0	3	0	0	0	0	0	5
4	HRM	2	1	0	3	1	1	0	0	2	3	0	0	0	3	8
5	Laws	3	0	0	3	0	0	0	0	0	1	4	0	0	5	8
6	Product Manage	2	1	0	3	1	1	0	0	2	0	0	0	0	0	5
7	Market	2	0	0	2	2	0	0	0	2	0	0	0	0	0	4
8	Entrepreneurship	1	1	0	2	2	1	0	0	3	0	0	0	0	0	5
9	Forms of BO	2	1	0	3	0	0	0	0	0	1	4	0	0	5	8
10	MSME	2	0	0	2	0	0	0	0	0	2	3	0	0	5	7
11	Support to Entp.	3	0	0	3	1	0	0	0	1	0	4	0	0	4	8
	Total	20	5	0	25	12	5	0	0	17	7	21	0	0	28	70

K = Knowledge C = Comprehension A = Application HA =
Higher Than Application

T = Total



Higher than Application (Analysis, Synthesis, Evaluation)

11. Suggested implementation Strategies: Modified syllabus may be implemented with effect from January, 2020 (Starting with the present batch (2018) of 2nd Semester students)

12. Suggested learning Resource:**a. Book list :**

Sl. No.	Title of Book	Name of Author(s)	Publisher
1	Industrial Management	S.C. Jain H.S. Bawa	Dhanpat Rai & Co. (P) Ltd. New Delhi-110006
2	Business Organisation and Entrepreneurship Development	S.S. Sarkar R.K. Sharma Sashi K. Gupta	Kalyani Publishers, New Delhi-110002
3	Entrepreneurial Development	S. S. Khanka	S. Chand & Co. Ltd. New Delhi-110055
4	Business Methods	R.K. Sharma Shashi K Gupta	Kalyani Publishers, New Delhi
5	Entrepreneurship Development and Management	Dr. R.K. Singhal	S.K. Kataria & Sons, New Delhi-110002
6	Business Administration & Management	Dr. S. C. Saksena	Sahitya Bhawan, Agra

b. List of Journals**c. Manuals****d. Others**

1. Course Title : CONSUMER ELECTRONICS

2. Course Code :Et-601

3. Semester :6th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
4hrs	0	0	4 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	0	100	4
	TA	HA						
70	10	20		0	0			

6. Rationale of the Subject/Course:

Revolution in electronics technology has brought radical changes in Audio & Video system in the recent years and the state of art will enable the students to comprehend the fact, concept, working principle and its application .The knowledge so gathered by the students will help them to be familiar with designing concepts and repairing of audio& video system.

7. COs and ILOs:

ET-505	Consumer Electronics	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Learn the construction and working principle of Microphone.	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Explain the construction and working principle of carbon, condenser and crystal microphone.</p> <p>ILO2: Define the terms sensitivity, frequency response, output impedance, distortion and directivity for</p>

		<p>CO-2 Understand the construction and working of loud speakers.</p>	<p>microphones.</p> <p>ILO3: Discuss about moving coil microphones and wireless microphones.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Explain the construction and working of moving coil loud speakers.</p> <p>ILO2: Give the frequency response of Woofer, Tweeter, Squawker, loudspeaker enclosure.</p> <p>ILO3: Discuss impedance matching of loudspeaker.</p> <p>ILO4: Calculate the impedance of series and parallel loudspeakers.</p> <p>ILO5: Write short notes on matching transformer.</p> <p>ILO6: Explain multi way speaker system.</p>
		<p>CO-3 Analyze the working and construction of Audio systems.</p>	<p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Give the basic principles of magnetic recording and playback systems.</p> <p>ILO2: Explain the block diagram of MP3 player and the basic principles of digital recording.</p> <p>ILO3: List the characteristics of monophonic and stereo phonic sound systems.</p> <p>ILO4: Describe various blocks of stereo systems.</p> <p>ILO5: Discuss the electronic circuit, function of balance, bass and treble controls of stereo systems.</p> <p>ILO6: Explain crossover networks, passive and active cross over networks,</p>



		<p>CO-4 Learn the block diagram, functions and various types of TV receiver.</p>	<p>graphic equalizer and Dolby noise limiting systems.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Discuss the fundamentals and construction of picture tubes for B/W TV systems.</p> <p>ILO2: Draw the block diagram of monochrome receiver and explain each block.</p> <p>ILO3: Compare the NTSC, SECAM and PAL colour systems for TV receiver.</p> <p>ILO4: Explain the process of reception of colour signals in PAL system.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Write short note on Plasma display and LED & LCD display.</p> <p>ILO2: Draw the block diagram of Digital colour TV receiver.</p> <p>ILO3: Describe the Remote control IR transmitter and Receiver systems.</p> <p>ILO4: List the applications of CCTV.</p> <p>ILO5: Explain Telecine equipment and Digital CCD Telecine systems.</p> <p>ILO6: Describe the block diagram of DTH system and discuss the characteristics of set-top box.</p> <p>ILO7: Draw the block diagram of modern cable TV system.</p> <p>ILO8: Discuss the HDTV system and give the HDTV standards.</p> <p>For CO-6: After completion of this course students will be able to-</p>
		<p>CO-5 Understand the circuitry and applications of Advanced Television Systems.</p>	

		<p>CO-6 Describe the working principle and block diagram of CD players.</p> <p>CO-7 Analyze evolution of Mobile handset and its block diagram.</p>	<p>ILO1: Give the working principle of CD recording and CD playing.</p> <p>ILO2: Describe the block diagram and working principle of VCD and DVD player.</p> <p>For CO-7: After completion of this course students will be able to-</p> <p>ILO1: Give a brief note on cell phone evolution.</p> <p>ILO2: Discuss the various cell phone generations.</p> <p>ILO3: Discuss the block diagram of a typical mobile handset and explain each block with typical components.</p>
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8. Detail Course Content:

Chapter	Chapter Title	Content	Duration
1.0	MICROPHONE	<p>1.1 Construction and working principles of carbon, condenser and crystal microphones and study of their technical parameters-Sensitivity, Frequency Response, Output Impedance, Distortion, Directivity</p> <p>1.2 Moving Coil Microphone-Wireless Microphone.</p>	4
2.0	LOUD SPEAKERS	<p>2.1 Constructions and working principles of Moving Coil Loudspeaker,</p> <p>2.2 Frequency response of Practical Loudspeakers: Woofer, Tweeter, Squawker, Loudspeaker Enclosure</p> <p>2.3 Impedance matching of loud speakers; series & parallel connections of loud speaker and impedance calculations, matching transformers; multi-way speaker systems.</p>	6



3.0	AUDIO SYSTEMS	<p>3.1 Basic principles of Magnetic Recording, Playback.</p> <p>3.2 Basic principles of digital recording & block diagram of MP3 player & explanation.</p> <p>3.3 Concept of monophonic & stereophonic sound system, Study of different blocks of Stereo systems, their electronic circuits, function of balance, bass & treble controls.</p> <p>3.4 Cross over Networks, passive & active crossover network; Graphic Equalizer; Dolby noise limiting systems.</p>	8
4.0	BASIC TV RECEIVERS	<p>4.1 B/W TV systems–fundamentals, picture tubes & their constructions</p> <p>4.2 Block diagram of Monochrome Receiver functions of each block.</p> <p>4.3 Different colour systems like NTSC, SECAM and PAL system and their comparison</p> <p>4.3Reception of colour signals in PAL system.</p>	8
5.0	ADVANCED TELEVISION SYSTEMS	<p>5.1 Principles of Flat panel display: Plasma display, LED & LCD display– Block diagram of a digital color TV receiver – Remote control IR transmitter and receiver</p> <p>5.2 Closed circuit TV system (CCTV) – Applications of CCTV – Telecine equipment – Digital CCD Telecine system.</p> <p>5.3 Direct to Home System (DTH) Introduction & Block diagram concept of set-top box</p> <p>5.4 Modern cable TV system block diagram</p> <p>5.5 Concepts of HD TV system, List of HDTV standards</p>	8
6	CD PLAYERS	<p>6.1 Working principle of CD recording and CD playing</p> <p>6.2 Block diagram and working principle of VCD and DVD Player</p>	4



7	MOBILE HANDSET	7.1 Cell phone History, Cell phone generations 7.2 Block diagram of a typical mobile handset, brief description of each block with typical components.	4
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9. Distribution of Marks

Chapter No.	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	MICROPHONE	4	2	-	6
2	LOUDSPEAKERS	-	4	5	9
3	AUDIO SYSTEMS	5	2	7	14
4	BASIC TVRECEIVERS	7	-	7	14
5	ADVANCEDTELEVISION SYSTEMS	3	4	7	14
6	CDPLAYERS	3	3	-	6
7	MOBILEHANDSET	3	-	4	7
	Total	25	15	30	70

10.SuggestedLearningResources

Suggested Books:

1. A.K. Maini-Colour Television and Video Technology
2. B.R. Gupta-Consumer Electronics
3. Ajay Sharma – Audio and Video systems
4. R.G. Gupta –Audio and Video Systems
5. Gulati- Monochrome and colour TV
6. Manohar Lotia- Modern CD Player Servicing Manual
7. Bartlett Cable-TV Technology and Operation
8. R.G. Gupta -Electronic Instruments and Systems
9. A.M. Dhake –Television & Video Engineering
10. Bernard Grob -Basic Television and Video Systems

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1. Course Title :Data Communication and Networking

2. Course Code :ET-602

3. Semester :6thSemester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	3hrs	6 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional(SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

6. Rationale of the Subject/Course:

With the widespread uses of the electronic gadgets, data exchange among the devices has become very common. The course will give knowledge of data communication basics, different techniques and also advanced methods of data communication. Data communication in different environments like LAN, ISDN and Internet are also included.

7. COs and ILOs:

ET-602	Data communication and networking	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Understand the basics of data communication system, different types of communication links and types of wired and wireless	For CO1: After completion of this course students will be able to- ILO1: State the differences between analog and digital transmission systems. ILO2: Distinguish between synchronous and asynchronous transmission.



		<p>communication.</p> <p>CO-2 Implement the concept of serial communication using different types of data interface standards and will also learn about the operation of MODEMS.</p>	<p>ILO3: Explain with examples the terms simplex, half duplex and full duplex.</p> <p>ILO4: Give the applications of baseband and broadband communication.</p> <p>ILO5: Discuss the various types of communication links with neat diagrams.</p> <p>ILO6: Define bit rate, baud rate and data format.</p> <p>ILO7: Explain the concept of point to point communication and broadcast communication and mention their advantages and disadvantages.</p> <p>ILO8: Differentiate between connection oriented and connection less communication.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Describe the Serial packet format in detail.</p> <p>ILO2: Give the pin description and operational functions of USART 8251.</p> <p>ILO3: Write the characteristics of RS 232-C, RS 422-A and RS 489.</p> <p>ILO4: Discuss the various types of MODEMS and their operation in data communication.</p> <p>ILO5: Mention some applications of MODEMS.</p>
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		<p>CO-3:Analyze the various types of computer networks, their topologies and applications and also learn about the OSI model in detail.</p>	<p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Discuss briefly the purpose of computer networks and differentiate among the types of networks.</p> <p>ILO2: Describe the various types of network topologies with suitable diagrams and mention their functionalities.</p> <p>ILO3: Define the terms “server”, “client”, “switch” and “hub”.</p> <p>ILO4: Compare among bridge, router and gateway in tabular form.</p> <p>ILO5: Explain the working of circuit switching, packet switching and message switching.</p> <p>ILO6: Discuss in detail the OSI model and also write the functions of each layer of the OSI model.</p>
		<p>CO-4: Understand the Local Area Networks in detail, IEEE 802 family of LAN standards, wireless LAN and LAN protocols.</p>	<p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Describe in detail the IEEE 802.3 LAN standard.</p> <p>ILO2: Discuss the working of Token bus and Token ring standards of LAN.</p> <p>ILO3: Draw and explain the frame format of CSMA/CD.</p> <p>ILO4: Distinguish between structured and Ad-hoc networks.</p>

		<p>CO-5: Interpret the various types of Protocols used in transmission of information over different networks.</p>	<p>ILO5: Explain the working of MANET.</p> <p>ILO6: Discuss the various types of IEEE 802.11 and their features.</p> <p>ILO7: List the differences between PCF and DCF.</p> <p>ILO8: Explain the working of CSMA/CA with the help of a flowchart.</p> <p>ILO9: Write short notes on LAN protocols.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Discuss the structure of internet with a pictorial representation.</p> <p>ILO2: List the goals and challenges faced by internet.</p> <p>ILO3: Explain the various types of TCP/IP protocols.</p> <p>ILO4: Describe the internet addressing schemes of various classes of the IP.</p> <p>ILO5: List the characteristics of four different types of Internet routing protocols.</p> <p>ILO6: Define the terms “WWW”, “HTTP”, “HTML”, and “E-mail”.</p> <p>ILO7: Discuss the architecture of web browser and mention its functionalities.</p> <p>ILO8: State the differences between FTP and TELNET.</p> <p>ILO9: Write short notes on internet services.</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1: Write short notes on integrating services.</p>
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		CO-6: Learn about the integrating services and the significance of Asynchronous Transfer Mode (ATM) in communication.	ILO2: Explain the working of ISDN and its interfaces. ILO3: Mention some applications of ISDN. ILO4: List some features of broadband ISDN. ILO5: Draw the Network Node Interface (NNI) and the User Node Interface (UNI) of an ATM cell and discuss the various terms involved. ILO6: Discuss the ATM architecture. ILO7: State the purpose of ATM switches.
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8. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	Introduction to Data Communication	1.1. Fundamental of data communication system, Analog and digital transmission, Synchronous and asynchronous communication, Simplex and duplex communication, Base band and broadband communication. 1.2. Communication links: Guided and unguided, Twisted pair cable, Co-axial cable and Optics fibre Cable. 1.3. Data rate: Bit rate, baud rate, Data format. 1.4. Point-to-point and Broadcast communication, Connection oriented and connectionless communication.	4
2.0	Serial Data Communication	2.1. Serial Communication concept, Communication method, Serial packet format. 2.2. Universal synchronous asynchronous receiver transmitter 8251: Pin description, operational options of 8251A, 2.3. Data interface standards: RS 232-C, RS 489/RS 422-A/RS 423. 2.4. MODEMS : Types, operation and application.	8



3.0	Computer Networks	<p>3.1. Network concept, purpose of computer networks</p> <p>3.2. Types of network : LAN,MAN,WAN.</p> <p>3.3. Network topologies: Star, bus, ring, tree, mesh etc.</p> <p>3.4.Network components: Server, client, switch, hub, bridge router and gateways.</p> <p>3.5. Switching basics : circuit switching, packet switching, message switching</p> <p>3.6 .The Open System Interconnection (OSI) model: Layered model, layer description and functions.</p>	10
4.0	Local Area Networks	<p>4.1. Evolution of LAN standards, IEEE 802 family of standards of LAN, Ethernet, Token Bus and Token ring.</p> <p>4.2. CSMA/CD protocol, Frame format</p> <p>4.3.Wireless LAN: Structured and Ad-hoc, MANET, IEEE802.11 types, CSMA/CA description, PCF and DCF, frame format.</p> <p>4.4.Network Operating System–Features in common, LAN protocols.</p>	8
5.0	Internetworking	<p>5.1. Concept of Internet, Interconnecting networks, evolution.</p> <p>5.2. Structure of Internet, Goals and challenges of Internet</p> <p>5.3. TCP/IP Protocols, Classes of IP, Internet addressing schemes</p> <p>5.4. Internet routing protocols, GRP, EIGRP,OSPF,BGP</p> <p>5.5. WWW, HTTP, Hyperlink, web browser architecture</p> <p>5.6. Internet services, E-mail, FTP and Telnet</p>	7
6.0	ISDN and ATM	<p>6.1.Integratingservices,ISDNconnections&interface, ISDN application</p> <p>6.2. Broadband ISDN</p> <p>6.3 Introduction to ATM network, ATM cell, ATM switches.</p>	5

9. Distribution of Marks

Chapter	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	Introduction to Data Communication	4	2	-	6
2	Serial Data	6	-	8	14
3	Computer Networks	4	4	8	16
4	Local Area Networks	-	6	8	14
5	Internetworking	6	-	6	12
6	ISDN and ATM	5	3	-	8
	Total	25	15	30	70

10.Suggested Learning Resources**Suggested Books:**

- i) Introduction to Digital & Data communication-Michael A.Miller
- ii) Data communication-William L. Schweber
- iii) Data Communication Networks and Systems-Thomas C. Bartee
- iv) Computer Networks -Tanenbam

DATA COMMUNICATION&NETWORKINGLAB

1.0 Study & preparation of communication cables like

a) Twisted Pair b) Coaxial Cable c) Fiber Optics d) RS-232e) Null Modem etc.

2.0 Study of Modems

3.0 Study of Network Interface Cards

4.0 Study of Hubs &Switches

5.0 Study &Configuration of LAN

6.0 Study & Configuration of WAN

7.0 Network Administration (Basics only)



1. Course Title : **Microcontrollers and Embedded Systems**

2. Course Code : **Et-603**

3. Semester : **6th Semester**

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	3hrs	6 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	17/50	150	4
	TA	HA						
70	10	20		25	25			

6. Rationale of the Subject/Course:

The technology of microprocessor has led to a single chip Microcontroller technology MCS-51 family architecture, details of 8051 Microcontroller and its programming is covered in this subject use of assembler and stimulator for programming of Microcontroller will make the students equipped for the development of embedded systems.



7. COs and ILOs:

ET-603	Microcontrollers and Embedded systems	Course Outcome (CO)	Intended Learning Outcome (ILO)
		<p>CO-1 To understand the fundamental concepts of microcontroller.</p> <p>CO-2 To have depth understanding and knowledge of the architecture and features of 8051 microcontroller.</p>	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Define Microcontroller.</p> <p>ILO 2: Describe the block diagram of microcontroller.</p> <p>ILO 3: Compare microprocessor and microcontroller.</p> <p>ILO 4: Compare 8bit, 16bit & 32bit microcontroller.</p> <p>ILO 5: Describe Embedded and External memory Microcontroller.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO 1: Describe the general features of 8051 microcontroller.</p> <p>ILO 2: Describe the Block diagram and pin functions of 8051 with suitable sketch.</p> <p>ILO 3: State the functions of registers of 8051.</p> <p>ILO 4: Discuss various flags with simple examples.</p> <p>ILO 5: Describe in detail the Internal memory organization of 8051</p> <p>ILO 6: Define Stack and stack pointer of 8051.</p> <p>ILO 7: Explain Program memory of 8051.</p> <p>ILO 8: Explain the configuration of port</p>



		<p>CO-3:To develop skill in simple program writing for 8051 microcontroller.</p>	<p>For CO-3: After completion of this course students will be able to-</p> <p>ILO 1: Define assembler, cross assembler, compiler, cross compiler, linker and loader.</p> <p>ILO 2: Explain the Structure of Assembly language.</p> <p>ILO 3: Explain various addressing modes with examples.</p> <p>ILO 4: Discuss the function of each instruction of 8051 with bytes, no. of machine cycles.</p> <p>ILO 5: Explain the importance of rotate, swap, jump and call instructions in a program.</p> <p>ILO 6: Define sub routine and its function.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO 1: Discuss the Data types, memory types and models of C program for 8051.</p> <p>ILO 2: Define Strings, arrays, pointers, time delay generation along with its function.</p> <p>ILO 3: Discuss the use of arithmetic & logical operators.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO 1: Write programs with assembly & C.</p> <p>ILO 2: Define Polling.</p> <p>ILO 3: Describe various Interrupt methods.</p>
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		<p>CO-4: Implement programming in 8051</p> <p>CO-5: Write advanced programs.</p> <p>CO-6: To familiarize with interfacing of various peripheral devices with 8051 microcontroller.</p>	<p>ILO 4: Explain how to execute an Interrupt.</p> <p>ILO 5: Define IE and IP registers.</p> <p>ILO 6: Define Timer and Counters.</p> <p>ILO 7: Explain TMOD and TCON registers.</p> <p>ILO 8: Explain mode 1 & mode 2 operation of timers and counters.</p> <p>ILO 9: Explain SBUF & SCON registers.</p> <p>ILO 10: Describe working of serial port.</p> <p>ILO 11: Explain Serial data transmission & reception with example.</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO 1: Describe the operation of Interfacing LED with 8051.</p> <p>ILO 2: Explain the operation of Interfacing Seven segment Display with 8051 along with suitable sketch.</p> <p>ILO 3: Explain the mechanism of Interfacing LCD module with 8051.</p> <p>ILO 4: Explain the mechanism of Interfacing ADC & DAC with 8051 along with suitable sketch.</p> <p>ILO 5: Describe the operation of Interfacing DC motor & Stepper Motors with 8051.</p>
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8. Detail Course Content

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	Introduction	1.1 Definition of microcontroller. 1.2 Overview of block diagram of microcontroller. 1.3 Comparing 8bit, 16 bit, 32bit microcontroller. 1.4 Comparison of microprocessor and microcontroller. 1.5. 8051 family of microcontrollers. 1.6. Description of Embedded and External memory microcontroller.	5
2.0	8051 Architecture	2.1. The general features of 8051 microcontroller. 2.2. Block diagram description of 8051 and pin functions of 8051. 2.3. Understand the functions of various registers of 8051 like Program Counter, DPTR, A and B registers 2.4. PSW register-discussion on various flags with simple examples. 2.5. Special function registers of 8051. 2.6. Internal memory organization of 8051-register banks & their selection, bit/byte addressable RAM 2.7. Stack and stack pointer of 8051. 2.8. Program memory of 8051-internal and external. 2.9. I/O ports, configuration of port 1. Reading from and Writing to a port	10



3.0	8051 Assembly Language Programming	<p>3.1 Definition of assembler, cross assembler, compiler, cross compiler, linker and loader.</p> <p>3.2. Structure of Assembly language, Assembling and running an 8051 program.</p> <p>3.3. Addressing modes-Accessing memory using various addressing modes.</p> <p>3.4. Instruction set- Arithmetic operations, Logical operations and data block movement.</p> <p>3.5. Single Bit level logical instructions, rotate, swap, jump and call instructions, Function of each instruction with bytes, no. of machine cycles and details of flags affected.</p> <p>3.6. Using loops, calling subroutines.</p>	10
4.0	8051 Programming in C	<p>4.1. Introduction, advantages & disadvantages.</p> <p>4.2. Data types, generalized C program for 8051, memory types and models.</p> <p>4.3. Strings, arrays, pointers, time delay generation.</p> <p>4.4. Use of arithmetic & logical operators, accessing SFRs and bit addressable RAM, example programs</p>	6
5.0	Advanced Programming	<p>5.1. I/O Port Programming: Byte size I/O, bit addressability, example programs with assembly & C</p> <p>5.2. 8051 Interrupts: Polling & Interrupt methods, executing an Interrupt, different types, IE and IP registers, enabling, disabling and priority setting.</p> <p>5.3. Timer and Counters : TMOD and TCON registers, mode1&mode2 operation of timers and counters, Time delay generation & example programs.</p> <p>5.4. Serial I/O: SBUF & SCON registers, working of serial port, Serial data transmission & reception, Example programs</p>	8
6.0	Interfacing the 8051	<p>6.1. Interfacing LED, pushbutton switch, Seven segment Display, LCD module, ADC, DAC, DC motor & Stepper motors.</p>	3



9. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	Introduction	5	2	-	7
2	8051 Architecture	4	4	10	18
3	8051 Assembly Language	4	2	10	16
4	8051 Programming in C	2	4	6	12
5	Advanced Programming	6	2	4	12
6	Interfacing the 8051	4	1	-	5
	Total	25	15	30	70

10. Suggested Learning Resources:**Suggested Books:****Text Books:**

- i) The 8051 microcontroller & Embedded systems, M. A. Mazidi, J. G. Mazidi, R. D. McKinlay, Pearson
- ii) The 8051 microcontroller & Embedded systems, Kenneth J. Ayala, Dhananjay V. Gadre, Cengage Learning
- iii) Embedded/real-time systems: concepts, design & programming, Black Book, Dr. K. V. K.K. Prasad, Dreamtechpress, Reprint edition 2013
- iv) Introduction to embedded systems, Shibu K. V., McGraw Hill
- v) ARM System on chip Architecture, Steve Furber, Pearson, edition second

Reference Books:

- i) Embedded systems an integrated approach, Laya B. Das, Pearson, Third impression, 2013
- ii) ARM system developer's guide, Andrew N. Sloss, Dominic Symes, Chris Wright, Morgan Kaufmann Publishers
- iii) Embedded system design A Unified hardware/software Introduction, Frank Vahid, Tony Givargis, Wiley
- iv) ARM Technical Reference manual



Microcontrollers and Embedded Systems Lab

1. Multiplication and division of two numbers using MULDIV command
2. Pick the smallest and largest number among a given set of numbers
3. Arrange 'n' numbers in ascending and descending order
4. Generate a specified time delay
5. Interface a ADC and a temperature sensor to measure temperature
6. Interface a DAC & Generate as taircasewave form—with step duration and no. of steps as variables
7. Flash a LED connected at a specified output port terminal
8. Interfaceasteppermotor—androtateitclockwiseoranticlockwisethroughgiven angle steps
9. Using Keilsoftware write a program topick the smallest and largest among a given set of numbers
- 10.Using Keilsoftware write a program to arrange a given set of numbers in ascending and descending order
- 11.Using Keilsoftware write a program to generate are ctangularwave format as pecified
Port terminal



PROFESSIONAL PRACTICE IV**L T P****1 0 2****Curri. Ref. No: Et-610****Total Contact hrs.: 45****Total Marks: 50****Practical: PA=25, PT=25****Theory: 10****Pass Marks : 17/50****Practical: 35****Credit: 2****Rational :**

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

Aim

- Student will be able to:
- Acquire information from different sources.
- Prepare notes for given topic.
- Present given topic in a seminar.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture

1. INDUSTRIAL VISITS**8**

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. (2 visits) Following are the suggested types of Industries/ Fields –

- i) Satellite Earth Station.
- ii) Radar Establishment.
- iii) Mobile Telephone Switching Office.
- iv) Large Scale Industries where Robot is used
- v) Industries where Automation is in use
- vi) Industry where solar energy related production under process.
- vii) Any other relevant area.

2. THE GUEST LECTURE/S**8**

From field/industry experts, professionals to be arranged (2 Hrs duration), minimum 4 nos. from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of Team work

- i) Mobile communication.
- ii) Digital Literacy
- iii) Software debugging.

- iv) EMI/EMC
- v) Fuzzy logic and neural network.
- vi) Image processing
- vii) PLC and its application
- viii) Electronics Packaging
- ix) Carrier guidance and interviewing techniques.
- x) Self-employment.
- xi) Any other relevant topic

3. GROUP DISCUSSION:**4**

The students should discuss in group of six to eight students and write a brief report on the same, as a part of term work. The topic of group discussions may be selected by the faculty members. Some of the suggested topics are **(any one)** –

4. SEMINAR: (ANY 2 TOPICS)**8**

Seminar topic should be related to the subjects of fifth semester / topics from guest lectures. Students shall submit a report of at least 10 pages and deliver a seminar (Presentation time - 10 minutes for a group of 2 students)

5. MINI PROJECTS: (IN A GROUP OF 4-5 STUDENTS)**6****6. MODELS OF MATERIAL HANDLING ROUTE SYSTEMS OR MODULAR COURSE ON ANY ONE OF THE SUGGESTED OR ALIKE RELEVANT TOPIC BE UNDERTAKEN BY A GROUP OF STUDENTS (MIN 10):****9****7. STUDENT ACTIVITIES:****5**

Students in a group of 3 to 4 shall perform **any two** of the following activities (Other similar activities may be considered) and write a report as a part of term work.

1. Collection of data regarding loan facilities or other facilities available through different organizations / banks to budding entrepreneurs
2. Survey and interviews of successful entrepreneurs in nearby areas
3. Survey of opportunities available in thrust areas identified by Government or DIC.
4. Survey of data regarding different types of equipments with specifications from manufacturers catalogue, local markets, end users (any other engineering products may be considered for survey)



1. Course Title : **Medical Electronics**
2. Course Code : **Et-604**
3. Semester : **6th Semester**

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional(SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			

6. COs and ILOs:

ET-607	Medical Electronics	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 To have a basic understanding of medical terminology, relevant for biomedical instrumentation. CO-2 To understand and	For CO1: After completion of this course students will be able to- ILO1: Define Biomedical Engineering. ILO 2: State The development of biomedical instrumentation. ILO 3: Explain the Basic model of instrumentation systems with suitable diagram. ILO 4: Define biometrics. ILO 5: Explain the components of the man and instrument system. For CO-2: After completion of this course students will be able to-



		<p>describe the physical and medical principles used as a basis for biomedical instrumentation.</p> <p>CO-3:To understand the different bio potential characteristics and recording methods so as to enable to record various biosignals.</p>	<p>ILO 1: Define Transducer.</p> <p>ILO 2: Explain the transduction principle.</p> <p>ILO 3: State The Characteristics of Transducer.</p> <p>ILO 4: Classify different types of Transducer.</p> <p>ILO 5: Explain the importance of transducers used in Biomedical applications.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO 1: Define Bioelectricity & Bioelectric potential.</p> <p>ILO 2: Define Resting membrane potential.</p> <p>ILO 3: Explain the transmission of impulses.</p> <p>ILO 4: Explain the Electrical activity of the heart with diagram.</p> <p>ILO 5: Define Pace maker and its potential.</p> <p>ILO 6: Describe electro cardiograph with suitable diagram.</p> <p>ILO 7: Define receptor potentials.</p> <p>ILO 8: Explain the Electrical activity of the Brain with diagram.</p> <p>ILO 9: Define Resting and action potentials.</p> <p>ILO 10: Explain the Propagation of</p>
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		<p>CO-4: To have depth knowledge of Cardiovascular System and its measurement techniques.</p>	<p>action potentials with diagram.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO 1: Explain the cardiovascular system.</p> <p>ILO 2: Describe the Heart Pumping mechanism.</p> <p>ILO 3: State the function of Purkinje fibres.</p> <p>ILO 4: Define heart sounds.</p> <p>ILO 5: Explain briefly the circulation of blood.</p> <p>ILO 6: State the Characteristics of blood flow.</p> <p>ILO 7: Define blood pressure.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO 1: Describe the elements of Intensive care monitoring.</p> <p>ILO 2: State the instruments used in ICU.</p> <p>ILO 3: Explain the importance of patient monitoring equipment.</p> <p>ILO 4: Discuss the Calibration & reparability of patient monitoring equipment.</p> <p>ILO 5: Describe pacemaker and its function.</p>
		<p>CO-5: To become familiar with the elements of intensive - care monitoring of patient.</p>	



		<p>CO-6: To understand the physiology of the respiratory system, anatomy of the nervous system and the measurements in them.</p>	<p>ILO 6: Describe Defibrillators and its function.</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO 1: Describe the physiology of the respiratory system.</p> <p>ILO 2: Explain the mechanism of breathing.</p> <p>ILO 3: Explain the types of measurements in Breathing.</p> <p>ILO 4: Define Gas exchange and distribution.</p> <p>ILO 5: State Respiratory therapy Equipments.</p> <p>ILO 6: Describe the anatomy of the nervous system.</p> <p>ILO 7: Explain neuronal communication.</p> <p>ILO 8: Describe the organization of the Brain.</p> <p>ILO 9: State the types of receptors.</p> <p>ILO 10: Explain the autonomic nervous system.</p>
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7. Detail Course Content

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	INTRODUCTION TO BIOMEDICAL INSTRUMENTATION	1.1 The age of biomedical engineering, Development of biomedical instrumentation, biometrics. 1.2 Introduction to the man, components of the man, instrument system, physiological systems, 1.3 Some conclusions, body, problems encouraged in measuring a living system.	2
2.0	BASIC TRANSDUCER PRINCIPLES	2.1 Transducer and transduction principles 2.2 Transducer classification-active transducers, passive transducers, transducers used in biomedical applications.	3
3.0	SOURCES OF BIOELECTRIC POTENTIALS	3.1 Introduction to Bioelectricity - Resting Membrane potential, transmission of impulses. 3.2 Electrical activity of the heart, Pacemaker potential, electro cardiograph. 3.3 Biological transducers- receptor potentials, electrical activity of the brain. 3.2 Resting and action potentials, Propagation of action potentials,	8
4.0	ELECTRODES	4.1 Electrode theory, bio-potential electrodes. 4.2 Bio-chemical Transducers.	3
5.0	THE CARDIOVASCULAR SYSTEM	5.1 The heart and cardiovascular system, the heart, heart sounds 5.2 Blood pressure, characteristics of blood flow.	3
6.0	CARDIOVASCULAR MEASUREMENTS	6.1 Electrocardiography (ECG) 6.2 Measurement of blood pressure 6.3 Measurements of blood flow and cardiac output	6
7.0	PATIENT CARE AND MONITORING	7.1 The elements of intensive-care monitoring. 7.2 Diagnosis calibration and reparability of patient 7.3 Monitoring equipment. 7.4 Pacemakers, defibrillator.	6



8.0	MEASUREMENTS IN THE RESPIRATORY SYSTEM	8.1 The physiology of the respiratory system. 8.2 Tests and instrumentation for the mechanism of breathing. 8.3 Gas exchange and distribution. 8.4 Respiratory therapy Equipment.	5
9.0	THE NERVOUS SYSTEM	9.1 The anatomy of the nervous system, Neuronal communication, the organization of the brain. 9.2 Neuronal receptors-the somatic nervous system and signal reflexes, the autonomic nervous system. 9.3 Measurements from the nervous system.	6

8. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	INTRODUCTION TO BIOMEDICAL INSTRUMENTATION	3	-	-	3
2	BASIC TRANSDUCER PRINCIPLES	3	2	-	5
3	SOURCES OF BIOELECTRIC POTENTIALS	2	6	6	14
4	ELECTRODES	3	2	-	5
5	THE CARDIOVASCULAR SYSTEM	3	2	-	5
6	CARDIOVASCULAR MEASUREMENTS	4	-	6	10
7	PATIENT CARE AND MONITORING	4	2	4	10
8	MEASUREMENTS IN THE RESPIRATORY SYSTEM	-	-	8	8
9	THE NERVOUS SYSTEM	3	1	6	10
	Total	25	15	30	70

9. Suggested Books:

- i) Massey and Meredeth, "Medical Physics"
- ii) Joseph Bronzino, "Biomedical Instrumentation"
- iii) Khandpur R S, "Handbook of Medical Instrumentation", Tata Mc Graw Hill
- iv) David Cooney, "Principles of Biomedical Engineering"
- v) Ruch and Patton, "Bio Physics and Medical Physiology"



1. Course Title : **MODERN COMMUNICATION SYSTEMS**
2. Course Code : **Et-605**
3. Semester : **6thSemester**

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			

6. COs and ILOs:

ET-608	Modern Communication Systems	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Identify various satellite services, satellite orbits and their launching techniques and will also be familiar with the earth segment and space segment components used in satellite communication.	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: State Kepler's law of planetary motion.</p> <p>ILO2: Differentiate between Artificial satellite and Geostationary satellite.</p> <p>ILO3: Explain the significance of station keeping in low Earth orbit and geostationary orbit in Satellite communication.</p> <p>ILO4: Discuss about the types of satellite launching vehicles and also the stages involved in launching a satellite in its orbit.</p>



		<p>CO-2 Understand the basics of signal propagation through optical fibers, measure the performance through transmission losses and also learn about the optical sources and functions of optical detectors.</p> <p>CO-3:Analyze various Network security services, cryptographic algorithms and the significance of message authentication and its confidentiality.</p>	<p>ILO5: Give the block schematic description of a communication satellite with a neat block diagram.</p> <p>ILO6: Compare the TDMA, FDMA and CDMA techniques in a tabular form.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: List the advantages and disadvantages of optical fiber communication.</p> <p>ILO2: Describe the construction of optical fiber cable and discuss its types.</p> <p>ILO3: Discuss the performance of optical fiber in terms of bandwidth and transmission loss.</p> <p>ILO4: Explain the modulation process used in LED and LASER.</p> <p>ILO5: Mention some functions of optical detectors.</p> <p>ILO6: Draw the block diagram of optical fiber communication system and explain each stage.</p> <p>ILO7: Describe the components of an optical fiber with a neat sketch.</p> <p>ILO8: Discuss the ways of connecting an optical fiber for communication.</p> <p>ILO9: Explain the working of Fibre Distributed Data Interface.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Discuss the terms message confidentiality, message integrity, message authentication and message</p>
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		<p>CO-4: Explain the various types of switching techniques used in transmission of information.</p> <p>CO-5: Understand the working of wireless communication and the evolution of modern telecommunication processes.</p>	<p>non-repudiation.</p> <p>ILO2: Define encryption and decryption.</p> <p>ILO3: Compare the symmetric key and asymmetric key algorithms.</p> <p>ILO4: Explain the significance of Digital signatures and Public-key certificates.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Compare circuit switching and packet switching techniques.</p> <p>ILO2: Define message switching.</p> <p>ILO3: Explain the architecture of circuit switching network with diagram.</p> <p>ILO4: Discuss the working principle of packet switching network and give its significance.</p> <p>ILO5: Describe the structure of a circuit switch and a packet switch with respective diagrams.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Explain the working principle of FAX.</p> <p>ILO2: Describe the basic operation of Charged Coupled Devices through image process.</p> <p>ILO3: Discuss the working principle of Mobile Telephone Switching Office with a suitable diagram.</p> <p>ILO4: Describe the cellular telephone unit.</p> <p>ILO5: Define frequency synthesizer.</p> <p>ILO6: Give the significance of Mobile Identification Number.</p>
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			<p>ILO7: Compare the GSM and CDMA technologies in Digital Telephony.</p> <p>ILO8: List the characteristics of 1G, 2G, 3G and 4G technologies in tabular form.</p> <p>ILO9: Differentiate between the terms WiFi and WiMax used in wireless communication.</p> <p>ILO10: Write short notes on Cordless telephone and Video phone.</p>
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7. Detail Contents

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	SATELLITE COMMUNICATION	<p>1.1 Kepler's Law, Artificial Satellite, Orbits – Geostationary Orbit, Satellite Speed, Power Systems, Satellite Angles, Station Keeping, Satellite Launching, Altitude Control.</p> <p>1.2 Transponder and satellite frequency allocations – Frequencies reuse.</p> <p>1.3 Block schematic description of communication satellite</p> <p>1.4 Elementary idea of FDMA, TDMA and CDMA</p>	10
2.0	OPTICAL COMMUNICATION	<p>2.1 Concept of fiber optic communication system – Advantages and limitations of optical fibre communication – Construction of optical fibre – Optical fibre types: Monomode and Multimode.</p> <p>2.2 OPTICAL FIBRE PERFORMANCE: Bandwidth-Distance product – Transmission loss.</p> <p>2.3 OPTICAL SOURCES : LED and LASER – Modulation of LED and LASER – functions of optical detectors. Block schematic description of optical fibre communication system.</p> <p>2.4 Components of optical fibre – Coupler connector splice.</p>	10



		<p>2.5 Basic idea of Fibre-optic networking, Fibre Distributed Data Interface – Synchronous optical network.</p> <p>2.6 Applications of fibre optics.</p>	
3.0	NETWORK SECURITY	<p>3.1 Security services : Message confidentiality, integrity, authentication, non repudiation</p> <p>3.2 Cryptography: Introductions, Definitions of cryptographic terms; Two types of basic cryptographic algorithms: Symmetric Key and Asymmetric encryptions, their comparison</p> <p>3.3 Use of Digital signatures and Public-key certificates</p>	6
4.0	DIGITAL SWITCHING	<p>4.1 Switched systems–circuit switching, message switching, packet switching, virtual circuit packet switching; their comparison.</p> <p>4.2 Circuit switching network - digital switching concepts; digital private branch exchange– general architecture.</p> <p>4.3 Packet switching – General principles of datagram packet switching and virtual packet switching.</p> <p>4.4 Switch structure: Structure of circuit switches and packet switches.</p>	8
5.0	MODERN TELEPHONY	<p>5.1 Working of facsimile or fax – Idea of image Processing by Charged Coupled Device.</p> <p>5.2 Concept of cordless telephony.</p> <p>5.3 CELLULAR TELEPHONE SYSTEM: Concept – Mobile Telephone Switching Office–Cellular telephone unit–Frequency synthesizer–Number Assignment Module – Mobile Identification Number– Digital cellular telephone system–Global System for Mobile communication– Concept of CDMA.</p> <p>5.4 Concept of 1G,2G,3G and 4G</p> <p>5.5 Wireless Communication—Wi-Fi and Wi max (Basic ideas only)</p> <p>5.6 Concept of Video Phone</p>	8



8. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	SATELLITECOMMUNICATION	5	3	8	16
2	OPTICALCOMMUNICATION	6	-	10	16
3	NETWORKSECURITY	6	4	-	10
4	DIGITALSWITCHING	4	4	6	14
5	MODERNTTELEPHONY	4	4	6	14
	Total	25	15	30	70

9. Suggested Learning Resources**List of Books:**

- i) William C YLee, "Mobile Cellular Telecommunications system", McGraw Hill
- ii) Martins Roden, "Analog and digital communication system"
- iii) Martins Roden, " Digital communication system Design"
- iv) Bruce Carlson, "Communication system"
- v) Tanenbaum, "Computer Networks"
- vi) John Freer, " Computer communication networks
- vii) Thiagarajan Viswanath, "Telecommunication switching systems and networks", Prentice hall Ed.
- viii) Dennis Roddy , "Satellite Communication", PH



1. Course Title : **Microwave Techniques**
2. Course Code : **Et-606**
3. Semester : **6thSemester**

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional(SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			

6. COs and ILOs:

ET-609	Microwave techniques	Course Outcome (CO)	Intended Learning Outcome (ILO)
		CO-1 Understand the basics of microwave, its frequency range, significance, properties and application.	For CO1: After completion of this course students will be able to- ILO1: Define microwave frequency and give its range. ILO2: Explain the significance of microwave frequency range. ILO3: List the properties of microwave frequency. ILO4: Mention the safety rules to follow while working with microwave frequency. ILO5: Write the applications of microwave.



		<p>CO-2 Implement various microwave passive components like waveguides, cavity resonators, waveguide junctions, directional couplers, microwave antennas, slotted line in the field of electronics which uses microwave frequencies.</p>	<p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Discuss the rectangular and circular waveguides and explain their modes of propagation.</p> <p>ILO2: Explain the work of a cavity resonator.</p> <p>ILO3: Describe the rectangular and circular cavity resonator.</p> <p>ILO4: Define Q factor for cavity resonator.</p> <p>ILO5: Give the significance of re-entrant cavity resonator.</p> <p>ILO6: Discuss various ways used for coupling two microwave cavities.</p> <p>ILO7: Explain the construction and use of H-type T junction, E-type T junction, Magic T waveguide junction and Hybrid Ring waveguide junction.</p> <p>ILO8: Describe the construction and working of a Magic tee coupler.</p> <p>ILO9: Explain the rat-race circuit along with its construction and working principle.</p> <p>ILO10: Define corners, bends and twists for waveguides and illustrate using suitable diagrams.</p> <p>ILO11: Discuss the construction and working of directional couplers and two hole directional couplers.</p> <p>ILO12: List the important microwave properties and applications of ferrites.</p> <p>ILO13: Write short notes on Microwave/Horn antennas.</p>
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		<p>CO-3:Analyze different type of microwave tubes, their working principle and their applications.</p>	<p>ILO14: Define attenuators and phase shifters.</p> <p>ILO15: Describe the E-plane, H-plane and Magic tee in microwave devices.</p> <p>ILO16: Give the uses of slotted line and explain its design and operation.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Mention the frequency limitations faced by conventional tubes.</p> <p>ILO2: Discuss the principle of operation, performance and applications of linear space beam (o type) tubes.</p> <p>ILO3: Draw the schematic diagram of a reflex klystron and explain it working principle and give its characteristics.</p> <p>ILO4: Describe the working of helix travelling wave tube.</p> <p>ILO5: Give the uses and operation of working for microwave crossed field (M type) tubes.</p> <p>ILO6: Discuss the principle of operation, performance and application of a cavity magnetron and Travelling Wave Tube (TWT).</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Discuss the operation, characteristics and applications of BJT.</p> <p>ILO2: Discuss the operation,</p>
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		<p>CO-4: Learn about different types of semiconductor microwave devices, their operations, characteristics and applications.</p> <p>CO-5: Understand the working principle of different devices like IMPATT and TRAPATT diodes, LASERS and MASERS and analyze their performances.</p> <p>CO-6: Analyze the effects of curvature of earth, layers of atmosphere, tropospheric refraction and scattering and terrestrial links in the propagation of microwaves.</p>	<p>characteristics and applications of FET.</p> <p>ILO3: Explain the basic principle of negative resistance amplifiers.</p> <p>ILO4: Describe the principle of operation of tunnel diode, varactor diode and step recovery diode and give their characteristics.</p> <p>ILO5: Explain the working principle and modes of operation of gunn diode.</p> <p>ILO6: Describe the principle of operation and applications of parametric amplifiers.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Explain the operation of IMPATT and TRAPATT diode and also discuss their performances.</p> <p>ILO2: List the applications of IMPATT and TRAPATT diodes.</p> <p>ILO3: Distinguish between LASERS and MASERS.</p> <p>ILO4: Explain the unique properties of LASERS.</p> <p>ILO5: Discuss the transition process and population inversion in LASERS.</p> <p>ILO6: Describe the construction and working principle of solid state ruby laser.</p> <p>ILO7: Give some applications of LASER in various field.</p> <p>For CO-6: After completion of this course students will be able to-</p> <p>ILO1: Discuss the effects of earth</p>
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			<p>and its curvature in the propagation of microwaves.</p> <p>ILO2: Explain the propagation of microwaves through atmospheric duct.</p> <p>ILO3: Describe the phenomenon of tropospheric refraction and scattering during microwave propagation.</p> <p>ILO4: Write short note on terrestrial line of sight communication for microwave propagation.</p>
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7. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	INTRODUCTION TO MICROWAVES	<p>1.1 Microwave frequency range, significance of microwave frequency range, properties of microwaves</p> <p>1.2 Microwave safety rules, applications of microwaves.</p>	4
2.0	MICROWAVE PASSIVE COMPONENTS	<p>2.1 Waveguides-Rectangular and Circular, modes of propagation.</p> <p>2.2 Cavity resonators- rectangular and circular cavities, Q of cavity resonator, re-entrant cavities</p> <p>2.3 Coupling two cavities, microwave junctions, Tee junctions, Magic Tee.</p> <p>2.4 Retrace, Corners, bends and twists, directional couplers, two hole directional couplers</p> <p>2.5 Ferrites-important microwave properties and applications –microwave antennas</p> <p>2.6 Attenuators, phase shifters, E-plane, H-plane and magic-less, slotted line as standing wave detector</p>	12



3.0	MICROWAVE TUBES	3.1 Frequency limitation of conventional tubes, Principles of operation, performance and application of linear space beam(O Type) Tubes 3.2 KLYSTRON-Reflex KLYSTRON and helix traveling, Wavetube. 3.3 Microwave crossed-field tubes(M type) 3.4 Principles of operation, performance and application of cavity Magnetron & Traveling Wave Tube TWT).	8
4.0	SEMICONDUCTOR MICROWAVE DEVICES	4.1 Operation, characteristic and application of BJTs and FETs. 4.2 Negative resistance amplifiers, Principles of tunnel diodes, Varactor and Step-Recovery diodes 4.3 Principles and modes of operation of gun diodes. 4.4 Parametric devices - Principles of operations and applications of parametric amplifier.	8
5.0	OTHER DEVICES	5.1 Operation, performance and application of IMPATT and TRAPATT diodes, 5.2 LASER & MASERS, Transition process, Population-inversion, solid state Ruby laser.	6
6.0	PROPAGATION OF MICROWAVES	6.1 Effects of earth and its curvature, Duct formation, Tropospheric refraction and scattering. 6.2 Microwave links - Terrestrial line of sight communication links propagation.	4

8. Distribution of Marks:

Chapter No.	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	INTRODUCTION TO MICROWAVES	3	4	-	7
2	MICROWAVE PASSIVE COMPONENTS	4	4	10	18
3	MICROWAVE TUBES	3	3	8	14
4	SEMICONDUCTOR MICROWAVE DEVICES	6	-	8	14
5	OTHER DEVICES	6	-	4	10
6	PROPAGATION OF MICROWAVES	3	4	-	7
	Total	25	15	30	70

9. Suggested Implementation Strategies

10. Suggested Learning Resources

Suggested Books:

- i) Samuel YLiao, "Microwave Devices & Circuits" Prentice Hall India
- ii) Reich, "Microwave Techniques "East West Press
- iii) K. C Gupta, "Microwaves"- Wiley Eastern
- iv) George Kennedy , "Electronic Communication Systems "McGrawHill
- iv) R. Chatterjee, "Elements of Microwave Engineering"-East West Pres



1. **Course Title** : **Industrial Electronics**
 2. **Course Code** : **Et-607**
 3. **Semester** : **6th Semester**

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional(SS)		33/100	PT	PA	0	100	3
	TA	HA						
	70	10	20	0	0			

6. CO & ILOs

ET-610	Industrial Electronics	Course Outcome (CO)	Intended Learning Outcome (ILO)
		<p>CO-1 Learn about different types of Choppers.</p> <p>CO-2 Learn and choose different methods of motor speed control</p>	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Explain the basic principle of operation of chopper.</p> <p>ILO2: List various application of choppers.</p> <p>ILO3: Describe the functional operation of forced, commutated, Jone's and 4-quadrant chopper.</p> <p>ILO4: Explain the working Cycloconverter and give its applications.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Explain different factors effecting speed control of dc motors like Armature Voltage and the Field Current control.</p> <p>ILO2: Describe DC motor drives- Controlled Rectifier Drive – Reversible</p>

			<p>Drive – Quadrant Drive</p> <p>ILO3: Explain principle of operation of induction motor,</p> <p>ILO4: List various types of speed variation of induction motor like Frequency variation Stator voltage variation</p> <p>ILO5: Explain the closed loop control of motor speeds</p> <p>ILO6: List and explain types of motor breaking: Regenerative breaking – Plugging.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: State the role of PLC in Automation</p> <p>ILO2: Explain the block diagram principle of working of PLC</p> <p>ILO3: List and explain PLC Characteristics and hardware configuration – CPU, Racks, Power Supply, Speed of execution, Communication, Redundancy.</p> <p>ILO4: List and explain different modules of PLCs like Memory, Input & Output Modules, Application Specific Modules,</p> <p>ILO5: Explain the use of Ladder diagram and Instruction List to program PLCs</p> <p>ILO6: Write basic programs to run PLCs using Structured Text and GRAFCET.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Explain the basic concepts of</p>
		<p>CO-3 Learn to use Programmable Controller (PLC) Logic</p>	



			<p>numerical control using block diagram</p> <p>ILO2: List the advantages, disadvantages and applications of numerical control system</p> <p>ILO3: List and explain different concepts of Numerical Control Systems like Programming systems, Data processing unit, Data reading, Part programming steps and Post processor</p> <p>ILO4: Explain the basic concepts of Computer Numerical Control</p> <p>ILO5: Bring out a comparison between NC & CNC</p> <p>ILO6: Explain a typical CNC system block diagram</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Define a Robot</p> <p>ILO2: Explain the basic configuration of a robots and its working</p> <p>ILO3: List and explain various concepts of robot and its components like manipulator, end effectors, drive system, controller, sensors, mechanical arm, degrees of freedom, links and joints, construction of links, types of joint.</p> <p>ILO4: Classify robots and briefly explain – Cartesian, cylindrical, spherical,</p>
		<p>CO-4 Learn the various aspects of Numerical Control Systems.</p> <p>CO-5 Learn a Robotic</p>	



		<p>system.</p>	<p>horizontal articulated (SCARA), vertical articulated Robots.</p> <p>ILO5: Explain structural characteristics of robots like work envelope and work volume its comparison, wrist rotations, mechanical transmission, pulleys, belts, gears, harmonic drive, conversion between linear and rotary motion and its devices.</p> <p>ILO6: Explain the various aspects of Robot controller – level of controller, open loop and closed loop controller, servo systems, robot path control, point to point, continuous path control, sensor based path control, actuators</p> <p>ILO7: List and explain the functional requirements of various components of Robots like dc servo motors, stepper motors, hydraulic and pneumatic drives, feedback devices, potentiometers, optical encoders, dc tachometers.</p>
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Chapter No.	Chapter Title	Content	Duration (in hours)
1.0	CHOPPERS	1.1. Principle of operation of chopper and its application. 1.2. Functional operation of forced, commutated and Jone's chopper and their areas of applications. 1.3. Principle of operation of 4-quadrant chopper. 1.4. Principle of operation of Cycloconverter and its applications	8
2.0	SPEED CONTROL OF DC MOTORS	2.1. Types of speed control of dc motor: Armature Volt – Field Current Control. 2.2. Drive System: Controlled Rectifier Drive – Reversible Drive – Quadrant Drive	6
3.0	SPEED CONTROL OF AC MOTORS	3.1. Introduction to induction motor, Types of speed variation – Frequency variation – Stator voltage variation – Closed loop control – Types of feedback. 3.2. Types of breaking: Regenerative breaking – Plugging.	6
4.0	PROGRAMMABLE LOGIC CONTROLLER	4.1. Evolution and Role of PLC in Automation 4.2. Block Diagram & Principle of Working 4.3. PLC Characteristics and hardware configuration – CPU, Racks, Power Supply, 4.4. Memory, Input & Output Modules, Application Specific Modules, Speed of execution, Communication, Redundancy. 4.5. Introduction to PLC Programming Languages – Ladder, Instruction List 4.6. Structured Text, Grafcet	6



5.0	NUMERICAL CONTROL SYSTEMS	<p>5.1. Basic concepts of numerical control - Block diagram of numerical control system– Advantages, disadvantages , applications of numerical control system</p> <p>5.2. Programming systems – Data processing unit – Data reading – Part programming – steps - Post processor</p> <p>5.3. Introduction to CNC – Basic concepts of CNC – Comparison between NC & CNC – Typical CNC system – Block diagram, Advantages.</p>	8
6.0	ROBOTICS	<p>6.1. Introduction–definition–basic configuration of robotics and its working–robot components–manipulator, end effectors, drive system, controller, sensors–mechanic alarm–degrees of freedom–links and joints–construction of links, types of joint.</p> <p>6.2. Classification of robots–Cartesian, cylindrical, spherical, horizontal articulated (SCARA), vertical articulated.</p> <p>6.3. Structural characteristics of robots–work envelope and work volume-robot work volumes and comparison–wrist rotations–mechanical transmission, pulleys, belts, gears, harmonic drive–conversion between linear and rotary motion and its devices.</p> <p>6.4. Robot controller–level of controller –open loop and closed loop controller–servo systems —robot path control–point to point–continuous path control–sensor based path control-actuators</p> <p>– dc servomotors –stepper motors –hydraulic and pneumatic drives - feedback devices – potentiometers–optical encoders–dc tachometers</p>	8



8. Distribution of Mark

Chapter No.	Chapter Title	Type of Question			Total Marks
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	CHOPPERS	4	3	7	14
2	SPEED CONTROL OF DC MOTORS	4	-	6	10
3	SPEED CONTROL OF AC MOTORS	5	4	-	9
4	PROGRAMMABLE LOGIC CONTROLLER	4	5	-	9
5	NUMERICAL CONTROL SYSTEMS	3	-	11	14
6	ROBOTICS	8	-	6	14
		25	15	30	70

9. Suggested Learning Resources**Suggested Books**

- i) Power Electronics P. C. Sen
- ii) Modern power Electronics- P. C. Sen
- iii) Power Electronics: Converters, Application & Design—Mohan, Undeland, Robbins
- iv) Industrial Electronics and control by Biswanath Paul—PHI publications-2nd Edition - 2010
- v) Programmable Logic Controller – Pradeep Kumar & Srivashtava-BPB Publications
- vi) Numerical control of Machines—Yoram Koren & Joseph Ben
- vii) Robotics—An Introduction—Doughales—R. Halcon Jr



1. Course Title : Digital Signal Processing

2. Course Code : Et-608

3. Semester : 6thSemester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			

6. COs and ILOs:

ET-608	Digital Signal Processing	Course Outcome (CO)	Intended Learning Outcome (I LO)
		CO-1 Identify different types of signals, their properties and their application in the field of communication.	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Define continuous-time signals, discrete-time signals and digital signals with suitable waveforms.</p> <p>ILO2: Sketch the continuous time signal $x(t) = 2e^{-2t}$ for an interval $0 \leq t \leq 2$. Sample the continuous-time signal with a sampling period $T = 0.2$ sec and sketch the discrete-time signal.</p> <p>ILO3: Explain continuous-time systems and discrete-time systems also list their differences.</p>

		<p>CO-2 Understand the significance of Discrete Fourier transform and Fast Fourier transform and its use in signal processing.</p> <p>CO-3:Design an FIR filter, understand the characteristics of FIR filters and its use in signal processing.</p>	<p>ILO4: Discuss the terms linearity, time-invariance, causality and stability for a discrete-time system.</p> <p>ILO5: Analyze the difference equation representation for various properties of a discrete-time system.</p> <p>ILO6: Compare the characteristics of Laplace transform, Fourier transform and Z-transform in a tabular form.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: List the properties of Discrete Fourier series and Discrete Fourier transform and explain the difference in their application.</p> <p>ILO2: Explain with an example block convolution of a signal using Decimation-in-time FFT algorithm.</p> <p>ILO3: Draw a diagram of Decimation in Frequency FFT algorithm for an 8 – point DFT and explain.</p> <p>ILO4: Differentiate between DFT and FFT.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: List the advantages and disadvantages of FIR filter.</p> <p>ILO2: Compare the direct, cascade and lattice form of FIR filter structure.</p> <p>ILO3: Design an FIR filter using Fourier series method.</p> <p>ILO4: Give the significance of window function and mention the types of window function applicable to an FIR</p>
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		<p>CO-4: Understand the characteristics of IIR filters and its use in signal processing</p> <p>CO-5: Learn the basics of a DSP processor and its architecture.</p>	<p>filter.</p> <p>ILO5: Design an FIR filter using a rectangular window or a Bartlett window.</p> <p>ILO6: Draw the frequency response for an LPF using Hanning window and Hamming window.</p> <p>ILO7: Discuss the frequency response of an FIR filter.</p> <p>ILO8: Design an FIR filter using frequency sampling method.</p> <p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: List the characteristics of low-pass filter, high-pass filter, band-pass filter and band-stop/band-reject filter.</p> <p>ILO2: Discuss the direct, cascade and parallel forms of IIR filters.</p> <p>ILO3: Write the applications of IIR filters</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Draw the architecture of a DSP processor.</p> <p>ILO2: List the differences between microprocessor and DSP processor.</p> <p>ILO3: Give some applications of DSP processor</p>
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7. Detail Course Content

Chapter	Chapter Title	Content	Duration (in hours)
1.0	INTRODUCTION TO DISCRETE TIME SIGNALS AND SYSTEMS	1.0 Discrete time signals and systems, Properties of discrete systems: Linearity, time-invariance, causality, stability, convolution Difference equation representation of discrete systems 3.0 The Laplace transform: Properties of Laplace Transform 4.0 The Fourier Transform: Properties of Fourier Transform The Z-Transform: Properties of Z-transform, The inverse Z-transform, System function	15
2.0	DISCRETE FOURIER TRANSFORM & FAST FOURIER TRANSFORM	2.1. Discrete Fourier series- properties 2.2. Discrete Fourier transform-properties 2.3. Block convolution: Decimation-in-time FFT algorithms, decimation-in-frequency FFT algorithm	15
3.0	FIR DIGITAL FILTER REALIZATIONS	3.1. Direct, cascade, lattice forms, FIR filters design Using Fourier series- 3.2. Use of window functions, frequency sampling design	6
4.0	IIR DIGITAL FILTERS REALIZATION	4.1. Direct, Cascade, Parallel forms	4
5.0	DSP PROCESSORS	5.1. Typical DSP Architecture of typical DSP processor, typical DSP processors and their comparisons	2



8. Distribution of Marks:

Chapter No.	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	INTRODUCTION TO DISCRETE TIME SIGNALS AND SYSTEMS	10	3	12	25
2	DISCRETE FOURIER TRANSFORM & FAST FOURIER TRANSFORM	10	3	12	25
3	FIR DIGITAL FILTER REALIZATIONS	1	3	6	10
4	IIR DIGITAL FILTERS REALIZATION	4	3	-	7
5	DSP PROCESSORS	-	3	-	3
	Total	25	15	30	70

9. Suggested Learning Resources:**Suggested Books:**

- i) Introduction to Digital Signal Processing-Roman Kuc
- ii) Digital Signal Processing –Oppenheim & Ronald W Schafer.
- v) Theory & Application of Digital Signal processing-R Rabiner & B. Gold
- iv) Digital Signal Processing-Andreas Antoniou
- v) The scientist and engineer's guide to Digital Signal Processing- Steven W. Smith.



1. Course Title : Advance Microprocessors
 2. Course Code : Et-609
 3. Semester : 6th Semester

4. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	0	0	3 hrs/week

5. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		33/100	PT	PA	0	100	3
	TA	HA						
70	10	20		0	0			

6. COs and ILOs:

ET-612	Advanced microprocessor	Course Outcome (CO)	Intended Learning Outcome (I LO)
		CO-1 To understand the architecture of 16-Bit Microprocessors to utilize it in programming.	<p>For CO1: After completion of this course students will be able to-</p> <p>ILO1: Describe 8086 Architecture with its functional components.</p> <p>ILO 2: Describe each Pin of 8086 along with the Pin diagram.</p> <p>ILO3: Explain the Memory Segmentation and Segment registers of 8086.</p> <p>ILO4: Describe the Addressing modes of 8086 with examples.</p> <p>ILO5: Compare 8086 and 8088 microprocessors.</p>



		<p>CO-2 To develop skill in writing algorithm for 16-Bit Microprocessors.</p>	<p>ILO6: Explain Minimum mode and Maximum mode.</p> <p>For CO-2: After completion of this course students will be able to-</p> <p>ILO1: Classify various instructions of 8086/8088.</p> <p>ILO2: Explain assembly language program of 8086.</p> <p>ILO3: Write simple programs for 8086.</p> <p>ILO4: Define DEBUG and LINK utility.</p> <p>ILO5: State the Interrupts of 8086.</p> <p>ILO6: Explain interrupt priority management in 8086.</p> <p>ILO7: Describe architecture and functions of 8087 numeric processor.</p> <p>ILO8: Explain the concept of Interfacing 8087 numeric processor with 8086/8088.</p> <p>For CO-3: After completion of this course students will be able to-</p> <p>ILO1: Describe 80386 Architecture with its functional components.</p> <p>ILO2: Explain the modes of operation of 80386.</p> <p>ILO3: Explain Memory management of 80386.</p> <p>ILO4: State the interrupts and exceptions.</p> <p>ILO5: Define I/O privilege level.</p> <p>ILO6: Describe 80486 Architecture with its functional components.</p> <p>ILO7: Define implementation of paging and its hardware enhancement.</p>
		<p>CO-3: To understand the architecture and Memory management of 32-Bit Microprocessor.</p>	



		<p>CO-4: To become familiar with the architecture of 64-Bit Microprocessors.</p>	<p>For CO-4: After completion of this course students will be able to-</p> <p>ILO1: Describe the working of Pentium processor.</p> <p>ILO2: Explain the Functional units of Pentium processor.</p> <p>ILO3: Explain the Superscalar Operation of Pentium processor.</p> <p>ILO4: Describe the Addressing modes of Pentium processor with examples.</p> <p>ILO5: Define the concept of intelligent branch prediction and U-V pipelining.</p> <p>ILO6: Explain Burst mode of data transfer.</p> <p>ILO7: Describe the working and the architecture of Pentium pro.</p> <p>For CO-5: After completion of this course students will be able to-</p> <p>ILO1: Define Microcontrollers.</p> <p>ILO2: Compare Microcontrollers with Microprocessors.</p> <p>ILO3: Study of microcontroller MCS 51 family.</p> <p>ILO4: Describe Architecture of MCS 51.</p> <p>ILO5: Classify various instructions and addressing modes of MCS 51.</p> <p>ILO6: Write simple programs for MCS 51.</p>
		<p>CO-5: To understand the architecture of Microcontrollers and compare it with Microprocessors</p>	



7. Detail Course Content:

Chapter	Chapter Title	Content	Duration
1.0	16-BIT MICROPROCESSORS	1.1 Architecture of typical 16 bit microprocessors (Intel8086), Memory address space and data organization, Segment registers and memory segmentation, I/O address space, Addressing Modes. 1.2 Comparison of 8086 and 8088, basic 8086/8088 configurations, Minimum mode – Maximum mode.	8
2.0	PROGRAMMING	2.1 Instruction set of 8086/8088 microprocessors, Programming examples, and assembly language program development on IBMPC, Study of DEBUG and LINK utility. 2.2 Interrupts and interrupt priority management in 8086, architecture and functions of 8087 numeric processor, interfacing with 8086/8088.	12
3.0	32-BIT MICROPROCESSORS	3.1 Intel 80386 - Architecture, Modes - Real, protected and virtual 8086 mode. 3.2 Memory management - management of tasks, interrupts and exceptions, I/O privilege levels, initialization, advanced instructions. 3.3 Intel 80486 - Architecture, implementation of paging and its hardware enhancement.	8
4.0	64-BIT MICROPROCESSORS	4.1 Pentium processor - Functional units and its working, Super scalar architecture, Addressing modes, Concepts like intelligent branch prediction and U-V pipelining, Burst mode of data transfer. 4.2 Pentium Pro – Introduction and its architecture.	6



5.0	MICROCONTROLLERS	5.1 Introduction, comparison with microprocessors. 5.2 Study of microcontroller (MCS 51 family) - Architecture, instruction set, addressing modes and its programming.	8
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8. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type (compulsory)	Short Questions	Descriptive Questions	
1	16-BITMICROPROCESSORS	4	4	6	14
2	PROGRAMMING	4	6	8	18
3	32-BITMICROPROCESSORS	6	2	6	14
4	64-BITMICROPROCESSORS	6	-	4	10
5	MICROCONTROLLERS	5	3	6	14
	Total	25	15	30	70

9. Suggested Learning Resources

Suggested Books:

- i) YU-Cheng Liu & Glenn A Gibson, "Microprocessor System, Architecture Programming & Design
- ii) Douglas V Hall, "Microprocessors & Interfacing-"
- iii) Avtar Singh , "IBMPC/8088Assembly Language Programming"
- iv) Scott Muller, "Upgrading and repairing IBMPCs"
- v) JamesLHardey, "Advanced80386ProgrammingTechniques
- vi) Intel Users manual for 8086, 80386&80486,Pentium & Pentium pro

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