INSTRUMENTATION ENGINEERING (NEW SYLLABUS)

PROGRAM OUTCOMES(POs)

1. **Basic knowledge:** An ability to apply knowledge of basic mathematics, science and engineering to solve the engineering problems.

2. **Discipline knowledge**: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.

3. **Experiments and practice:** An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

4. **Engineering Tools**: Apply appropriate technologies and tools with an understanding of the limitations.

5. **The engineer and society**: Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.

6. **Environment and sustainability**: Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

7. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

8. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.

9. **Communication:** An ability to communicate effectively.

10. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the context of technological changes.

PROGRAM SPECIFIC OUTCOMES(PSOs)

PSO 1: The student should be able to clearly understand the concept and application in the field of industrial measurement and process control.

PSO 2: The student should be able to arrive at the solution to industrial application and problem.

PSO 3: The student should be able to comprehend the capability of use of modern design tools to analyze the subsystems, processes for a variety of application.

PSO 4: The student should be able to develop work skill and communication skill in both of oral and written and plan with road map.

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COURSE STRUCTURE OF 3rd SEMESTER (INSTRUMENTATION TECHNOLOGY)

Sl No	Code No.	Subject	Study Scheme (Contact hours/week)			Evaluation Scheme									
						Theory					Practical			Total	Credit
			L	T	P	ESE	Sessional (SS)			Pass(ESE+SS)	Practical Test (PT) #	Practical Assessment(PA) @	Pass (PT+PA)	Marks(Theory+Practical)	
							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 Engg.	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
5	Me-304	Elements of Mechanical Engg.	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
6	Et-305	Analog Electronics-I	3	1	3	70	10	20	30	33/100	25	25	17/50	150	5
7	IT-310	Professional Practice-I	1		2						25	25	17/50	50	2
		Total	19	2	14									850	25
			35												

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

1. Course title: Computer Application & Programming

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: ExaminationScheme :

	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 &it's different types, I/O devices, Role of O.S., computer languages, translator software, editor. Data, different types of data, information and its characteristics	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.	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.	10. Define operating system. 11. Operate different commands of DOS, Windows & UNIX/LINUX	**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.	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**

Unit	Topic/Sub-Topics	Intended Learning Outcome	Hours
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. 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.	18. Write algorithm and flow charts for simple programs. 19. Define basic terminology of C language. 20. Write small programusing C language. 21. Write diversified solutions using C language. 22. Differentiate between IF..Else and Switch statement.	15
	Internal Assessment		3

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 Weightage (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 = KnowledgeC =Comprehension A =ApplicationHA =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

10. Intellectual Skills :

- Logical reasoning
- Relating programming concepts in problem solving

11. 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) Mailmerge.

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 in iput/output function like getchar, putchar, gets, puts, scanf, printf etc. Programming exercise on simple if statement, If..else statement, switch statement Programming exercise on looping with do-while, while, for loop and array.

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2. Course Title– Engineering Economics and Accountancy (All Branches)

1. Course Title : **ENGINEERING ECONOMICS AND ACCOUNTANCY**
2. Course Code: **Hu – 302**
3. Semester: 3rd

4. 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

- CO_1 = Define some important economic and accounting terms.
- CO_2 = explain some basic economic laws.
- CO_3 = Describe overall economic environment.
- CO_4 = explain double entry system of book keeping.
- CO_5 = record business transactions under double entry system of book keeping
- CO_6 = define financial statements.

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

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

2. **Examination Scheme:**

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

3. **Detailed Course Content:**

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
Part – A : Engineering Economics				**21 hrs**
1.0	**Introduction to**	i) Definition of Economics, its	i) explain core	5

	Economics :	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	economic terms concepts and theories	
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 Schedule	Define the Laws of Demand and Supply	4
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

Chapter No.	**Chapter Title**	Content	Intended Learning Outcomes	Duration (in hours)
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				**21 hrs**
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 Accounting iv) Difference between Book-keeping and Accounting v) Double Entry System – main features vi) Advantages and disadvantages of Double Entry System	i) Define Double Entry System of Book Keeping ii) State its objectives, features merits and demerits	3
(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

Chapter No.	**Chapter Title**	Content	Intended Learning Outcomes	Duration (in hours)
9.0	**Journal and Ledger**	i) Meaning Journal ii) Recording of Transactions in Journal iii) Meaning of Ledger iv) Objectives and utility of Ledger v) Posting and balancing of Ledger vi) Distinction between Journal and Ledger vii) Names of different Books of Accounts	i) Record business transactions under double entry system in books of accounts	4
10.0	**Cash Book:**	i) Meaning and importance of Cash Book ii) Characteristics and advantages of Cash Book iii) Discount – Trade Discount and Cash Discount iv) Different types of Cash Book: - Single Column Cash Book - Double Column Cash Book - Triple Column Cash Book v) Bank Reconciliation Statement – Basic idea	i) Differentiate different types of Cash Book ii) Record transactions in Cash Book	4
11.0	**Trial Balance & Errors in Accounting:**	i) Meaning and objects of Trial Balance ii) Main features and advantages of Trial Balance iii) Preparation of Trial Balance iv) Types of errors in Accounting	i) Explain meaning and features of Trial balance	3

Chapter No.	**Chapter Title**	Content	Intended Learning Outcomes	Duration (in hours)
12.0	**Components of Final Accounts:**	i) Meaning and objectives of Trading 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	i) Identify different components of Financial Statements	3
	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	Comprehension	**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

Sl. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Knowledge	Compre-hension	Application	HA
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		**42 hrs**	**100**	**41**	**24**	**5**	**0**

K = Knowledge C = Comprehension A = Application

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

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

10 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	Introduc	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	Introdu to B K	2	0	0	2	3	0	0	0	3	0	0	0	0	0	5
	Introduc to Comput	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	Componts 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**Higher than Application (Analysis, Synthesis, Evaluation)**

T = Total

11 Suggested implementation Strategies: Modified syllabus may be implemented with effect from July, 2018 (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	Introductory Micro Economics	Sandeep Garg	Dhanpat Rai Publication Pvt. Ltd. New Delhi
2	Introductory Macro Economics	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
6			
7			
8			

b. List of Journals

c. Manuals

d. Others

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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**

xamination Scheme:	**Theory**		**Total Marks**
ESE Full Marks	**Sessional Full Marks**	**Pass Marks (ESE+Sessional)**	**100**
70	**30**	**33**	

7. 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. 1.2. Formation of Ordinary Differential Equations.	Recognize and form differential equations.	3
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	3.1. Left hand side resolved into factors, 3.2.Equations solvable for x,	Solution of different types of first order and	

	higher degree	3.3. Equations solvable for y, 3.4. Clairaut's equations.	higher degree ordinary differential equations.	4
B 4	Differential Equations of second order	4.1. Differential Equations of second order with constant co-efficient and right hand side zero. 4.1.1. Operator D, Auxiliary equation. 4.1.2. Rules for real and equal, real and unequal and complex roots. Complete solution. 4.2. Differential Equations of second order with constant co-efficient and right hand side a simple function of x. [Exponential , Trigonometric and algebraic function].	To know about Complementary function, particular integral, General solution, particular solution, complete solution of different types of second order differential equations.	7

		GROUP – C: STATISTICS AND PROBABILITY Hours: 13 Marks: 18		
C 1	Measures of Central Tendency	Mean, Median, Mode.	Basic measures of central tendency	3
C 2	Measures of Dispersion	2.1. Range, Quartile Deviation. 2.2. Mean Deviation (from mean, median, mode). 2.3. Standard Deviation, Variance, Co-efficient of variation.	Different types of measures of dispersion	5
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 Equations.	1. Use of matrices for solving simultaneous equations. 2. Computation of determinants and eigenvalues of a matrix.	4
D3	Linear Programming Problems (Basics)	3.1. Introduction of system of Linear Inequations involving two variable and graphical solution of the system. 3.2. Mathematical formulation of LPP (two variables). 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)	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	70
B1	Differential Equation	1+1+1=3	2		
B2	Diff. Equation of first ord. first degree	1+1+1+1=4	2	3	
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 .

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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) . $c = \frac{b}{\sum b} \times 100$

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

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXxxx

4. Course Title: Elements of Electrical Engineering

1. Course Code: El - 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		3hrs	6hrs/week

9. Examination Scheme:

Theory 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			

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 seriescircuit 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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4. Course Title– Element of Electrical Engineering Laboratory

3rd Semester

CODE No. El – 304P

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

Pass Marks: 17/50

Skills to be developed

a)Intellectual Skills:-

1. Skill of analyzing results.

2. Skill of identification of instruments.

b) Motor Skill:-

1. Skill of connecting the instruments/machines properly.

2. Skill of taking the reading of the instrument properly.

3. Skill of drawingphasor diagram and graph.

List of Practical

1. To find the following for a filament lamp

a) Variation of resistance with voltage
b) Variation of power with voltage

2. Verification of Ohm's law.

3. Verification of Kirchhoff's laws.

4. Testing of fuse and find out the fusing constant.

5. To find out the voltage-current relationship in an R-L series AC circuit to determine power factor of the circuit.

6. To find out the voltage-current relationship in an R-C series AC circuit to determine power factor of the circuit.

7. To find out the voltage-current relationship in an R-L-C series AC circuit to determine power factor of the circuit.

8. Study of two point starter and DC series motor & starting of DC series motor.

9. Study of three point starter and DC shunt motor & starting of DC shunt motor.

10. Find the transformation ratio of single phase transformer.

Reference Book:

Lab manual on basic Electrical Engineering and Electrical MeasurementBy 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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5. Course Title : Elements of Mechanical Engineering

Subject Title	**:**	**Elements of Mechanical Engineering**
Subject Code	**:**	**Me-302**
Hours Per Week	**:**	**03**
Hours Per Semester	**:**	**45**
Class Test hrs	**:**	**03**
Total hrs	**:**	**48**
Full marks(Theory)	**:**	**70**
Sessional Marks	**:**	**30**
Class hours		**L T P**
		3 0 3

TOPIC ANALYSIS

SL.No	Major Topics	Hours Allotted	Weightage of Marks	Marks of questions of type		
				Obj	**Short**	Long
1	Introduction	02	04	2	2	-
2	Properties and Laws of Gases	04	10	3	3	4
3	Properties of Steam	07	15	3	4	8
4	Generation of Steam	06	13	3	3	7
5	Steam Engine	05	12	3	3	6
6	Internal Combustion Engine	07	14	3	5	6
7	Steam Turbines	06	12	3	3	6
8	Gas Turbines	04	09	3	2	4
9	Transmission Of Motion And Power	04	08	2	2	4
Total		**45**	**97**	**25**	**27**	**45**

CO : Outcome based Course Objectives

After studying the subject the students will be able to

1. Acquire a brief information of the prime mover
2. Solve problems on ideal gases following Characteristics Gas Equation
3. Explain the thermodynamic process Isothermal, Adiabatic and polytropic.
4. Solve problems of steam using steam table
5. Explain the function of a boiler
6. Identify the Mounting and accessories of a boiler
7. Know the function of a steam engine
8. Know the operation of an Internal Combustion Engine
9. Know the principle of steam turbine
10. Acquire the knowledge of information on power transmission systems.

ILO (Intended Learning Objectives)

1. Know the information about the source of power
2. Explain the principle of prime mover
3. Know the conversion of thermal energy to mechanical energy
4. Know the Types of prime mover
5. Define Charles Law
6. Define Boyle's Law
7. Derive Characteristics Gas Equation
8. Define Ideal Gas
9. Solve problems on Characteristics Gas Equation
10. Explain Energy equation
11. Know about thermodynamic system, surrounding and environment
12. Define isothermal, Adiabatic, Polytropic process
13. Describe the properties of Steam
14. Explain sensible heat & latent heat of steam
15. Define the enthalpy of steam
16. Know about wet, dry saturated and superheated steam
17. Know the use of steam table for solving problems
18. Define boiler or steam generator
19. Explain the importance of Mountings
20. Explain the function of accessories
21. Know brief about draught, natural and artificial type
22. Know the working principle of steam engine, its parts and functions in brief
23. Calculate the power developed, efficiency and its related small problems
24. Know about the principle of Internal Combustion engine , its type(SI & CI engine)
25. Explain the thermodynamic cycle(Two stroke and four stroke)in SI and CI engine
26. Know the important parts of engines and its functions
27. Estimate the power developed, efficiency and the work done in IC engine
28. Know the working principle of steam turbine
29. Know the function of condenser
30. Know the working of gas turbine cycle and its types
31. Know the type of fuel used in gas turbine cycle
32. Know the application of gas turbine
33. Know about belt and pulley its uses
34. Know the effect of creep, slip, and centrifugal force in belt
35. Calculate the velocity ratio of belt and pulley
36. Know about the power transmission through gears
37. Determination of size of gears according to the velocity ratio
38. Determine the power transmitted by gear train
39. Solve small problems on simple machine

Course Details

1. Introduction: Sources of power, prime movers, types of prime movers, Heat and temperature, conversion of heat into mechanical power—2 hrs
2. Properties and laws of gases: Internal energy, enthalpy, specific volume, specific heats, energy equation, isothermal, adiabatic and polytropic processes of gases—4 hrs
3. Properties of steam: Differences between gas and vapour, sensible heat, latent heat, enthalpy of steam, wet, dry saturated and superheated steam, steam table and its uses, some basic problems---6hrs
4. Generation of steam: Boilers, different classification of boiler, Mainly study of Cochran, Lancashire, and water tube boilers, Boiler mountings and accessories pressure gauge, water level indicator, safety valve, stop valve, feed check valve, blow off cock, fusible plug, manhole, feed pump, injector, feed water heater , air pre heater, steam separator, steam separator, steam trap, all with brief study, Draught natural and artificial draught---- 8hrs
5. Steam engine: Working principle of steam engine, and its classification, names of various parts of steam engine and their function, Estimation of power and its efficiency and related problem.
6. Internal combustion engine: What is I.C. engine , Classification of IC engine, four stroke cycle, two stroke cycle, principle of working of diesel and petrol engine, names and function of the main parts, carburation, ignition , injection, governing, cooling and lubrication , estimation of power and efficiency and its problem, common defects in IC engines and their remedies
7. Steam Turbines: Classification -impulse and reaction turbine, Cycle and principle of working of a simple steam turbine, Condenser functions and types.
8. Gas Turbines: Cycle and principle of working, main components, types of fuel used in gas turbine, application of gas turbine.
9. Transmission of motion and power: Belt and pulley, types of belts, pulleys and drives, velocity ratio, length of belt tension in belts, power transmitted by belt, effect of creep, slip, and centrifugal force, gears, types of gears , elements of spur gear , velocity ratio, determination of sizes of gears, gear trains, power transmitted by gear drive, worm and worm wheel, rack and pinion

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5. Course Title: -Elements of Mechanical Engineering Laboratory

Elements of Mechanical Engineering Laboratory

CO------Outcome based objectives:

After performing the experiments the students will be able to

1. Identify the mountings and accessories of a boiler
2. Know the working principle of a steam engine
3. Explain the working principle of an SI Engine
4. Explain the working principle of an CI Engine
5. Explain the principle of power transmission system

Course Content

Total 48 hrs

1. Study of boilers
   - i) Cochran boiler
   - ii) Lancashire boiler
   - iii) Babcock & Wilcox boiler
   - iv) Locomotive Boiler
2. Study of Steam Engine
   - i) Reciprocating Steam Engine
3. Study of S I & C I Engine
   - i) Two stroke cycle model and valve diagram
   - ii) Four stroke cycle model and valve diagram
4. Study of power transmitting devices
   - i) Belt
   - ii) Gear
   - iii) Pulley
   - iv) Link
5. Viva voce

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6. Course Title: Analog Electronics-I

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

3. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	1	3hrs	7 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. COs and ILOs

ET-305	Analog Electronic- 1	CO	I LO
		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 reference to the energy band. 3) Explain the atomic bonding in semiconductors
		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.	**For CO-2** Through this course , the student – 1) Understand the PN Jun-Tion Diode and their Characteristics. 2) Acquire basic knowledge on Forward bias and reverse bias 3) Familiarize with the various types of Diode.
		CO-3 To Study the uses and application of the semiconductor diode such as- rectifier circuit: Half wave & full wave, filter circuits. Also Clipping circuit and Clamping circuit using Diode	CO-3 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.
		CO-4 To study the transistor basics: Construction, configuration circuit, Input and output characteristics, biasing, different modes of transistor, transistor as an	CO-4 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

		amplifier, load line analysis. **CO-5 To study the JFET, MOSFET, UJT,- Their construction, input output characteristic and as amplifier.** **CO-6 To study different types of transistor amplifier: -Class A, B, C &AB, push – pull amplifier, R-C coupled, transformer coupled amplifier etc.** **Also study the single stage , multistage amplifier and their relation with gain, frequency and bandwidth**	of BJT, AC/ DC Load line etc. CO-5: 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. CO-6 Explain and understand different types of amplifier. 1) Can understand and explain and ability to construct the Direct Couple, R-C Couple and transformer Coupled amplifier 2) Can interprets between class A, Class B, Class C and Class AB amplifier. 3) Can study and built Single stage and multistage amplifier and can observed their input and output waveform. 4) Can observe and acquire knowledge the amplitude, frequency response and their bandwidth of common amplifier circuit.

7. Detail Course Content:

Chapter	Chapter Title	Content	Duration
1.0	**Semiconductor Devices**	1.1 Electrical properties of semiconductor materials, energy level diagrams of conductor, semi conductor and Insulator. 1.2 Formation of P-Type and N-Type materials and their properties. Formation and behaviour of PN junction diode. 1.3 Zener diode, Zener breakdown & Avalanche Breakdown. Varactor diode, Schottky diode. 1.4 Diode wave shaping circuits – clipper and clamper circuits 1.5 Opto-electronic devices- LDR, LED, LCD, photovoltaic cell, solar cells, their construction, operation and applications.	**9**
2.0	**Rectifier and Power Supply**	2.1 **Half Wave 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, ??type 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 ά, ß and γ factors 3.3 Comparison of CB, CE, and CC configurations	**4**
4.0	**Transistor Biasing**	4.1 AC and DCload 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, Crossover 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
		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 - I LAB

1. To study the VI characteristics of a forward and reverse biased p-n junction Diode
2. To study the VI characteristics of a 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 bandwidth, midband gain, input impedance and output impedance for:

   (a) Single-stage amplifier,
   (b) Double-stage amplifier

9. To study the output waveform of push-pull amplifier for Class-A, Class-B & Class-AB operations
10. To study the V-I characteristics of UJT

7 Course Title: Professional Practice-I

PROFESSIONAL PRACTICE –I

CODE: IT-310

THEORY SCHEME:	PRACTICAL SCHEME:
Theory: 1hr/week	Practical assessment: 25 marks
Practical: 2hrs/week	Practical test: 25 marks
Credit: 2	

A) RATIONAL:-

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through industrial visits, guest lectures on technical topics and conducting group discussions.

B) AIMS AND OBJECTIVES:-

The student will be able to:

- Preparing report on industrial visits, expert lectures.
- Interacting with peers to share thoughts.
- Prepare notes for given topic.
- Presentation in seminar, group discussion on improvement of communication skills.
- Acquire information from different sources.

C) PRE- REQUISITE:-

1. Desire to gain comparable knowledge and skills of various activities in various areas of importance.
2. Eagerness to participate in group work and to share thoughts with group members.
3. Knowledge of basic Instrumentation engineering.

Activities:

1. INDUSTRIAL/FIELD VISIT: - 10 Hours

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

Visits to ANY TWO from the list below:

a. Nearby manufacturing and process industries.
b. Electrical and Electronic equipments manufacturing and repairing workshop and observe the repairing of different parts.
c. Cable manufacturing company.

d. Nearby Instrumentation workshop for observation of installation and identifications of various equipments.
e. Nearby petrol pump (fuel, oil, product specifications)
f. Tea processing industry (layout and machine)
g. Food processing industry (layout and machine)

2. GUEST LECTURES: (Any three) Lectures by professional /industrial expert/ student

Seminars on the following areas. -10 HRS

a. Street lighting system and illumination
b. Safe application of electrical energy in daily life.
c. Instrumentation and control
d. Computer networking and MAT lab.
e. Topics related to social awareness –
   i) Energy saving and protection of power theft
   ii) Pollution control.
   iii) Yoga meditation practice.
   iv) AIDS awareness and health awareness programme.

Individual report of the above lecture should be submitted by the students.

3. GROUP DISCUSSION: (Any TWO among a group of four to five students). Topic and time duration of the group discussion to be decided by concerned teacher. –10 HRS.

a. Current topics related to Instrumentation engineering field.
b. Current news items
c. Current and historical events related to social, cultural and environmental.
d. Discipline and housekeeping.
e. Use of plastic carry bag (social and domestic Hazard)

4. STUDENTS ACTIVITY: The students in a group of 4 to 5 will perform any one of the following activities. –10 HRS.

a) Identify the various electrical and Electronics tools and equipments and write their functions and ISI standard specification.
b) List of Energy efficient equipments and uses.
c) Tree plantation inside or outside of the institute campus.
d) Help in flood relief camp (by all students)
e) Other co- curricular and extracurricular activity.

EXAMINATION SCHEME (on Practical assessment)

Continuous internal assessment of 25 marks is to be carried out by the teachers.

Distribution of marks: -

Activities =10, Field visits=5

Group discussion = 5, Guest lecturer attendance and Report=5

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COURSE STRUCTURE OF 4th SEMESTER (INSTRUMENTATION TECHNOLOGY)

Sl No	Code No.	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-403	Digital Electronics	3		3	70	10	20	30	33/100	25	25	17/50	150	4
2	EI-403	Electrical Measurement and Measuring Instrument-I	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
3	EI-401	Electrical Circuit & Network	3	-	3	70	10	20	30	33/100	25	25	17/50	150	5
4	IT-402	Optical Fibre	3	-	-	70	10	20	30	33/100	-	-	-	100	3
5	IT-404	Instrumentation Workshop	-		6	-	-	-	-	-	50	50	33/100	100	3
6	Et-405	Analog Electronics-II	3		3	70	10	20	30	33/100	25	25	17/50	150	4
7	IT-410	Professional Practice-II	1		2						25	25	17/50	50	2
		Total	16		20									850	25
			36												

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			

6. **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 (I LO)
			For CO1: **After completion of this course students will be able to-**
		CO-1 To have a thorough understanding of the fundamental concepts of digital representation of information along with the analog representation.	**ILO1:** Define analog and digital signals. **ILO2:** Differentiate analog and digital signals with examples. **ILO3:** Explain logic levels with suitable sketch.
			For CO-2: After completion of this course students will be able to-
		CO-2 To interpret logic functions, circuits, truth tables, and Boolean algebra expressions.	**ILO1:** Define Logic gates. **ILO2:** State basic Logic gates and Universal gates with their truth tables. **ILO3:** Describe the significance of universal logic gates. **ILO4:** Classify logic families. **ILO5:** Compare the characteristics of RTL,DTL, ECL, & CMOS **ILO6:** Explain IC gates- Quad NAND, Quad NOR, Hex Inverter, Tristate Buffer. **ILO7:** Explain IC gates- Quad NAND, Quad NOR, Hex Inverter, Tristate Buffer

		CO-3 To apply the laws of Boolean algebra to simplify circuits for a cost effective solution.	**For CO-3: After completion of this course students will be able to-** **ILO1:** Define Boolean algebra & Boolean constant. **ILO2:** State the rules of Boolean Algebra. **ILO3:** State the De- Morgan's theorem with examples. **ILO4:** Realize the Boolean expression using logic gates. **ILO5:** Simplify Boolean expression using Algebraic method. **ILO6:** Define K-map **ILO7:** Simplify Boolean expression using K-map
		CO-4 To understand, analyze and design various combinational and sequential circuits.	**For CO-4: After completion of this course students will be able to-** **ILO1:** Explain Combinational Logic Systems. **ILO2:** Define Binary Adders: Half Adder, Full Adder with their circuit diagram & truth table. **ILO3:** Define Binary Subtractors: Half Subtractor, Full Subtractor with their circuit diagram & truth table. **ILO4:** Explain Digital Comparator with examples. **ILO5:** Define Parity bit. **ILO6:** Explain Parity checker & Generator

			ILO7: Compare Decoder & Encoder with suitable diagram. **ILO8:** Compare Multiplexer & De-multiplexer with suitable diagram. **ILO9:** Describe Seven segment display with diagram. **ILO10:** Explain BCD to seven-segment Decoder with diagram.
		CO-5 To learn about various types of flip-flops and their functions.	**For CO-5: After completion of this course students will be able to-** **ILO1:** Define Flip-flops. **ILO2:** Define clock, Preset and clear. **ILO3:** Explain the operation of S-R flip flop. **ILO4:** Explain the operation of J- K flip flop. **ILO5:** State the Race around condition. **ILO6:** Explain the operation of Master Slave J-k. **ILO7:** Explain the operation of D-type & T-type flip flops.
		CO-6 To understand the use of registers and counters.	**For CO-6: After completion of this course students will be able to-** **ILO1:** Define Registers and Counters. **ILO2:** Explain the types of Shift

			registers with suitable diagram. **ILO3:** Explain the types of counters. **ILO3:** Explain Ripple Counter, Ring counter, Up/Down counter & Decade Counter with suitable diagrams.
		CO-7 To become familiar with memory devices to properly incorporate into a circuit design.	**For CO-7: After completion of this course students will be able to-** **ILO1:** State the Characteristics of memories. **ILO2:** Classify the types of memories. **ILO3:** Explain the structure of memory organization. **ILO4:** State the application of memories.
		CO-8 To understand the interfacing of digital circuits with converters (ADC, DAC)	**For CO-8: After completion of this course students will be able to-** **ILO1:** Explain the general principle of A/D and D/A conversion. **ILO2:** Explain the types of network methods of D/A conversion. **ILO3:** State the application of A/D and D/A conversion. **ILO4:** Define the types of ADC

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, their 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	4.1. Binary Adders & Subtractors: Half Adder, Full Adder, Half Subtractor, Full Subtractor. 4.2. Digital Comparator, Parity checker/ Generator, Error code. 4.3. Decoder/De-multiplexer, Data selector / Multiplexer, Encoder. 4.4. Seven segment display, BCD to seven-segment decoder (7447). **4.5.** IC Comparator (7485), IC Decoder (74138), IC Multiplexer (74151)	**6**

5.0	Flip-flops	**5.1. Flip-flops:** latch as a 1-bit memory cell, S-R flip flop, concept of clock, Preset and clear. 5.2. J-k flip flop, Race around condition, Master Slave J-k, D-type, T-type flip flops. 5.3. Dual JK (7474), Hex D flip flop (74174)	**6**
6.0	Registers and Counters	**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. **6.2.**Counters: synchronous, asynchronous counter, Ripple Counter, Ring counter, Up/Down counter, Decade Counter. **6.3.** IC Shift Register (74194), IC Ripple Counter (74293), Decade Counter (74290)	**5**
7.0	Memory Devices	**7.1.** Introduction: Classification and Characteristics of memories 7.2. Structure and application of memories. 7.3. Memory Expansion and organization. **7.4.** Various memory IC's.	**5**
8.0	Converters	8.1. General principle of A/D and D/A conversion and brief idea of their applications. 8.2. Digital to Analog converters: Binary resistor network and resistor ladder network methods of D/A conversion. 8.3. Analog to Digital Converters: Dual slope and successive approximation types of ADC. 8.4. IC Converters: ADC0800, DAC0801.	**4**

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:

a. Modern Digital Electronics – RP Jain

b. Digital Principles & Application – Malvino & Leach

c. Digital System - Ronald Tocci

d. Digital Fundamentals - Thomas L.Floyd

e. Digital Electronics - Douglas V.Hall

Course Title : DIGITAL ELECTRONICS LAB

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: - ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS. –I

2) Course Code: - EL- 403

3) Semester: - 4th.

4) Rational of the Subject: - The quality of electrical energy supplied is governed by the values of operating variables maintaining at consumer terminals. The operating variables that define the condition of the supply system are voltage, current, frequency, power and energy. In order to monitor the operating variables, measuring instruments are essential to measure these quantities accurately. Therefore, in this subject included some measuring instruments, such that student can acquired knowledge how to measure such operating variables with the help of these instrument and also categorize the various types of errors likely come about while taking measurements.

5.Aims: - a) Identify the different instruments their construction and uses.

b) Testing, measuring and monitoring of the instruments for particular uses.

6. Course objectives:- Students will be able to:-

1. Identify the measuring instruments used for measuring electrical quantities like current, voltage, resistance, inductance, capacitance etc.

2. Select appropriate instruments with range for measurement of various electrical quantities. Select and use range multiplier if required.

3. Classify measuring instruments based on construction, principle of operation and quantities to be measured.

6(a) COURSE OUTCOMES:-

Sl. no	COURSE OUTCOMES (COs)
	Student will be able to learn–
1.	CO-1 Unit and dimension of measuring system ,dimensional equation
2.	CO-2 Classification of measuring instruments. Essentials of indicating, recording and integrating instrument. Different torques and their importance.
3.	CO-3 MC, MI, ED and induction type instrument, their construction and working.
4.	CO-4 Identify the measuring instruments used for measurement of electrical quantities like resistance, inductance and capacitance using different bridges.
5.	CO-5 Extension of meter range using shunt and multiplier, construction and working of CT and PT.

7. Pre- requisite –

1. Knowledge of current, voltage, resistance and their measurements

8. Teaching Scheme (In hrs):-

Lecturer	Tutorial	Practical	Total
03		03	06

9. Examination scheme:-

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

10. Detailed course content:-

Chapter No	Chapter Title	Contents	Durations (hrs)
1.0	Unit, dimensions and Standards	1.1Fundamental unit, absolute and derived units, CGS, MKS, RMKS, RMKSA, SI, unit. 1.2Dimensional analysis. 1.3Standards and classification of standard.	5 hrs
2.0	Measurement and instrumentation system	2.1Method of measurement, Role of instrument. Selection of instrument and type of instrument static and dynamic characteristics	4hrs
3.0	Electromechanical instruments	3.1Classification – absolute, secondary indicating, integrating instruments. 3.2 Constructional idea, different types of torque, 3.3 PMMC, MI, Induction type instrument, Electro dynamometer type, electro static instruments.	8 hrs
4.0	Measurement of resistance	4.1Measurement low, medium and high resistance by modified Kelvin's double bridge, wheat stone bridge and megger . 4.2 Construction and working principle of megger.	5 hrs
5.0	Potentiometer	5.1D.C. and A.C. potentiometer, basic circuit, applications, standardization, advantages.	4 hrs
6.0	A.C. Bridge	6.1Fundamentals of A.C. bridge, 6.2 measurement of inductance and capacitance – Maxwell's, Inductance bridge, Hay's bridge, Anderson bridge, Owens bridge, De-Sauty's bridge, Schering bridge, Wien bridge, universal inductance bridge, balance equation ,simple problems.	10 hrs
7.0	Measurement of current and voltage	7.1Construction and working principle of different type of ammeter and voltmeters 7.2Extension of range –shunt and multiplier. 7.3CT and P.T., Ratio error, Phase angle error, simple problems.	6 hrs
8.0	Class test		3 hrs

11. TABLE OF SPECIFICATIONS FOR THOERY (EMMI-I)

Sr no	Topic (a)	Time allotted in hrs (b)	Percentage Weightage (c)	Modified % weightage (d)	K	C	A	HA
1	Unit ,dimensions and standards	5	12	12	3	1	5	
2	Measurement and instrumentation	4	10	10	6	0	9	
3	Electromechanical instruments	8	18	18	3	1	6	
4	Measurement of resistance	5	12	12	5	1	3	
5	Potentiometer	4	10	10	4	1	5	
6	A.C bridge	10	24	24	2	1	7	
7	Measurement of current and voltage	6	14	14	1	0	6	
	Total	42	100	100	24	5	41	
	Class test	3						

12. DETAILED TABLE OF SPECIFICATION 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	Unit ,dimension &standard	2	1	2	5	1		1		2			2		2
2	Measurement & instrumentation	2		3	5	1		3		4	3		3		6
3	Electromechanical instruments	2		2	4	1	1			2			4		4
4	Measurement of resistance	1	1	1	3			2		2	4				4
5	Potentiometer	1	1	2	4	2				2	1		3		4
6	A.C bridge	1		1	2	1	1			2			6		6
7	Measurement of current and voltage	1		1	2			1		1			4		4
	Total				25					15					30

13. Suggested implementation:- There are Five questions in Descriptive portion each carry 15 marks. Student should be allow to answer any three questions.

14. Suggested learning resources =

List of books:-

Sl No	Title of book	Authors	Publications
1.	A course in Electrical measurement and measuring instrument	A.K. Sawhney	-DhanpatRai, New Delhi
2.	Electrical measurement and measuring instrument	M.L. Anand	-S.K. Katariae sons, New Delhi
3.	Electrical measurement and measuring instrument	S.K. Sahdev	-Unique international publication, Jalandhar.
4.	Electrical measurement and instrumentation	J.B. Gupta	- S.K. Katari& Sons, New Delhi
5.	Fundamentals of microprocessor & microcontrollers	Ram. B	- DhanpatiRai Publications, New Delhi
6.	Modern electronic Instrumentation & measurement techniques	Albert D. Helfrick William David	- Prentic-Hall India (P) Ltd, New Delhi.

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ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENT –I

LABORATORY

Code = EL-403 (P)

Total Marks =50

Practical/ Viva = 25 Pass Marks = 17/50

Sessional = 25

1. Skills to be developed –
   a) Intellectual skills :-- I. Identification of instruments
      II. Selection of instruments for particular applications
   b) Motor skills :-- I. Accuracy in measurement
      II. Making proper connection.

Experiment No :-	**Title of the Experiments**
1.	Calibration of Ammeter by direct loading with standard one.
2.	Calibration of voltmeter by direct loading with standard one.
3.	Extension of range of Ammeter and voltmeter with the help of shunt & multiplier.
4.	Measurement resistance by Wheatstone bridge method.
5.	Measurement of insulation resistance with megger.
6.	Study of Anderson Bridge and find out unknown inductance.
7.	Study of Maxwell Bridge and find out unknown inductance.
8.	Study of De-Sauty's bridge and find out unknown capacitance.
9.	Study of current transformer.
10.	Study of potential transformer.

Reference books:-

1. Lab manual on basic Electrical Engineering and electrical measurement – By S.K. Bhattacharjee, K.M. Rastogy.

2. Lab. Course in Electrical engg – By S.G. Tarnekar, P.K. Kharbandha.

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Course Title: Electrical Circuit & Network

1. Course Code: El - 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.

5. 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)			PT	PA			
	TA	HA						
70	10	20	33/100	25	25	17/50	150	5

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, Norton's theorem, maximum power transfer theorem,	8
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

1. TABLE OF SPECIFICATIONS FOR THEORY (Electrical circuit and network)

Sr. No	**Topic** (a)	Time allotted in hours(b)	Percentage Weightage(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 ACparallel 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 MATlab	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

COURSE TITLE: ELECTRICL CIRCUIT AND NETWORK LABORATORY

CODE No. El – 401P

Practical: Full Marks: 50, Practical test/viva = 25Sessional (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

COURSE TITLE: OPTICAL FIBRE

1. Course Code: IT - 402

2. Semester: 4th

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to

CO1: explain special features and structure of Optical Fibre with types and Modes
CO-2: understand the mechanism of transmission of light signal through optical fibre
CO-3: analysis different attenuation and dispersions in optical fibre
CO-4: recognize different types of fibre joints , couplers and drawings of optical fibre
CO-5: develop knowledge of optical fibre sources and detectors
CO-6: analysis and differentiate different optical fibre parameters

DETAILED COURSE CONTENT WITH ILO

Module/Unit -	Intended Learning Outcomes	Topic and Sub-topic
1.Introduction	1 Define General Communication system and optical communication system 2. differentiate between Copper cable and optical communication system. 3, state the advantages and disadvantages of optical communication system 4.Define RI profile, NA, Refractive index 5.Classify different modes of optical fibre	1.1 Special features, types, R I profile, 1.2 modes of optical fibre. 1.3 Functions of measurement systems, applications of measurements.
2. Optical Fibre wave guide	6. Define ray theory of transmission and to relate it with OFC 7. Define total internal reflection and discuss its importance in optical fibre communication 8. Derive numerical aperture and solve numerical problems	2.1 Ray theory of transmission, 2.2 Total internal reflection, acceptance angle, N A, skew rays, 2.3 Numerical problems
3. Transmission Characteristic	9.. Describe various attenuation observed in optical fibre transmission 10. define and discuss different losses like absorption , bending loss, dispersion etc	3.1Fibre attenuation and losses, 3.2 absorption, scattering, bend losses, dispersion, 3.3numerical problems.
4.Optical fibre fabrication	11.. Define fabrication of fibre 12. Classify different fabrication techniques 13.Discuss OVPO, MCVD, PCVD etc	4.1 Different methods of fabrications- OVPO, MCVD, PCVD
5.Fibre drawing	14. Discuss different methods observed in fibre drawing. 15. discuss Rod and tube method 16. state the double crucible method of optical fibre drawing	**5..1** Rod and tube methods 5.2 double crucible method.
6.Fibre joints and couplers	17.Classify fibre joints 18. classify fibre couplers 19. Discuss the advantages of using	**6.1** Fibre alignments and joint loss, 6.2 fibre splices—fusion splices, mechanical splices. 6.3 Fibre

	fibre couplers 20. Discuss the importance of fibre alignment during joint of fibre	couplers.
7.Sources and detectors	21. define optical source and detectors 22. discuss the criterion for an source to be a good optical source 23. discuss the criterion for an detector to be a good optical detector	7.1Basic requirements, 7.2 LED & LASER sources, 7.3 PIN diodes, APD detectors.
8.Fibre measurements	24. state different methods of attenuation measurement 25. Describe different method for measuring RI profile , scattering and dispersion.	8.1Attenuation, dispersion, 8.2 RI profile, NA, scattering etc. 8.3 OTDR
9.Optical sensors	26. Define OF sensor. 27. define optical sensor and state its applications. 28. discuss the method of using Optical sensor for measuring physical parameters.	9.1introduction to fibre optic sensing 9.2, advantages and disadvantages of FOS. 9.3 Transduction technique based on intensity modulation, 9.4 position sensors. 9.5 Measurement of pressure, temperature, current, voltage liquid level and strain.

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	**Topic** (a)	**Time allotted in hours (b)**	**Percentage Weightage (c)**	K	C	A	HA
1	Introduction	5	11	√			
2	Optical Fibre wave guide	5	11	√	√		
3	Transmission Characteristic	5	11	√	√	√	
4	Optical fibre fabrication	3	6.5	√	√	√	
5	Fibre drawing	3	6.5	√	√		
6	Fibre joints and couplers	5	11	√	√	√	
7	Sources and detectors	5	11	√	√	√	
8	Fibre measurements	5	11	√	√	√	
9	Optical sensors	4	10	√	√	√	
10	tutorial	5	11	√	√	√	√
Total			100				

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

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

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	Introduction	2			**2**	**2**				**2**	**3**				**3**
2	Optical Fibre wave guide	1	**1**		**2**	**1**	**1**			**2**	**1**	**1**			**2**
3	Transmission Characteriatic	2	**2**	**1**	**5**	**1**	**1**			**2**	**2**	**2**	**1**		**5**
4	Optical fibre fabrication	2	**1**		**3**	**1**	**1**	**1**		**3**	**1**	**1**			**2**
25	Fibre drawing	1	**2**		**3**	**1**	**1**			**2**	**1**	**1**			**2**
62	Fibre joints and couplers	1	**1**		**2**	**1**	**2**			**3**	**1**	**1**			**2**
7	Sources and detectors	2		**1**	**3**	**1**	**1**	**1**		**3**	**2**	**2**	**1**		**5**
8	Fibre measurements	1	**2**		**3**	**1**	**1**			**2**	**2**				**2**
9	Optical sensors	2			**2**	**1**				**1**	**2**				**2**
	Total				**25**					**20**					**25**

COURSE TITLE: INSTRUMENTATION WORKSHOP

1. Course Code: IT – 404

2. Semester: 4th

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to

CO1. use the different hand tool and understand their safety measures.

CO2: become familiar with electrical connections of circuits and uses of soldering.

CO3: identify electronic devices with their terminal configurations.

CO4: Test the different measuring instruments.

CO5: find out the faults in different electronic circuits and repair them.

CO6: use the different meters for measurement purpose.

DETAILED COURSE CONTENT WITH ILO

Module/Unit -	Intended Learning Outcomes	Topic and Sub-topic
1.Safety Precaution and Hand tools:	1.Identify the different hand tools and their proper applications. 2. Know the precautionary measurements and elementary First Aid in case of accident.	1.1 Precaution. 1.2 Elementary First Aid. 1.3 Hand tools uses.
2.Electrical connections and materials	3.Idetify the different wires for soldering. 4. know the materials used for soldering. 5.Mark the different parts of soldering irons. 6.Use the soldering iron for ICs and other electronic devices.	2.1Different wires. 2.2 Soldering. Materials used in Soldering. Solder,Flax,Solvents. 2.3 Familiarization with different types of Soldering iron –A.C. operated, Battery operated, and high and low leakage adjustable bit type. 2.4 Precautionary measures for soldering semiconductors and IC's.
3.Heat Dissipation:	7.Know the different types of heat sink. 8. Connect the heat sink with the different devices.	3.1 Heat sink and methods of connection with device.
4. **Electronic Devices & Identifications**	9. Identify the different electronic devices with their ratings and terminals. 10. know the color code of resistors.	4.1 identification of electronic devices e.g. Resistors, Capacitors, Inductors, Semiconductor Diodes, Transistors, Zener Diodes, FETs , MOSFETs, UJT, SCR, PHOTO DIODE, LED, LDR, OP-Amps, ICs, etc. 4.2 Colour code of resistor.
5.Fabrication, Assembly, Installation and Testing	11.know the circuit tracing in PCB and vero board of rectifier, Oscillator, amplifier etc. 12.Test the transistors, ICs etc. 13. Assemble IC regulator circuit, IC timer circuit, IC flip-flop circuit.	5.1 Circuit Tracing. 5.2 Circuit Assembly on Vero boards and PCB (Rectifier, Oscillator, Amplifier, etc). 5.3 Familiarization of IC's. Tracing of different connections of IC's in a circuit.

		5.4 Circuit Assembly of OP-Amp. IC. Assembly of IC regulator circuit, IC Timer circuit, IC Flip-Flop circuit. 5.5 Testing of Transistors and IC's in passive and active conditions. 5.6 Discuss Dual-in-line package and Mos/LST Type.
6. Test Instruments	14.Use analog and digital multimeters for different electrical parameter measurements. 15. Use oscilloscope for measurement of AC voltage of different types. 16. know the different types of voltage stabilizer.	6.1 Study of Multimeter (Analog & Digital) 6.2 Study of Cathode Ray Oscilloscope, Measurement of CRT voltage. 6.3 Study of different type of stabilizer.
7. Maintenance and servicing and industrial cables.	17. Maintain all the electronic circuit and devices for their long life and proper output. 18. Identify the different cables used in industry.	6.1 Maintenance and servicing of electronic circuits and devices. 6.2 study of different types of industrial cables and their application.

1. **Course Title : ANALOG ELECRONICS - II**

2. **Course Code : Et-405**

3. **Semester : 4th Semester**

4. **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.

5. COs and ILOs:

ET-405	**Analog Electronics-II**	**Course Outcome (CO)**	**Intended Learning Outcome (I LO)**
			For CO1: **After completion of this course students will be able to-**
		CO-1 Understand the circuitry of tuned amplifiers.	**ILO1:** Explain the basic principle of single tuned amplifiers. **ILO2:** Explain the circuit operation of double tuned amplifiers. **ILO3:** Explain the circuit operation of stagger tuned amplifiers.
			For CO-2: After completion of this course students will be able to-
		CO-2 Learn the working and applications of feedback amplifiers.	**ILO1:** Explain the working of positive and negative feedback amplifiers. **ILO2:** Describe the effect of negative amplifier on gain, gain stability, distortion, noise, bandwidth, phase shift, and input and output impedances. **ILO3:** Define voltage and current feedback amplifiers. **ILO4:** Differentiate between series and shunt feedback amplifiers. **ILO5:** Analyse the performance of emitter

			follower circuit for negative feedback. **ILO6:** Calculate the gain, input and output impedances for emitter follower circuit and Darlington pair.
		CO-3 Describe the working principle, circuitry and applications of operational amplifiers.	**For CO-3: After completion of this course students will be able to-** **ILO1:** Describe the circuit operation of single and double ended differential amplifier. **ILO2:** Explain the inverting and non inverting mode of operational amplifiers. **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. **ILO4:** Describe the application of and OPAMP as an adder, subtractor, Voltage follower, Integrator, Differentiator, Comparator, Schmitt trigger, Voltage limiter, Clipper and Clamper.
		CO-4 Understand the operations of an oscillator.	**For CO-4: After completion of this course students will be able to-** **ILO1:** Explain Barkhausen criteria of oscillation. **ILO2:** Describe the working principle of Tuned collector, Hartley oscillator, Colpitt oscillator, Wein bridge oscillator, Phase shift oscillator and Crystal oscillator.
		CO-5 Explain the operation of Relaxation oscillators and their waveforms.	**For CO-5: After completion of this course students will be able to-** **ILO1:** Explain the operation of monostable, astable and bitstable multivibrators with their respective waveforms.

			ILO2: Discuss Schmitt trigger circuits. **ILO3:** Describe the internal block diagram, pin function and construction of different multivibrators with IC-555.
		CO-6 Learn the fundamentals of Sweep Circuits.	**For CO-6: After completion of this course students will be able to-** **ILO1:** Differentiate between voltage time base generator and current time base generator. **ILO2:** Discuss the operation of Miller and Bootstrap circuit. **ILO3:** Write applications of Sweep circuits.
		CO-7 Analyze various types of microelectronic technology.	**For CO-7: After completion of this course students will be able to-** **ILO1:** List some advantages of ICs over discrete elements. **ILO2:** Distinguish between Linear and Digital ICs. **ILO3:** Differentiate between Monolithic and Hybrid ICs. **ILO4:** Explain the terms Crystal growth of Wafer, Epitaxial growth, Oxidation, Photolithography, Chemical etching, Diffusion, Ion implantation and Metallisation related to Planar Technology. **ILO5:** Discuss the techniques involved in the fabrication of BJT, Diode, resistor, capacitor, CMOS, PMOS and NMOS.

6. Detail Course Content:

Chapter No.	Chapter Title	Content	Duration (hours)
1.0	**Tuned Amplifier**	1.1 Circuit operation of single tuned, double tuned and stagger tuned amplifiers	2
2.0	**Feedback Amplifier**	2.1 Basic idea of positive and negative feedback – Effect of negative feedback on gain, gain stability, distortion, noise, bandwidth, phase shift, input and output impedances 2.2 Voltage and current, series and shunt feedback 2.3 Performance of emitter follower circuit – Calculation of gain and input & output impedances – Darlington pair	7
3.0	**Operational Amplifier**	3.1 Circuit operation of differential amplifier – single & double ended operation. 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 3.3 APPLICATIONS OF OPAMP**:** Adder, Subtractor, Voltage Follower, Integrator, Differentiator, Comparator, Schmitt Trigger, Voltage Limiter, Clipper, Clamper etc.	10
4.0	**Oscillator**	4.1 Concept of oscillation – Barkhausen criteria 4.2 Operation of following oscillators**:** — a) tuned collector, b) Hartley, c) Colpitt, d) Wein- bridge, e) Phase Shift, and, f) Crystal.	4
5.0	**Relaxation Oscillator**	5.1 Operation of monostable, astable and bistable multivibrator with waveforms 5.2 Schmitt trigger circuits 5.3 IC-555, internal block diagram and pin function, construction of different multivibrators with IC-555	7
6.0	**Sweep Circuits**	6.1 Fundamentals of sweep circuit operation – Difference between voltage time base generator and current time base generator 6.2 Operation of Miller and Bootstrap circuits – Applications of Sweep Circuits.	6

7.0`	**Microelectronics Technology**	7.1 Advantages of ICs over discrete elements 7.2 TYPES OF ICS**:** Linear and Digital – Monolithic and Hybrid 7.3 PLANAR TECHNOLOGY**:** Crystal growth of wafer – Epitaxial growth – Oxidation – Photolithography – Chemical etching – Diffusion – Ion implantation and metallisation (ideas only) 7.4 Fabrication of BJT, diode, resistor and capacitor (salient features), Fabrication of NMOS, PMOS & CMOS	6

7. 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

8. Suggested Learning Resources

<u>Suggested Books:</u>

i) Electronic Principles - Malvino

ii) Electronic Devices & Circuits - Robert Boylestad iii) Electronic Devices & Circuits - Allen Mottershead iv) Integrated Electronic - Millman Halkias

v) Electronic Devices and Circuits – S. Salivanan, Suresh Kumar, Vallavaraj vi) Microelectronics Circuits - Sedra & Smith

vii) Electronic Devices and Circuits - J B Gupta

viii) Electronic Devices and Circuits - Anil K. Maini

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 waveforms 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) astable multivibrator, b) monostable multivibrator.
5. To observe the waveform 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

COURSE TITLE: PROFESSIONAL PRACTICE-II

Code no:-IT-410

TEACHING SCHEME:	EXAMINATION SCHEME:
Theory: 1 hr/week	Practical assessment: 25 marks
Practical: 2hrs/week	Practical test: 25 marks
Credit: 2	Pass marks: 17/50

A. 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.

B. AIM: - Student will able to:

a) Acquire information from different sources.

b) Prepare notes for given topic.

c) Presentation on given topic in a seminar.

d) Interact with peers to share thoughts.

e) Prepare a report on industrial visits, expert lecture.

C. PRE- REQUISITE:

1. Desire to gain comparable knowledge and skills of various activities in various areas of importance.

2. Eagerness to participate in group work and to share thoughts with group member.

3. Knowledge of instrumentation engineering up to 4th semester.

Activities:

1. Industrial/ Field Visits: - -15hrs

Structured field visits be arranged and report of the same should be submitted by the individual student to form part of the team work. (Any ONE).

a) Nearby bottling plant

b) Visit nearby electrical workshop and auto electrical workshop for observing wiring, installation and maintenance of motor and their starting, running and applications.

c) Visits nearby electrical repairing shop for skill development on repairing, rewinding and assembling of various dc/ac motors.

d) An industry automation in manufacturing.

e) Signalling system of a railway station.

2. Guest lectures by professional/industry expert: - -15hrs

Individual report of the above lecture should be submitted by the students.

3. Seminar/ activities :- (Any one seminar and one activity) -10hrs

a) Making working model of 3-point starter, M.C and M.I instrument.

b) Repairing of some common form of measuring Instrument

c) Seminar on non conventional sources and uses.

d)Seminar on energy efficient devices.

e) Seminar on Seismic protection /environment protection/ pollution control.

f) Water supply scheme/ problems of drinking water in rural area.

g) Computer security

COURSE STRUCTURE OF 5th SEMESTER (INSTRUMENTATION TECHNOLOGY)															
Sl No	Code No.	Subject	Study Scheme (Contact hours/week)			Evaluation Scheme								Total Marks(Theory +Practical)	Credit
						Theory					Practical				
			L	T	P	ESE	Sessional (SS)			Pass(ESE +SS)	Practical Test (PT) #	Practical Assessment(PA)@	Pass (PT+PA)		
							TA	HA	Total (TA+HA)						
1	IT-501	Instrumentation System-I	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
2	IT-504	Process Control-I	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
3	IT-505	Analytical Instruments	3	1		70	10	20	30	33/100	-	-	-	100	3
4	Et-502	Microprocessor	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
5	El-503	Electrical Measurement and Measuring Instrument-II	3	-	3	70	10	20	30	33/100	25	25	17/50	150	5
6	IT-510	Professional Practice-III	1		2						25	25	17/50	50	2
7	Optional (Any one)														
A	IT-506	Bio-Medical Instruments	3		-	70	10	20	30	33/100	-	-	-	100	3
B	IT-507	Virtual Instrumentation	3		-	70	10	20	30	33/100	-	-	-	100	3
		Total	19	1	14									850	25
			34												

COURSE TITLE: INSTRUMENTATION SYSTEM-I

Course code: IT-501

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to

CO-1: know the historical development of measuring instruments and the types of measurements.
CO-2: understand the static and dynamic characteristic of measuring instruments.
CO3: evaluate the output response of 1st order and 2nd order system with standard input signals.
CO-4: identify the sensors and transducers and their uses in measuring instruments.
CO-5:Explain the Pneumatic and Electric transducers.
CO-6: design different signal converter circuits with their standard range.

DETAILED COURSE CONTENT WITH ILO

Module/Unit -	**Intended learning Outcome**	**Topic and Sub-topic**
1.Measurements	1. Define measurements and Instruments 2. Classify the method of measurements 3. Draw the general block diagram of measurement system and explain each block 4. State the functions and application of measurements	1.4 Physical measurement 1.5 Measuring Instruments, 1.6 Accuracy and Cost, Selection of 1.7 Instruments, Classification of 1.8 Methods of Measurement 1.9 Historical background of method of measurements. 1.10Classification of instruments. 1.11Measurement Problems. 1.12General block diagram of measurement system. 1.13 Functions of measurement systems. 1.14Applications of measurements.
2.Performance characteristics of measuring instruments	5. Define and classify transducer 6. Explain the performance characteristics of instruments 7. Define all the static and dynamic characteristic of instruments 8. Distinguish between precision and accuracy. 9. Show how instrument can be calibrated	2.1Functional elements of an instrument; active & passive transducers; analog& digital modes of operation; null & deflection methods; I/O configuration of measuring instruments & instrument system – methods of correction for interfering & modifying inputs. 2.2Generalized performance characteristics of Instruments: Static characteristics and static calibration- Meaning of static calibration, measured value versus true value, Some basic statistics least square 2.3Calibration curves, calibration accuracy versus installed accuracy, Combination of component errors in overall system accuracy calculations, static sensitivity, linearity, threshold,noise , resolution, hysteresis and dead space. Scale readability. Span, Generalized static stiffness & input impedance. 2.4 Dynamic characteristics- speed of response, lag, fidelity, dynamic error.
3.Signals and response of measurement systems	10. Explain and draw different type 11. list the different standard test signals 12. write the generalized equation of a system	3.1Definition, types of signals and their representations- continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random. Commonly used signals (in continuous-time as well as in discrete-time)

	13. Derive the output response of 1st order system with step and ramp input 14. Define time constant. 15. Derive the output response equation of a second order system with step input	3.2 Unit impulse, unit step, unit ramp. Order of a measurement system. General equation of a nth order system. Zero order, first order and second order instruments. 3.3 Response of first order and second order instruments with step and ramp input. Definition of Time constant.
4.Sensors and transducers	16. Distinguish sensors and transducer 17. explain the basic principle of resistive transducer 18. explain strain gauge and strain gauge factor of resistive transducer 19. explain the method of linear displacement resistive transducer with loaded and unloaded condition 20. describe how linear displacement can be measured by Inductive transducer 21.explain the working principle of capacitive transducer 22. Describe the method of angular and linear displacement measurement with capacitive transducer 23. Explain piezoelectric transducer and state its modes f operation	4.1 Definition, classification (active, passive, primary, secondary, mechanical, electrical, analog, digital), selection criteria, 4.2 sources of error for parameter under measurement, transducer specifications, test condition and operating conditions. 4.3 Resistive transducer- Principle of operation, loading effect. Strain gauge and gauge factor, strain measuring circuit temperature compensation. 4.4 Inductive transducer- working principle and types, LVDT- working, advantages and disadvantages, phase sensitive demodulator. 4.5 Capacitive transducer- Principle and working, linear displacement and angular displacement measurement, advantages and disadvantages piezo electric transducer- modes of operation, equivalent circuit loading, effect n frequency response.
5.Pneumatic transducer	24. Give the standard range of electrical , pneumatic and digital signals 25. Explain the flapper nozzle system 26. State the advantage and applications of flapper nozzle system	5.1 Standard pneumatic signal. 5.2 pneumatic source 5.3 Flapper nozzle system- working and advantages. Applications of flapper nozzle system. 5.4 Electro pneumatic systems

6.Signal conversion	27. Analyse the necessity of signal conversion industrial application 28. Describe the method of signal conversion from P-I and I-P 29. Draw and explain the circuit diagram of V-I and I-V converter	6.1. Need of signal conversion 6.2 .Current to pneumatic, pneumatic to current , voltage to current, current to voltage converters

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	**Topic** (a)	**Time allotted in hours** **(b)**	**Percentage Weightage** **(c)**	**K**	C	**A**	**HA**
1	**Measurements**	6	13	√			
2	**General configurations & performance characteristics of measurements**	8	18	√	√		
3	**Signals and response of measurements**	8	18	√	√		
4	**Sensors and transducers**	8	18	√	√	√	
5	**Pneumatic Transducers**	5	11	√	√	√	
6	**Signal conversion**	5	11	√	√	√	
7	**Tutorial**	5	11	√	√	√	√
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	Measurements	2			**2**	**3**				**3**					
2	General configurations & performance characteristics of measurements	1	**2**		**3**		**4**			**4**		**5**			**5**
3	Signals and response of measurements	2	**2**	**1**	**5**		**4**			**4**		**5**			**5**
4	Sensors and transducers		**4**	**2**	**6**		**3**	**2**		**5**		**5**	**2**		**7**
5	Pneumatic Transducers		**3**	**2**	**5**		**2**			**2**		**5**			**5**
6	Signal conversion		**2**	**2**	**4**		**2**			**2**		**3**			**3**
	Total				**25**					**20**					**25**

COURSE TITLE: PROCESS CONTROL-I

Course code: IT-504

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to

CO-1: define and classify control system, understand open loop and closed loop control system, servo and regulatory operation, process and process variable, the ideal process control loop and the different elements.

CO-2: evaluate the Laplace transformations and inverse Laplace transformations of basic functions and solve simple problems.

CO-3: understand the linear time invariant system and develop mathematical model of physical system, obtain transfer functions for electrical circuits, translational and rotational mechanical systems and electromechanical systems.

CO-4: understand the block diagram reduction techniques and solve the problems of block diagram reduction.

CO-5: understand and differentiate different controller modes.

CO-6: Derive impulse, step and ramp response of first order system, derive step response of second order system, understand stability and analyse stability using Routh-Harwitz criterion.

DETAILED COURSE CONTENT WITH ILO

Module/Unit -	Intended Learning Outcomes	Topic and Sub-topic
1.Introduction to control system	1.Define control system. 2.Describe manual and automatic control system 3.Describe open loop and close loop control system 4.Describe and distinguish servo and regulatory system 5.Define process and process variables 6.Explain ideal process control loop	1.1Control system, manual and Automatic control system, open loop and close loop control system, 1.2 Servo (position control) system and regulatory system, 1.3 Process and process variables, ideal process control loop, different elements of ideal process control loop.
2.Laplace transformation	7.Define Laplace transformation and inverse Laplace transformation 8.Derive from the first principle the Laplace Transformation of Impulse, Step, Ramp,	2.1 Definition of Laplace Transform, Laplace Transformation of basic functions-impulse, step, ramp, parabolic, exponential, and sinusoidal function,

	Parabolic, Exponential, Sinusoidal (Sine and Cosine) function, etc. 9.Determine Laplace transformation of a given function using Laplace transformation pairs 10.State and prove properties of Laplace transformation 11.Apply property of Laplace Transformation 12.Derive inverse Laplace transformation using partial fraction expansion method	2.2 Laplace Transformation of derivatives and integrals of function, 2.3 properties of Laplace Transformation, 2.4 Inverse Laplace transformation- partial fraction expansion method
3.Dynamic system representation	13.Define: Physical system, Physical model and mathematical model of a physical system 14.Describe general differential equation of a linear time invariant (LTI) system and define order of an LTI system. 15.Identify linear system, non-linear system, time invariant, time variant system from the given system differential equation 16.Deduce the general transfer function of an LTI system, transfer function of zero order, first order and second order system 17.Give the standard form of transfer function of 1st order and 2nd order system 18.Define zeros and poles of a function, find time constant of a 1st order system, natural frequency and damping ratio of a second order system	3.1 Physical system, 3.2 Linear and Nonlinear system, time variant and time invariant system 3.3 Mathematical model of linear time invariant (LTI) system, order of a system, transfer function of LTI system, 3.4 Pole and zero of transfer function, transfer function of zero order, first order and second order system.
4.Transfer function of physical system	19.Derive the transfer function of simple electrical network comprising of resistor, inductor and capacitor. 20.Derive transfer function of simple mechanical translational system consisting of mass, spring and damper.	4.1 Transfer Function of Electrical System, Mechanical Translational System, Mechanical Rotational System 4.2 Analogous System—Force (Torque) – Voltage Analogy, Force (Torque) – Current Analogy, Analogous Quantities

	21.Derive transfer function of mechanical rotational system consisting of moment of inertia, viscous friction and torsional stiffness. 22.Define and describe analogous system and its necessity. 23.Give the analogous quantities in both of Force-Voltage and Force-Current analogy 24.Define sinusoidal transfer function and determine angle and magnitude of sinusoidal transfer function	4.3 Sinusoidal Transfer Function.
5.Block diagram reduction	25.Define and discuss Block Diagram and its various elements 26.Construct and draw block diagram from given set of simultaneous equation 27.Explain the rules of block diagram reduction – Blocks in cascade, blocks in parallel, moving a summing point ahead of/after a block, moving a take-off point ahead of/after a block, elimination of a feedback loop. 28.Solve problems of block diagram reduction	5.1 Definition 5.2 Procedure of Drawing Block Diagram from Simultaneous Equation 5.3 Rules of Block Diagram Reduction 5.4 Examples of Block Diagram Reduction.
6.Control system analysis	29.Define and discuss response of a system 30.Derive impulse response of a system 31.Derive step and ramp response of a first order system and solve problems 32.Derive step response of a second order (under damped, critically damped and over damped system) 33.Define the time domain specification of step response of under damped second order system. 35.Solve problem to determine rise time, peak time, period of oscillation, maximum	6.1 Impulse Response of System, Step Response and Ramp Response of First Order System, 6.2 Step Response of Second Order System—Under damped, Critically damped and Over damped Response.

	overshoot, damped frequency, settling time, response time, decay ratio of step response of under damped second order system	
7.Controller modes	36.Define and classify controller modes 37.Describe two position (ON-OFF) controller modes and define differential gap. 38.Describe proportional action, integral(reset) action and derivative(rate) action and define: offset, proportional band, proportional gain, derivative action constant, integral action constant 39.Describe composite control action – PI, PD and PID action and define derivative action time, integral action time 40.Compare P-action, I-action and D-action 41.Compare PI-action, PD-action and PID-action	7.1 Definition and Types of Controller Modes 7.2 ON-OFF Mode 7.3 Continuous Mode – Proportional, Integral and Derivative Mode, Proportional plus Derivative mode, Proportional plus Integral mode, Proportional plus Integral plus Derivative Mode.

8.Stability analysis	42.Define forward path gain, feedback path gain, error transfer function, open loop transfer function, close loop transfer function, characteristic polynomial, characteristic equation and characteristic roots of a close loop system. 43.Define and discuss stability of a system and explain how stability is related to location of characteristic roots in the s-plane 44.State and explain the necessary conditions of the characteristic equation for the system to be stable 45. State and explain Routh-Harwitz criterion based on Routh array formed from characteristic equation 46.Solve problems on stability using Routh-Harwitz Criterion 47..Explain the special cases of fail of Routh test and how to overcome them and solve problems.	8.1 Definition and Condition of Stability, 8.2 Characteristic Polynomial, Characteristic Equation and Characteristic Roots, 8.3 Necessary conditions of characteristic Equation for Stability, 8.4 Routh – Harwitz Stability Criterion, Special Cases.

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	**Topic** (a)	**Time allotted in hours** **(b)**	**Percentage Weightage** **(c)**	K	C	**A**	**HA**
1	Introduction to control system	5	11.11	√			
2	Laplace transformation	5	11.11	√	√	√	
3	Dynamic system representation	5	11.11	√	√		
4	Transfer function of physical system	5	11.11	√	√	√	
5	Block diagram reduction	5	11.11	√	√	√	
6	Control system analysis	5	11.11	√	√	√	
7	Controller modes	5	11.11	√	√	√	

8	Stability analysis	5	11.11	√	√	√	
9	Tutorial	5	11.11	√	√	√	√
Total		45	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	Introduction to control system	1	1		**2**						**5**				**5**
2	Laplace transformation	1	1		**2**		**5**			5					
3	Dynamic system representation	1	2	**1**	**4**	**2**				2					
4	Transfer function of physical system	1	1	**1**	**3**							**5**			**5**
5	Block diagram reduction	1	1		**2**		**2**			2		**5**			**5**
6	Control system analysis	1	**2**	**2**	**5**	**2**	**3**			5					
7	Controller modes	1	1		**2**	**2**	**2**			4		**5**			**5**
8	Stability analysis	1	2	**2**	**5**			**2**		2			**5**		**5**
	Total				**25**					**20**					**25**

COURSE TITLE: ANALYTICAL INSTRUMENTS

Course code: IT-505

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to

CO-1: define $P^H$of aqueous, explain the method of P^H measurements and solve problems relating to P^H of aqueous solution.
CO-2: understand the electrolytic conductivity of electrolytic solution and explain the measurement of electrolytic conductivity of solution.
CO-3: define the humidity and moisture content, differentiate humidity and moisture contents and explain the methods of measurements of humidity and moisture contents.
CO-4: understand and explain the gaseous analysis based on thermal conductivity, heat of reaction, magnetic susceptibility method and Orsat apparatus
CO-5: define, classify spectrum, explain analysis based on spectroscopy.
CO-6: understand the sampling and sampling system, types and explain the objectives, requirements and rules of sampling.

DETAILED COURSE CONTENT WITH ILO

Model/ Unit	Intended Learning Outcomes	Topic and sub-topic

1. Electrochemical Measurements	1. Define P^H of aqueous solution; explain the necessity and application of P^H measurement. 2. Define buffer solution and discuss its preparation and application 3. Describe how P^H can be measured and discuss hydrogen electrode 4. Describe the commercial scheme of P^H measurement using measuring electrode and reference electrode 5. State and explain electrical conductivity of electrolytic solution, conductivity cell 6. Discuss measurement of electrolytic conductivity and state its application	1.1 Definition of P^H, Principle of P^H Measurements, 1.2 Hydrogen Electrodes, Buffer Solution, Commercial Scheme, Reference Electrode, Measuring Electrode, 1.3 Application of P^H Measurement, 1.4 Electrolytic Conductivity Measurement, Conductivity Cell, 1.5 Measuring Instrument—Wheatstone Bridge Method, Direct Measurement of Cell Conductance, Application of Conductivity Measurement.
2. Measurement of Humidity and Moisture Contents	7.Define and distinguish humidity and moisture contents 8.Define: Absolute humidity, Specific humidity, Relative humidity and Due point temperature 9.Describe measurement of humidity: hair hygrometer method, dry and wet bulb psychrometer method 10.Discuss the method of moisture content measurement in the laboratory 11.Describe the capacitive and conductivity method of measurement of moisture content	2.1 Definition of Humidity—Absolute Humidity, Specific Humidity, Relative Humidity, Dew Point Temperature, 2.2 Measurement of Humidity—Hair Hygrometer, Dry and Wet Bulb Psychromerer, 2.3 Definition of Moisture Content—Dry Basis, Wet Basis, Determination of Moisture Content—Capacitive Method, Conductivity Method.

3. Analysis of Gaseous Mixtures	12.Define thermal conductivity and thermal conductivity of gaseous mixture and explain analysis of gaseous mixture based on thermal conductivity measurement method. 13.Discuss the measurement of thermal conductivity using hot wire cell and deduce the expression of sensitivity of hot wire cell. 14.Describe gas analysis based on heat of reaction method 15.Describe the magnetic force type oxygen analyser 16.Explain flue gas analysis using Orsat apparatus	3.1 Definition Thermal Conductivity, Thermal Conductivity of Gaseous Mixture, 3.2 Measurement of Thermal Conductivity, Principle of Binary Gas Mixture Analysis Based on Thermal Conductivity Measurement, Analysis of Gas Based on Heat of Reaction Method—Estimation of Combustible Gases in Mixture, Analysis Based on Magnetic Susceptibility Measurement—Paramagnetic Oxygen Analyser, 3.3 Flue Gas Analysis—Orsat Apparatus
4. Spectroscopic Analysis	17.State the different ranges of electromagnetic radiation in wavelength and frequency scale. 18.Explain interaction of radiation with matters-absorption and emission of radiation 19.Discuss the basic principle of spectroscopic method of analysis and state its advantages over conventional method 20.State the different types of spectroscopic method and briefly explain them.	4.1 Different Ranges of Electromagnetic Radiation, Interaction of Radiation with Matter, 4.2 Basic Principle of Spectroscopy—Emission and Absorption of Radiation, Different types of Spectroscopy, 4.3 Advantages of Spectroscopic Method over conventional Method.

5. Sampling and Sampling System	21.Define and classify sampling and sampling system. 22.State the objectives and requirements of sampling 23.State the different rules to be followed during sampling a material under test.	5.1 Definition and types of Sampling, Objectives and Requirements of Sampling, Rules of Sampling, 5.2 Definition of Sampling System, Parts of Sampling System.

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	**Topic** (a)	**Time allotted in hours** **(b)**	**Percentage Weightage** **(c)**	**K**	C	**A**	**HA**
1	Electrochemical Measurements	8	17.78	√	√	√	
2	Measurement of Humidity and Moisture Contents	8	17.78	√	√	√	
3	Analysis of Gaseous Mixtures	12	26.67	√	√	√	
4	Spectroscopic Analysis	9	20.00	√	√		
5	Sampling and Sampling System	3	6.67	√	√		
6	Tutorial	5	11.11	√	√	√	√
Total		Σ b=45	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	Electrochemical Measurements	2	**2**	**1**	**5**		**2**	**2**		**4**	**5**				**5**

2	Measurement of Humidity and Moisture Contents	2	**2**	**1**	**5**	**2**	**2**			**4**	**5**				**5**
3	Analysis of Gaseous Mixtures	3	**3**	**2**	**8**	**2**	**2**	**4**		**8**	**5**				**5**
4	Spectroscopic Analysis	3	**3**		**6**	**2**	**2**			**4**	**5**				**5**
5	Sampling and Sampling System	1			**1**						**5**				**5**
	Total				**25**					**20**					**25**

1. Course Title : Microprocessors

2. Course Code : ET-502

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:

Microprocessor 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 (I LO)
		CO-1 To become familiar with microprocessor and various Computer languages	**For CO1: After completion of this course students will be able to-** **ILO1:** Define microprocessor. **ILO 2:** State different generations of microprocessor. **ILO 3:** Explain the Block diagram of Micro Computer system. **ILO 4:** Define Machine language, Assembly Language & High-level languages. **ILO 5:** State the memory structure of microprocessor
		CO-2 To become familiar with the architecture and Instruction set of Intel 8085 microprocessor.	**For CO-2: After completion of this course students will be able to-** **ILO 1:** Describe 8085 Architecture with its functional components. **ILO 2:** Explain various types of buses. **ILO 3:** Describe registers of 8085 along

			with their functions. **ILO 4:** Classify the flags of 8085 along with their functions. **ILO 5:** Describe the functions of pins in Pin diagram of 8085 with suitable sketch. **ILO 6:** State the importance of Demultiplexing of AD0-AD7 bus. **ILO 7:** State the functions of Read and Write control signals. **ILO 8:** Define Timing diagram and machine cycles. **ILO 9:** Classify various instructions of 8085. **ILO 10:** Describe the Addressing modes of 8085 with examples. **ILO 11:** Identify Addressing modes of 8085 for given examples.
		CO-3: To provide practical hands on experience with Assembly Language Programming.	**For CO-3: After completion of this course students will be able to-** **ILO 1:** Write Assembly language programs for Addition, subtraction, Multiplication, division. **ILO 2:** Write Assembly language programs for Logic Operations, Block data transfer.

		CO-4: To understand the architecture and instruction set of Intel 8086/8088 to utilize it in programming.	**ILO 3:** Write Assembly language programs for Comparison of numbers. **ILO 4:** Describe Handling of carry and using flags in programs. **ILO 5:** Define Subroutine. **ILO 6:** Describe the operation of Subroutine. **For CO-4: After completion of this course students will be able to-** **ILO 1:** Describe 8086 Architecture with its functional components. **ILO 2:** Describe registers and flags of 8086 along with their functions. ILO 3: Explain Special purpose registers. **ILO 4:** Describe memory segmentation of 8086 microprocessor. **ILO 5:** State 8086 instructions for Data transfer operation, Arithmetic operation, Logical operation, Branching operation, Machine control operation and String operation. **ILO 6:** Write simple programs using assemblers

		CO-5: To familiarize with interfacing of various peripheral devices with 8085 microprocessor.	**For CO-5: After completion of this course students will be able to-** **ILO 1:** Explain the concept of Interfacing I/O Devices. **ILO 2:** Define Direct I/O & Memory mapped I/O techniques. **ILO 3:** Describe Modes of operation of Programmable peripheral interface (PPI) 8255 IC with Pin diagram. **ILO 4:** Describe Programmable DMA controller 8257 with Pin diagram. **ILO 5:** Explain the DMA operations and DMA channels with suitable sketch. **ILO 6:** Describe the operation of Programmable Interrupt Controller 8259 with Pin diagram. **ILO 7:** Explain the internal block diagram of Programmable Interrupt Controller 8259 with suitable sketch.

8. Detail Course Content:

Chapter	Chapter Title	Content	Duration
1.0	Introduction	1.1. Introduction to microprocessor, Different generations of microprocessor. 1.2. Block diagram of Micro Computer system, description of each block. 1.3. Computer languages- Machine language, Assembly language, High-level languages. 1.4. Memory revisit, memory structure, memory expansion, memory organization	**3**
2.0	8-bit Microprocessor Architecture	2.1. Introduction to 8085 microprocessor, Different types of bus and their functions. 2.2. Microprocessor operations, descriptions of different control signals. 2.3.Programmable registers of 8085, Accumulator, General-purpose registers, Program counter and stack pointer, Using the stack 2.4. 8085 flags and their utilities. 2.5. Pin diagram of 8085, description of the pins. 2.6. Demultiplexing of AD0-AD7 bus. 2.7. Generation of Read/Write control signals. 2.8. Timing diagram and machine cycles.	**10**

3.0	Instructions and Programming	3.1. 8085 instructions and their classification; Data transfer, Arithmetic, Logical, Branching and looping, Machine control instructions. 3.2. Writing Assembly language programs for Addition, subtraction, Multiplication, division, Logic operations, Block data transfer, Comparison of numbers, Rotate. 3.3. Handling carry and using flags in programs, Writing programs to use stacks. 3.4. Subroutines, Writing subroutines and calling it in the main program, delay subroutines. 3.5. Addressing modes	**10**
4.0	16 bit Microprocessor 8086	4.1. Introduction to 8086 microprocessor; modes of operations. 4.2. Internal registers of 8086, General purpose registers, Index registers, Pointer registers, Special purpose registers, segment registers and flags. 4.3. Understanding memory segmentation and using register values. 4.4. 8086 instructions for Data transfer operation, Arithmetic operation, Logical operation, Branching operation, Machine control operation and String operation 4.5. Writing simple programs, using assemblers.	**10**

5.0	Interfacing Peripherals	5.1. Basic Interfacing concepts, Interfacing I/O devices. 5.2. Input/Output techniques, Direct I/O and memory mapped I/O. 5.3. Programmable peripheral interface (PPI) 8255 IC, different ports, Modes of operation, Control word register. 5.4. Programmable DMA controller 8257, DMA channel and DMA operations. 5.5. Programmable Interrupt Controller 8259, pin diagram, internal block diagram, operations.	**9**

9. Distribution of Marks:

Chapter	Chapter Title	Type of Question			Total
		Objective Type	Short	Descriptive	
1	Introduction	-	-	4	4
2	8 bit Microprocessor Architecture	8	4	5	17
3	Instructions and Programming	7	4	6	17
4	16 bit 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) Microprocessors Architecture Programming and Applications - Gaonkar

ii) Intel Peripheral Users manual - INTEL.

iii) Microprocessors & Interfacing to 8085 Introduction to - Douglas V Hall

iv) Introduction to Microprocessors - Lance A Leventhal

v) Introduction To Microprocessors - A.P. Mathur

MICROPROCESSOR LAB

1.0 Study of a typical microprocessor trainer kit and its operation

2.0 Simple programming examples using 8085 instruction set. To understand the use of various instructions and 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 Parallel interface using 8255.

9.0 Seven segment display interface.

10.0 Interfacing 8255 port to high power devices

1. Course Title: - ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS-II

2. Course Code: - EL – 503

3. Semester: - 5th

4. Rationale of the Subject: - Diploma holders in Electrical Engineering have to work on various job in the field as well as in testing laboratories and on control panels, where he performs the duties of installation, operation, maintenance and testing by measuring instruments. Persons working on control panels in power plant, substation, in industries and domestic consumer, etc. will come across the use of various types of instruments and have to take measurement. Instruments used to read and observe electrical power, energy, frequency, resistance, wave shapes etc, have been incorporated in this subjects. So the technician will understand the construction and use of various types of Electrical instrument.

5) Aims:- Diploma holder has to work as Supervisor , maintenance Engineer in Electrical power generation , transmission ,distribution system , installation system , machine operation etc .For the above job responsibility he has to take the measurement , testing ,monitoring ,maintenance and controlling of various electrical quantities current , voltage , power, energy , frequency etc .According to these contents of the subject is included .

6) COURSE OBJECTIVES:-- The students will be able to—

1. Identify the measuring instrument Wattmeter, Energymeter,Ohmmeter, frequency meter,CRO, Synchroscope, transducers etc for appropriate measurement.

2.Know the construction and operation and application of the above instruments.

3. Study of Microprocessor based instrumentation system.

COURSE OUTCOMES:-

Sl. no	COURSE OUTCOMES (COs)
1	CO-1 Students get familiar with the concept of instrument mainly used in the field as well as industry .
2.	CO-2 Measurement of electrical power and energy
3.	CO-3 Construction and used of electronics instruments like CRO, digital frequency meter, power factor meter ,DVM,TVM, FET , VMS ,Q meter .
4.	CO-4 Construction and uses of transducer ,Sensors like resistive , capacitive, inductive, magnetic , measurement of temperature , pressure ,flow of liquid .
5.	CO-5 Study of data transmission and telemetry , microprocessor based instrumentation system.

7. Teaching Scheme (In Hrs):-

Lecturer	Tutorial	Practical	Total
03		03	06

8. Examination scheme:-

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

9. Detailed course content:-

Chapter No	Chapter title	Contents	Duration hrs
1.0	Measurement of power.	1.1Wattmeter: Dynamometer type and induction type single phase and three phase wattmeter, construction, errors. 1.2Measurement of single phase power by three ammeters and three voltmeter method. 1.3Measurement of three phase power by two and three watt meter method.	6 hrs
2.0	Measurement of energy	2.1Single phase energy meter-induction, construction type- testing and adjustment. 2.2 Three phase energy meter-induction type construction error, torque equation, 2.3construction of single phase & three phase digital energy meter.	4hrs
3.0	Instruments for special purpose	3.1Construction of Digital frequency meter, 3.2 power factor meter, synchroscope ,construction 4.1C.R.O, its application, study of front panel, Measurement of phase, frequency, Lissajous pattern, B-H loop.	3 hrs
4.0	Electronics Instrument	4.2D.V.M. , T.V.M, FET Voltmeter, 4.3 Q- meter.	8 hrs
5.0	Primary sensing element and transducer	5.1Primary sensing element :- Diaphragm bellow, Bourdon tube, 5.2transducer :- basic requirement, selection of transducers, advantages, classification – resistive, inductive, capacitive, magnetic, photo electric, piezo electric transducer, thermistor, thermocouple, 5.3strain gauge, LVDT. Measurement of pressure, temperature, flow, liquid level etc.	10 hrs

6.0	Data transmission and telemetry	6.1 Method of data transmission, telemetry – classifications, different land line telemetering methods, 6.2 Recorder – graphic oscillographic, magnetic tape recorder, X-Y recorder and strip- chart recorder.	6 hrs
7.0	Microprocessor based Instrumentation system	7.1Principle of microprocessor based instrument, 7.2 Type of control – Lumped digital control and distributed digital control, Block diagram of both controls. 7.3Application of microprocessor & micro controller for switch, LED control, temperature control of furnace, Traffic light control, SCR firing angle control.	5 hrs
8.0	Class test		3 hrs

10. TABLE OF SPECIFICATIONS FOR THOERY:-

Sr no	Topic (a)	Time allotted in hrs (b)	Percentage Weightage (c)	Modified % weightage (d)	K	C	A	HA
1	Measurement of power	6	14	14	4	1	9	
2	Measurement of energy	4	10	10	3	0	7	
3	Instruments for special purpose	3	7	7	5	0	2	
4	Electronic Instrument	8	19	19	6	1	3	
5	Primary sensing element and transducer	10	24	24	5	2	8	
6	Data transmission and telemetry	6	14	14	5	0	2	
7	Microprocessor based instrumentation system	5	12	12	4		3	
	Total	42	100	100	32	4	34	
	Class test	3						

11. DETAILED TABLE OF SPECIFICATION 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	Measurement of power	2	1	2	5	2		1		3			6		6
2	Measurement of Energy	2		2	4	1		1		2			4		4
3	Instrumentation for special purpose	1		1	2			1		1	4				4
4	Electronic Instrument	1		2	3	1		1		2	4	1			5
5	Primary sensing element and transducer	2	1	2	5	1	1	2		4	2		4		6
6	Data transmission and telemetry	2		1	3	1		1		2	2				2
7	Microprocessor based instrumentation system	1		1	3	1		1		2	2				2
	Total				25					16					29

12. Suggested Implementation Strategies:- The Teacher should explain the scope of various measuring devices and their practical applications in the field. Frequent visit to nearby process industries, generating station, and substation will be immense help to the student.

13. Suggested Learning Resources:-

Sl No	Title of book	Authors	Publications
1.	-A course in Electrical measurement and measuring instrument	A.K. Sawhney -	-DhanpatRai, New Delhi
2.	-Electrical measurement and measuring instrument	M.L. Anand -	-S.K. Katariae sons, New Delhi
3.	-Electrical measurement and measuring instrument	S.K. Sahdev -	-Unique international publication, Jalandhar.
4.	-Electrical measurement and instrumentation	J.B. Gupta -	- S.K. Katari& Sons, New Delhi
5.	-Fundamentals of microprocessor & microcontrollers	Ram. B	- DhanpatiRai Publications, New Delhi
6.	-Modern electronic Instrumentation & measurement techniques	Albert D. Helfrick and William David	- Prentic-Hall India (P) Ltd, New Delhi.

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ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENT –II LABORATORY.

Code No = EL-503 P

Full marks = 25 Pass Marks = 17/50

Sessional Mark= 25

1. Skill to be developed :-
   a) Intellectual skills: - 1. Identification of instruments.

2. Selection of instruments for measurement.
   b) Motor skills:- 1. Accuracy in measurement.
2. Making proper connection.

Experiment No. : - Title of the experiment

1.0 Measurement of I- phase power and power factor by 3- ammeter method.

2.0 Measurement of I- phase and power factor by 3- voltmeter method.

3.0 Measurement of 3- phase power and power Factor by 2- wattmeter method.

4.0 Measurement of 3- phase power and power factor by 3- wattmeter method.

5.0 Calibration of analog energy meter and digital energy meter.

6.0 Calibration of C.R.O.

7.0 Use of analog and digital multimeter for measurement current, voltage and resistance.

8.0 Measurement of phase and frequency by C.R.O.

9.0 To obtain the Hysteresis loop curve of single phase transformer by C.R.O.

10.0 Measurement of displacement, pressure with the help of transducer.

Reference Books:-

- 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. Hkarbandha

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PROFESSIONAL SKILLS –III

CODE NO= IT-510

TEACHING SCHEME:	EXAMINATION SCHEME:
Theory: 1hr/week	Practical assessment: 25 marks
Practical: 2 hrs/week	Practical: 25 marks

Credit: 2 Pass marks: 17/50

A. 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.

B. AIM:-

Student will be able to:

a. Acquire information from different sources.
b. Prepare notes for given topic.
c. Presentation on given topic in a seminar.
d. Interact with peers to share thoughts.
e. Prepare a report on industrial visits and training, expert lecture.

C. PRE- REQUISITE:-

1. Survey of different electrical industries.

2. Knowledge of Instrumentation engineering up to 5th semester.

D. ACTIVITIES

1. Training / Industrial/ Field visits:

Structured training/ field visits be arranged and report of the same should be submitted by the individual student.

a. 7-10 days compulsory summer training during the end of 4th Semester final examination (during term vacation) in Instrumentation department of manufacturing industries and oil sectors.

AND (Any one of the following) - 14hrs

b. Visit any industry (Cement, Sugar, Gas cracker, oil refinery etc) to observe operation maintenance, safety arrangement on instrumentation and control equipments.
c. Industry of power electronics devices.
d. Instruments repairing workshop
e. Any other technical field area as may be found suitable alternative to above list.

2. Guest lectures by professional/industrial expert :- (any two) -10hrs

a. Application of sensors and transducer
b. Industrial control
c. Digital metering
d. Safety precaution and first aids from fire and accident
e. Indian electricity rules.
f. Social networking- effects and utility.

g. Entrepreneurship development and opportunities.

(Individual report of the above lecture should be submitted by the students.)

3) Information search: - Following (any TWO) topics are suggested for each group of 4-5 students have to search/collect information. -6 hrs

a. Latest development in Industrial controllers
b. Electrical drive and braking system.
c. Maintenance and installation of solar equipments.
d. Control centre design.

4) Mini project/ seminar/ activity: -(each group of 4-5 students) -10hr

Students should work with some Instrumentation related projects

COURSE TITLE: BIOMEDICAL INSTRUMENTS

Course code: IT-506

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to

CO-1: explain the working of instruments in various department & laboratories of a hospital and thereby recognize their limitations.
CO-2: understand fundamental knowledge of Biomedical instrumentation.
CO-3: develop knowledge in various bio-chemical signal generated by the body and their significance.
CO-4: illustrate the fundamental concept of heart , its internal structure and flow of blood through it.
CO-5: know and explain the basic idea about Non-invasive and invasive diagnostic instruments.
CO-6:apply the knowledge and ideas on the electrical safety of medical equipment .

DETAILED COURSE CONTENT WITH ILO

Model/ Unit	Intended Learning Outcomes	Topic and sub-topic
1. Introduction	1. Show the importance of Biomedical Instrumentation in the field of medical Engineering 2. Differentiate general instrumentation system and biomedical instrumentation 3. Give some applications of Bio – Medical Instrumentation	1.1 Biomedical instruments 1.2 biometrics -introduction and components of man instrument system, 1.3 transducers of biomedical applications.
2. Physiological Systems	4.Descrive the physiological system present in the human body. 5.Descrive cardiovascular system with neat sketch 6. Discuss the nervous system of human bieng	2.1 Introduction of physiological system of human body, 2.2 cardiovascular system, Respiratory system, 2.3 nervous system, Characteristic of living organism.
3.**Bio potential measurements**	6. Identify the sources of bio potential 7. Give the characteristics of different bio –potentials 8. Classify Bio-Potentials 9. Show how the ECG wave for a normal person and illustrate each	3.1 Sources of bioelectric potential human cells and its general characteristics, 3.2 resting and action potential, propagation of action potential, different 3.3 types of bio electric potential—ECG, EEG EMG and

	section	others.
4. **Electrodes**	10. Classify electrodes 11.State electrode theory and give Nernst equation	4.1 Electrode theory, Nernst equation, 4.2 biopotential electrodes—micro electrodes, skin surface electrodes and needle electrodes.
5. Cardiovascular measurements	12. Define systolic and diastolic blood pressure 13. Describe electromagnetic and optical blood flow meter 14. Show the flow of blood through different organs and cells	5.1 The heart blood pressure and its measurements, 5.2 Blood flow and its measurements, 5.3 Electrocardiography—electrodes and leads.
6. Imaging system	15. Describe the working principle of CT scan, X-ray and MRI 16. Discuss the Doppler effect is in ultra sonography	6.1 X-ray system,properties of X-ray, X-ray machine, 6.2 Computed tomography (CT) scan, 6.3 Magnetic resonance imaging (MRI), 6.4 Ultrasonography—properties of ultrasound, basic ultrasound system, ultrasonic Doppler, colour Doppler.
7.Selected topics	17. Describe Stethoscope, Pacemakers , defibrillators	**7.1** Stethoscope, cardiac pacemakers, cardiac defibrillators, fibre optics endoscopy, artificial respiration.
8. Patient care and monitoring	18. Give an overview of hospital organization. 19. Discuss about the hospital management	8.1 Introduction, element of intensive care monitoring, 8.2 Organisation of hospital for patient care monitoring

9. Electrical safety	19. Describe electrical safety of medical equipments	9.1 Physiological effect of electrical current 9.2 method of accident prevention.

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	**Topic** (a)	**Time allotted in hours** **(b)**	**Percentage Weightage** **(c)**	K	C	**A**	**HA**
1	Introduction to Bio-medical Instruments	3	7	√			
2	Physiological Systems	5	11	√	√		
3	Bio-potential Measurements	6	13	√	√		
4	Electrodes	3	7	√	√	√	
5	Cardiovascular Measurements	7	16	√	√	√	
6	Imaging Systems	7	16	√	√	√	
7	Medical Equipments	4	8	√	√	√	
8	Patients Care and Monitoring	3	7	√	√	√	
9	Electrical Safety	2	4	√	√	√	
10	Tutorial	5	11	√	√	√	√
Total		Σ b=45	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	Introduction to BMI	3			**3**	**2**				**2**	**5**				**5**
2	Physiological System	1	**1**		**2**	**1**	**1**			**2**	**2**	**1**			**3**
3	Biopotential Measurement	2	**2**		**4**	**1**	**1**			**2**					
4	Electrode	1	**1**		**2**	**1**	**1**			**2**	**1**	**1**			**2**
5	Cardiovascular Measurement	2	**1**	**1**	**4**	**2**	**1**			**3**					
6	Imaging System	1	**1**		**2**	**1**	**1**			**2**		**2**			**2**
7	Medical Equipment	2	1		**3**	**1**	**2**			**3**	**2**	**1**			**3**
8	Patient care and monitoring	1	1		**2**	**1**	**1**			**2**	**2**	**2**	**1**		**5**
9	Electrical Safety	1	2		**3**	**1**	**1**			**2**	**2**	**2**	**1**		**5**
	Total				**25**					**20**					**25**

COURSE TITLE: VIRTUAL INSTRUMENTS

Course code: IT-507

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to

CO-1: Explain the importance and role of virtual instruments.
CO-2: Apply virtual instrument in the field of Instrumentation Engineering
CO-3: Develop knowledge in various programs of Lab VIEW
CO-4: Able to analyse different AC and DC signals.
CO-5:Control hardware and interfacing cards .
CO-6: Apply the knowledge of VI in real life problems .

DETAILED COURSE CONTENT WITH ILO

Unit/ Topic	Intended Learning Outcomes	Topic/ sub topic
1.Introduction to Lab VIEW	1.Define virtual Instrumentation and state its application 2.Discuss the importance of LabVIEW in the field of Virtual Instrumentation 3. know about different parts and blocks of VI 4. Able to locate the component in Front and block diagram Panel	1.1 Virtual Instruments, 1.2Virtual Instrumentation applications, 1.3Design process, 1.4Virtual Instrument, 1.5 Parts of VI, Front Panel/ Block Diagram panel 1.6 Starting of VI
2.Navigating, Troubleshooting and debugging of VI	5. Distinguish an error in the block and to nullify the error 6. know the cloning of VI blocks, change the properties, color, parameters etc.	2.1 Data flow and Building Simple VI, 2.2Lab VIEW helps Utilities, 2.3 Correcting Broken VI's, 2.4 Debugging Techniques, 2.5Undefined or Unexpected data,

		2.6coloring and cloning of objects
3.Implementing VI	7. Design the front panel and to make it user friendly 8. Know the use of structures and implement it in different programming situations 9. Able to use different loops including For loop and While Loop	3.1Front Panel Design, 3.2Data types, 3.3Introduction to Structures, 3.4While Loop and For loop 3.5Feedback node, case structure Sequenced structures
4.Timing a VI and Plotting data	10. construct graphical chart using time axis as domain 21.Apply timing loop and delays	4.1. Waveform chart and graph (Scope, and sweep charts), 4.2. Plotting arrays on 4.3 .waveform graph and charts
5. Express V.I's	22. introduce and simulate different signal using function generator 23. Measure spectra of different wave signals	5.1Simulate signal, 5.2Spectral measurement
6. Strings and File I/O	24. Able to work using spreadsheet 25. design read write file using VI on spreadsheet and other acceptable format	6.1Strings, Understanding File I/O, 6.2write/read to spread sheet file, 6.3write/read to measurement file

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	**Topic** (a)	**Time allotted in hours** **(b)**	**Percentage Weightage** **I**	K	C	**A**	**HA**
1	Introduction to Lab VIEW	7	15.5	√			
2	Navigating, Troubleshootingand debugging of VI	9	20	√	√		
3	Implementing VI	10	22	√	√	√	
4	Timing a VI and Plotting data	5	11	√	√	√	

5	Express V.I's	7	15.5	√	√	√	
6	Strings and File I/O	7	16	√	√	√	
7	Tutorial						√
Total		Σ b=45	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	Introduction to Lab VIEW	3			**3**	**3**				**3**	**5**				**5**
2	Navigating, Troubleshooting and debugging of VI	1	**1**		**2**	**2**	**2**			**4**	**2**	**2**			**4**
3	Implementing VI	3	**2**		**5**	**2**	**1**			**3**	**2**	**2**			**4**
4	Timing a VI and Plotting data	2	**3**		**5**	**2**	**3**			**5**	**2**	**2**	**2**		**6**
5	Express VIs	1	**2**	**2**	**5**	**2**	**1**			**3**		**2**	**1**		**3**
6	Strings and File I/O	2	**1**	**2**	**5**	**1**	**1**			**2**		**2**	**1**		**3**
	Total				**25**					**20**					**25**

COURSE STRUCTURE OF 6th SEMESTER (INSTRUMENTATION TECHNOLOGY)

Sl No	Code No.	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	Hu-601	Industrial Management & Enterpreneurship	3		-	70	10	20	30	33/100	-	-	-	100	3
2	IT-601	Instrumentation System-II	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
3	IT-602	Process Control-II	3	-	3	70	10	20	30	33/100	25	25	17/50	150	4
4	IT-603	Automatic Control System	4		-	70	10	20	30	33/100	-	-	-	100	4
5	Optional (Any one)														
A	IT-604	Industrial Electronics	3		-	70	10	20	30	33/100	-	-	-	100	3
B	IT-605	Micro-Controllers and Embedded System	3		-	70	10	20	30	33/100	-	-	-	100	3
6	IT-610	Professional Practice-IV	1		2						25	25	17/50	50	2
7	IT-611	Project & Seminar		1	6	-	-	-	-	-	100	50	50/150	150	3
8	IT-612	General Viva		2							50		17/50	50	2
		Total	17	3	14									850	25
			34												

1. Course Title : Industrial Management and Entrepreneurship

2. Course Code : **Hu – 601**
3. Semester : **VI**
4. **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
5. **Course Outcomes**:

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

    - CO_1 = explain managerial activities.
    - CO_2 = describe leadership qualities and decision making process.
    - CO_3 = state the elements of costs.
    - CO_4 = explain important industrial laws.
    - CO_5 = define different forms of business organisations
    - CO_6 = identify entrepreneurial abilities for self employment through small scale industries.

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

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

7. **Examination Scheme:**

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

8. **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	3

			management	
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 motivation	i) State the qualities and functions of an entrepreneur	3
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	i) Differentiate different forms of Business organization ii) compare and contrast features,	5

		and demerits	merits and demerits of different business organizations.	
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 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	i) identify the supporting agencies to entrepreneurs ii) Explain the role of financial support organisations	5
	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	Compre-hension	**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)

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

10. Distribution of Marks:

DETAILED TABLE OF SPECIFICATIONS FOR IME

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	Total
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

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
7			
8			

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b. List of Journals
c. Manuals
d. Others

COURSE TITLE: INSTRUMENTATION SYSTEM - II

Course code: IT-601

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to-

CO-1: understand the basic knowledge and idea about instruments and their workings.
CO-2: know the basic physical parameters to be measured in Industries.
CO-3: differentiate the temperature measuring scales and transducers.
CO-4: explain the various temperature, pressure, flow and level measuring instrument, their construction, working principle application & range.
CO-5: design the various types of industrial measuring instruments of different physical parameters.
CO-6: analyse different telemetry system and their applications

DETAILED COURSE CONTENT WITH ILO

Unit/ Model	Intended Learning Outcomes	Topic/sub topic
1.Temperature measurements	1 Classify modes of heat transfer 2.Give the classifications of different temperature sensor 3. Explain the construction of different temperature scales 4.Define Seeback effect and Peltier's effect 5. Give the laws of thermocouple 6.Describe temperature scale and derive their conversions	1.1 Modes of heat transfer, laws of conduction, convection and radiation 1.2 Temperature scales, classification of Temperature Sensors, Overview of Temperature Sensor Material 1.3 Thermometers: Classification of Thermometers, Construction and working of glass thermometers 1.4 Liquid expansion thermometer, gas thermometer (filled system thermometer), bimetallic thermometer, solid state temperature sensor, Specifications of Thermometers 1.5 Resistance temperature detector Principle, types, Configurations, construction and working of RTD, Material for RTD, Signal Measurement techniques for RTD, Comparative Response curves for RTD, 2 wire,3wire and 4 wire RTD Element, Lead wire Compensation in RTD ,self heating effect, Specifications, advantages, disadvantages and applications of RTD. 1.6 Thermistors: Principle, types (NTC and PTC), characteristics, Construction and working of Thermistor, Materials, specifications of Thermistor, applications 1.7 Thermocouples: Principle, thermoelectric effect, See beck effect, Peltier effect, laws of thermocouple, types of thermocouple with characteristic curve, thermocouple table, Sensitivity, constructional Features of Thermocouples., Thermo couple

		Specifications 1.8 Electrical noise and noise reduction techniques, cold junction Compensation Method, thermopile, thermocouple emf measurement method, Thermo well Material of construction and its specifications
2. Pressure measurements	7. Give the construction and working of different types of pressure sensors 8.Give the classifications of pressure sensors 9.Define the term "calibration". Describe the calibration of pressure sensors 10.Describe absolute pressure, relative pressure, differential pressure, gauge pressure	2.1 Pressure scales, units and relations, classification.me pressure sensors elastic elements like bourdon tube, diaphragm, bellows 2.2 Properties and selection of elastic materials, Calibration using dead weight tester 2.3 Differential pressure measurement ,Force balance, motion balance 2.4Semiconductor strain gauges 2.5Manometers : U-tube types, well type, inclined type, micro manometer 2.6Vacuum Measurement Units and relations, McLeod gauge, Piranigauge, thermocouple gauge, hot cathode ionization gauge, Knudsen gauge, calibration using dead weight tester
3. Level measurements	11.Give the importance of level measurement in process plant and industries 12.Classify level sensors 13. Show how different intelligent level sensors are used for level measurements	3.1 Need for Level Measurement, Classification of Level Measurement Techniques 3.2 Direct and Indirect method, Construction and working of Dipstick, displacer, float system, bubbler, 3.3Capacitive devices for level measurement 3.4Ultrasonic level gauge, DP cell, load cell, , radioactive type level gauges, LASER type transducers 3.5Fibre optic level sensors, solid level detectors 3.6Intelligent level measuring instruments. Gamma ray absorption method. Air trap method
4. Flow measurements	14.Derive the Barnaullies	4.1 Introduction to fluid flow properties of fluid, types of fluid, dimensionless numbers,

	equation. 15.Give pascals law 16.Describe different types of flowmeters available on industries and explain the working and construction 17. Classify flowmeters 18. Discuss the effect of vapour pressure on flow sensors	types of fluid flow, continuity equation, Bernoulli's equation, hydrostatic law, Pascal's law. 4.2 Flow through pipes major and minor losses, flow measurement through open channel-weirs and notches 4.3Materials used for flow sensors, performance of materials, corrosion resistors, erosion, effect of vapour pressure 4.4Head Type orifice, venturi, nozzle, pitot tube, characteristics of head type flow meters. Variable Area Type-Rotameter and its type 4.5Other flow meters Turbine, electromagnetic, ultrasonic ,positive displacement, anemometers, mass flow meters, solid flow measurements.
5.Telemtering	19. Give the importance of telemetering 20. Classify telemetering system 21. Explain the process of voltage telemetering, current telemetering, position telemetering, frequency telemetering.	5.1Need of telemetering 5.2Voltage telemetering, 5.3Current telemetering, 5.4Position telemetering, 5.5 Impulse telemetering, 5.6Frequency telemetering

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	K	C	A	HA
1	Temperature Measurement	10	22	√	√	√	
2	Pressure Measurement	8	18	√	√	√	
3	Level Measurement	6	13	√	√	√	
4	Flow Measurement	8	18	√	√	√	
5	Telemetry	4	9	√	√	√	
6	Tutorial	5	10	√	√	√	√
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	Temperature Measurement	2	**2**	**1**	**5**	**2**	**2**			**4**	**3**	**2**			**5**
2	Pressure Measurement	2	**2**	**1**	**5**	**1**	**2**	**1**		**4**	**2**	**2**	**1**		**5**
3	Level Measurement	2	**2**		**4**	**1**	**2**	**1**		**4**	**2**	**2**			**4**

4	Flow Measurement	3	**2**	**1**	**6**	**1**	**2**	**1**		**4**	**2**	**3**	**2**		**7**
5	Telemetry	2	**1**	**2**	**5**	**1**	**2**	**1**		**4**	**2**	**2**			**4**
6	Tutorial														
	Total				**25**					**20**					**25**

COURSE TITLE: PROCESS CONTROL-II

Course code: IT-602

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to-

CO-1: understand and evaluate the mathematical model of simple process and Knowledge of field instrumentation.

CO-2; understand the pneumatic and electronic controllers

CO3: become familiar with ratio control , cascade control , digital control and programmable logic control

CO-4: understand the function of control elements in a process control

CO-5: understand and study control system stability

CO-6: become familiar with Process Instrumentation and control center layout diagram

DETAILED COURSE CONTENT WITH ILO

Module / unit	Intended Learning Outcome	Topic and sub topic
1.Process dynamics and mathematical modelling	1. Define process and discuss mathematical modelling of process/ system 2. Define fluidic resistance of flow pipe and fluidic capacitance of a tank 3. Deduce the mathematical model of a simple level process (linear) and find the transfer function. 4. Define thermal capacitance and thermal resistance and derive the mathematical model and transfer function of simple thermal system. 5. Derive the mathematical model of a simple pressure system 6. Derive transfer function of given two stage interacting and non interacting level processes.	1.1 Mathematical modelling 1.2 modelling of thermal system 1.3 modelling of water level system 1.4 modelling of pressure system 1.5 Illustrative Examples.

2.Control elements	7. Define final control element and give examples. 8. State and explain the working principle and application of electromagnetic relay, solenoid valve, nozzle flapper system and pneumatic relay. 9. Define synchro and describe the constructional details of a basic synchro unit. 10. Explain the working principle of a synchro and derive the stator phase voltages and line voltages. 11. Discuss the different types of synchro units and explain synchro as angular position transmitter and as error detector. 12. Draw a schematic diagram of a control valve and explain its construction and working. 13. Describe types of valve, lift flow characteristic of valve, valve sizing, cavitation and flashing of valve.	2.1: Electromagnetic Relay 2.2: Solenoid Valve 2.3:Synchro—principle, synchro angular position transmitter, synchro error detector 2.4: Flapper Nozzle System 2.5: Pneumatic Relay 2.6: Control Valve, Characteristic of control valve, types of control valve, control valve sizing, cavitation and flashing.
3. Controllers	14. Describe with the help of schematic diagram the working of and hence derive the transfer function of pneumatic Proportional, proportional plus derivative, proportional plus integral and proportional plus integral plus derivative controller. 15. Describe operational amplifier (Op-Amp) and list its various advantages. 16. Describe op-amp as summer, substractor, differentiator and integrator. 17. Draw circuits for electronic P, PI, PD and PID controller using op-amp and derive the output equation.	3.1**:** Pneumatic controller—P, PI, PD, PID. 3.2: Electronic controller—P, PI, PD, PID. 3.3:Hydraulic controller.

4. Special Control Schemes	18. Describe the working of a ratio control system with the help of a suitable example. 19. Describe the working of a cascade control system with the help of a suitable example. 20. Describe the principle of working of feed forward control 21. Discuss computer control and direct digital control 22. Define PLC, describe the basic building blocks of PLC and list the advantages of PLC. 23. Discuss the Ladder Diagram programming of PLC.	4.1: Ratio controller 4.2:cascade controller 4.3: feed forward control 4.4: digital controller—computer control, direct digital control 4.5: PLC—building blocks, programming methods, relay and logic ladder diagram, programming examples.
5. Stability analysis	24. State and explain stability of system 25. Explain necessary conditions of characteristic equation for stability and explain the Routh-Herwitz stability criterion. 26. Solve some problems of stability using RH criterion.	5.1: The concept of stability 5.2: Routh stability criterion 5.3 illustrative examples.
6. Process Instrumentation	7.control centre give the layout of control centre and state the basic requisites of control centre. 28.Give the definition of terms used in P & I diagram. 29. Identify Instruments in P & I diagram 30. State and explain the different types of scale used and instruments used in process control instrumentation.	6.1 Control centre requisite, lay-out of control centre 6.2 definition of terms used in P& I diagram, instrument identification, examples of P & I diagram. 6.3 Different types of Instruments and scales used in industrial instrumentation

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage(c)	K	C	A	HA
1	Process Dynamics and Mathematical Modelling	8	16.67	√	√	√	
2	Control Elements	8	16.67	√	√		
3	Pneumatic and Electronic Controllers	8	16.67	√	√		
4	Different Control Schemes	7	15.56	√	√		
5	Stability Analysis	5	11.11	√	√	√	
6	Process Instrumentation	4	8.89	√	√	√	
7	Tutorials	5	11.11	√	√	√	√
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	Process Dynamics and Mathematical Modelling	2	**2**	**2**	**6**	**3**				**3**		**5**			**5**
2	Control Elements	2	**1**		**3**	**3**				**3**		**5**			**5**
3	Pneumatic and Electronic Controllers	2	**2**		**4**	**2**	**2**			**4**	**5**				**5**
4	Different Control Schemes	2	**1**		**3**	**3**				**3**	**5**				**5**

5	Stability Analysis	2	**2**	**2**	**6**	**2**	**2**			**4**					
6	Process Instrumentation	3			**3**			**3**		**3**	**5**				**5**
	Total				**25**					**20**					**25**

COURSE TITLE: AUTMATIC CONTROL SYSTEM

Course code: IT-603

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to

CO-1: describe the basic elements of control system and various types of control system.
C0-2: become familiar with signal flow graph and Mason's gain formula with examples
CO-3: become familiar with time domain analysis with stability of a system and root locus technique.
CO-4: become familiar with frequency domain analysis and Nyquist plot.
CO-5: understand the Stability analysis of a system with Bode Plot and Nyquist Plot.
CO6: represent the state variable models of a system.

TABLE OF INTENDED LEARNING OUTCOMES (ILOs)

Module / unit	Intended Learning Outcomes	Topic and sub topic
1.Introduction	1.Describe the basic elements of control system and state the various control system terminology 2.Describe the various types of control system 3.State the advantages of automatic control over manual control 4.Discuss some basic simple control system	1.1 Basic elements of control system, control system terminology, automatic controlled closed loop systems. 1.2 Mathematical modelling, transfer function. 1.3 Analysis of steady state error, static error constants- Static position error constant Kp, Static velocity error constant Kv, Static acceleration error constant Ka. Steady state errors for Type 0,1,2 systems. 1.4 Errors for Step, Ramp and Parabolic Inputs.
2.Block diagram and signal flow graph	5.Describe the basic elements of block diagram and signal flow graph 6.Solve problems of block diagram reduction techniques 7.Construct signal flow graph from, simultaneous equation, from block diagram and from differential equation 8.Discuss Mason's gain formula 9.Solve problems of signal flow graph reduction using Mason's gain formula	2.1 Definition and basic elements of block diagram, 2.2 Rules of block diagram reduction, illustrative examples. 2.3 Signal flow graph from block diagram, Mason's gain formula, illustrative example.

3.Time domain analysis	10.Define Open Loop Transfer function, Close Loop Transfer Function, Open Loop Pole, Close Loop Pole, Characteristic Equation, Characteristic Roots and stability of close loop system. 11.Describe root locus and magnitude condition and angle conditions of open loop transfer function. 12.Discuss straight line asymptote, centroid and break away point, angle of departure and angle of arrival of root locus. 13.Explain the steps to construction of root locus. 14.Construct the root locus for some given system.	3.1 Response of first order and second order system. 3.1 stability of control system, Routh-Hurwitz's stability criterion, 3.2 Introduction of Root Locus method; Rules for constructing root loci, stability analysis of systems using Root locus, determination of roots of the closed loop system, 3.3 stability from root locus inverse root locus, concept of dominant, effects of parameter variations on closed loop poles, closed loop pole pair, Root-contour plots, effect of zeros & poles.
4.Frequency domain analysis	15.Describe the frequency response, frequency response method of analysis and frequency domain specifications. 16. Define and discuss bode magnitude and phase plot and discuss the steps to draw bode plot. 17.Draw bode plot of some given transfer function. 18.Define polar plot and discuss the steps to draw the polar plot of a given function. 19.Draw polar plot of a given type – 0, type – 1 and type – 3 systems. 20.Describe mapping theorem, principle of argument, Nyquist path, and critical point of Nyquist plot. 21.State and explain the Nyquist stability criterion 22.Discus the steps to draw Nyquist plot 23.Solve stability problems of a given close loop system using Nyquist stability ctiterion.	4.1 Introduction to Frequency Response, 4.2 Bode plots, stability margins on the Bode plot, stability analysis of systems using Bode plots, 4.3 polar plots, Nyquist stability criterion, relative stability, illustrative example.

5.State space model	24.Define state, state variable, state vector state space and state equations. 25.List the advantages of state variable approach of modelling a system 26.Construct the state variable model of a given system from state equations of the system. 27.Construct the state space model from system differential equations 28.Solve some problem to obtain the state space model of some given simple system.	5.1 State Space Representation of systems, 5.2 conversion of state variable models to transfer functions. 5.3 Illustrative examples.

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	**Topic** (a)	**Time allotted in hours** **(b)**	**Percentage Weightage** **(c)**	K	C	**A**	**HA**
1	Introduction	4	8.89	√			
2	Block diagram and signal flow graph	10	22.22	√	√	√	
3	Time domain analysis	6	13.33	√	√	√	
4	Frequency domain analysis	15	33.33	√	√	√	
5	State space model	5	11.11	√	√	√	
6	Tutorial	5	11.11	√	√	√	√
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	Introduction	3			**3**	**3**			**3**						
2	Block diagram and signal flow graph	2	**2**	**1**	**5**		**3**		**3**			**5**			**5**
3	Time domain analysis	2	**2**	**1**	**5**	**3**			**3**			**5**			**5**
4	Frequency domain analysis	3	**2**	**2**	**7**	**3**	**3**	**2**	**8**			**5**	**5**		**10**
5	State space model	2	**2**	**1**	**5**		**3**		**3**			**5**			**5**
	Total				**25**				**20**						**25**

COURSE TITLE: INDUSTRIAL ELECTRONICS

Course code: IT-604

COURSE OUTCOMES (COs)

After completion of this course, the students will be able to

CO-1: know the different power drives and their basic principle.
CO-2: explain the application of thyristors in power control circuits such as rectifier, inverter, chopper and cyclo-converter.
CO-3: explain the different ac and dc motor speed control methods.
CO-4: differentiate the power frequency and high frequency electrical heating and their practical utility.
CO-5: design the different timer circuits.
CO-6: analyse the dc regulated power supply and uninterruptible power supply.

DETAILED COURSE CONTENT WITH ILO

Module / unit	Intended Learning Outcomes	Topic and sub topic
1.Power devices	1. explain the working principle of power diode, with its V-I characteristic 2. explain the working principle of power transistor with its characteristic curves	1.1Power diodes-Characteristic and principle of working, 1.2 PIV, power rating. Power transistors- characteristic, operation, working principle and specifications
2. Thyristors	3 name the different members of thyristor family 4.explai the working principle of SCR with V-I characterstics 5.Describe the different triggering methods of SCR 6. state the principle of triggering circuit 7. state and compare the commutation method of SCR	2.1 SCR characteristic**,** rating, transistor analogy, turn on and turn off characteristic. SCR commutation methods. Other SCR family members-DIAC, 2.2 TRIAC, GTO. SCR triggering circuit and triggering methods
3.Rectifiers	8. Draw the circuit diagram and wave form diagrams of single phase half wave and full wave rectifier using SCR 9. State the role of freewheeling diode	3.1Single phase and three phase rectifiers-half wave , full wave, bridge type. 3.2 Controlled rectifier- single phase and three phase controlled rectifier, half controlled and full controlled, firing angle control, role of

	for inductive load 10.derive the equation of Output DC voltage of half wave and full wave rectifier 11. Draw the circuit diagram and Output waveform diagram of Three phase three pulse converter 12. Draw the circuit diagram and Output waveform diagram of Three phase six pulse converter 13.derive the equation of Output DC voltage of Three phase Three pulse and six pulse converter	freewheeling diode. Wave form diagrams
4.Inverters	14 explain the basic principle of inverter circuit 15. describe the series inverter circuit with circuit diagram 16. state the dis advantage of series inverter circuit. 17. modify the basic series inverter circuit 18. describe the parallel inverter circuit with circuit diagram 19.Explain the three phase inverter circuit.	4.1 Principle of inverter, thyristor inverters, series and parallel inverter, disadvantages of series inverter. 4.2 Voltage driven and current driven inverter. Three phase inverter
5.Choppers	20. State the basic principle of chopper circuit. 21.Describe the chopper control techniques. 22.Explain the step up chopper circuit. 23.State the applications of chopper circuit.	5.1 Basic principle of chopper circuit. 5.2 Classification on the basis of commutation, chopper control techniques, duty cycle, applications of chopper
6.Cycloconverters	24. explain the working of	6.1 Introduction and basic principle of operation.

	cycloconverter. 25.Describe the step-up and step-down cycloconverter with circuit diagram. 26.Explain the three phase cycloconverter with circuit diagram and waveform diagram. 27. State the applications of cycloconverter.	6.2 Single phase and three phase cycloconverter, application.
7.Power supply	28. State the importance of regulated dc power supply. 29.Explain the IC voltage regulator. 30.Describe the scheme of over voltage protection. 31.Write about the working of SMPS.	7.1.DC regulated power supplies, IC voltage regulators, 7.2 Over voltage protection, SMPS.
8.Motor speed control	32. List the different methods of speed control of DC motor. 33. Explain the armature voltage control and field current control scheme of DC motor. 34.Draw a block diagram of automatic speed control scheme of DC motor. 35. Classify the AC motor speed control methods. 36.Describe the speed control of AC motor with frequency and slip control methods. 37.Define electrical heating. 38. Explain regenerative, plugging and dynamic braking.	8.1 DC motor- characteristics, type of speed control, armature voltage control, field current control, automatic control scheme. 4-quadrant drives, dual converter. 8.2 AC motor- types of speed control, frequency control, slip control, automatic control scheme, types of braking-regenerative braking, plugging, dynamic braking.
9. Uninterruptible power supply	39. Draw the conventional block diagram of UPS system. 40. List the components of UPS system and explain them. 41. Describe the ON line and OF line UPS system.	9.1 Different sections and conventional block diagram, 9.2 ON line and OFF line UPS, different components, 9.3 static switches.

	42.Draw and explain the automatic battery charger circuit for UPS.	
10. Electrical heating	43. Give a comparative heat power output of different heating methods. 44. Classify the electrical heating. 45.Describe Induction and dielectric heating. 46.Name the electrodes and describe the method of coupling to RF generator. 47. State the application and thermal losses of electrical heating.	10.1 High Frequency heating, principle, merits, applications, High frequency Source for Induction heating. 10.2 Dielectric Heating, principle, material properties, 10.3 Electrodes and their Coupling to RF generator, 10.4 Thermal losses and Application.

TABLE OF SPECIFICATIONS FOR THEORY

Sr. No	**Topic** (a)	**Time allotted in hours** **(b)**	**Percentage Weightage** **(c)**	**K**	C	**A**	**HA**
1	Power devices	3	6.66	√	√		
2	Thyristors	4	8.88	√	√		
3	Rectifiers	4	8.88	√	√	√	
4	Inverters	4	8.88	√	√	√	
5	Choppers	3	6.66	√	√	√	
6	chycloconverter	3	6.66	√	√	√	
7	Power supplies	3	6.66	√	√	√	√
8	Motor speed control	6	13.33	√	√	√	√
9	UPS	4	8.88	√	√	√	√
10	Electrical heating	6	13.33	√	√	√	√
11	Tutorials	5	11.11	√	√	√	√
Total		Σ b=45	100				

K = Knowledge C = Comprehension

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

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	Power devices	1			**1**		**2**			**2**					
2	Thyristors	1	**2**		**3**		**2**	**1**		**3**		**3**			**3**
3	Rectifiers		**2**	**2**	**4**		**2**	**1**		**3**		**2**	**2**		**4**
4	Inverters		**2**	**1**	**3**		**2**			**2**		**2**			**2**
5	Choppers		**1**	**1**	**2**		**2**			**2**		**2**			**2**
6	chycloconverter		2	**1**	**3**		**2**			**2**		**2**	**2**		**4**
7	Power supplies		2		**2**		**2**			**2**					
8	Motor speed control		2	**1**	**3**		**2**			**2**		**2**	**2**		**4**
9	UPS		1	**1**	**2**		**1**			**1**		**2**	**2**		**4**
10	Electrical heating		1	**1**	**2**		**1**			**1**		**2**			**2**
	Total				**25**					**20**					**25**

1. **Course Title : Microcontrollers and Embedded Systems**
2. **Course Code : IT-605**
3. **Semester : 6th Semester**

4. **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.

5. **COs and ILOs:**

ET-603	Microcontrollers and Embedded systems	Course Outcome (CO)	Intended Learning Outcome (I LO)
		CO-1 To understand the fundamental concepts of microcontroller.	**For CO1: After completion of this course students will be able to-** **ILO1:** Define Microcontroller. **ILO 2:** Describe the block diagram of microcontroller. **ILO 3:** Compare microprocessor and microcontroller. **ILO 4:** Compare 8bit, 16bit & 32bit microcontroller. **ILO 5:** Describe Embedded and External memory Microcontroller. **For CO-2: After completion of this course students will be able to-**

		CO-2 To have depth understanding and knowledge of the architecture and features of 8051 microcontroller.	**ILO 1:** Describe the general features of 8051 microcontroller. **ILO 2:** Describe the Block diagram and pin functions of 8051 with suitable sketch. **ILO 3:** State the functions of registers of 8051. **ILO 4:** Discuss various flags with simple examples. **ILO 5:** Describe in detail the Internal memory organization of 8051 **ILO 6:** Define Stack and stack pointer of 8051. **ILO 7:** Explain Program memory of 8051. **ILO 8:** Explain the configuration of port 1.
		CO-3: To develop skill in simple program writing for 8051 microcontroller.	**For CO-3: After completion of this course students will be able to-** **ILO 1:** Define assembler, cross assembler, compiler, cross compiler, linker and loader. **ILO 2:** Explain the Structure of Assembly language. **ILO 3:** Explain various addressing modes with examples.

			ILO 4: Discuss the function of each instruction of 8051 with bytes, no. of machine cycles. **ILO 5:** Explain the importance of rotate, swap, jump and call instructions in a program. **ILO 6:** Define sub routine and its function.
		CO-4: Implement C programming in 8051	**For CO-4: After completion of this course students will be able to-** **ILO 1:** Discuss the Data types, memory types and models of C program for 8051. **ILO 2:** Define Strings, arrays, pointers, time delay generation along with its function. **ILO 3:** Discuss the use of arithmetic & logical operators.
		CO-5: Write advanced programs.	**For CO-5: After completion of this course students will be able to-** **ILO 1:** Write programs with assembly & C. **ILO 2:** Define Polling. **ILO 3:** Describe various Interrupt methods. **ILO 4:** Explain how to execute an Interrupt. **ILO 5:** Define IE and IP registers. **ILO 6:** Define Timer and Counters.

			ILO 7: Explain TMOD and TCON registers. **ILO 8:** Explain mode 1 & mode 2 operation of timers and counters. **ILO 9:** Explain SBUF & SCON registers. **ILO 10:** Describe working of serial port. **ILO 11:** Explain Serial data transmission & reception with example.
		CO-6: To familiarize with interfacing of various peripheral devices with 8051 microcontroller.	**For CO-6: After completion of this course students will be able to-** **ILO 1:** Describe the operation of Interfacing LED with 8051. **ILO 2:** Explain the operation of Interfacing Seven segment Display with 8051 along with suitable sketch. **ILO 3:** Explain the mechanism of Interfacing LCD module with 8051. **ILO 4:** Explain the mechanism of Interfacing ADC & DAC with 8051 along with suitable sketch. **ILO 5:** Describe the operation of Interfacing DC motor & Stepper Motors with 8051.

6. 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 8 bit, 16 bit, 32 bit 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	3.1 Definition of assembler, cross assembler, compiler, cross compiler, linker and loader. 3.2. Structure of Assembly language, Assembling and running an 8051 program. 3.3. Addressing modes-Accessing memory using various addressing modes. 3.4. Instruction set- Arithmetic operations, Logical operations and data block movement. 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. 3.6. Using loops, calling sub routines.	**10**
4.0	8051 Programming in C	4.1. Introduction, advantages & disadvantages. 4.2. Data types, generalized C program for 8051, memory types and models. 4.3. Strings, arrays, pointers, time delay generation. 4.4. Use of arithmetic & logical operators, accessing SFRs and bit addressable RAM, example programs	**6**
5.0	Advanced Programming	5.1. I/O Port Programming: Byte size I/O, bit addressability, example programs with assembly & C 5.2. 8051 Interrupts: Polling & Interrupt methods, executing an Interrupt, different types, IE and IP registers, enabling, disabling and priority setting. 5.3. Timer and Counters: TMOD and TCON registers, mode 1 & mode 2 operation of timers and counters, Time delay generation & example programs. 5.4. Serial I/O: SBUF & SCON registers, working of serial port, Serial data transmission & reception, Example programs	**8**
6.0	Interfacing the 8051	6.1. Interfacing LED, push button switch, Seven segment Display, LCD module, ADC, DAC, DC motor & Stepper motors.	**3**

7. 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 Programming	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

8. 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, Dreamtech press, 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, Wiely

iv) ARM Technical Reference manual

PROJECT WORKS FOR SIX SEMESTER.

Code No. IT – 611 for Project & Seminar

Code No. IT-612 for GV

Total Marks for project & GV = 200

Project viva / presentation = 50

General Viva =50

Project assessment: 100

Pass Marks = 66/200

Students have to work with Instrumentation related project and to develop a model in groups or individually. A project report is to be prepared on the work.

The external examiner, preferably, a person from industry/organization, who has been associated with the project oriented professional training of the students, should evaluate the student performance.

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PROFESSIONAL PRACTICE-IV

CODE NO: IT-610

TEACHING SCHEME:	EXAMINATION SCHEME:
Theory: 1hr/week	Practical assessment: 25 marks
Practical: 2hrs/week	Practical test: 25 marks
Credit: 2	Pass marks: 17/50

1. 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.

2. AIM:-

a) Student will be able to:-

a) Acquire information from different sources.

b) Prepare notes for given topic.

c) Presentation on given topic in a seminar.

d) Interact with peers to share thoughts.

e) Prepare a report on industrial visits, expert lecture.

ACTIVITIES:-

1. INDUSTRIAL /FIELD VISITS: - -10 hrs

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

a. Visit to nearest oil refineries, gas cracker, hospital for medical instruments, railway workshop etc.

2. Guest lecturers from field / industry / professional. (Any TWO) ----6hrs

a. Medical Instruments
b. Maintenance of controllers and control station
c. PLC and its application in manufacturing Industry.
d. SCADA, DCS etc.
e. Security measures in Industrial environment.

Individual report of the above lecture should be submitted by the students.

3. Group discussion: - Any two topics of Instrumentation and control by each group of 4-5 students. –10hrs

4. Information search: - (Any TWO) ----4 hrs

a. LabVIEW in practical field.
b. Calibrators
c. Smart controllers
d. PLC in operation of bottling plant

5. Student activities: - Any ONE activity in a group of 4-5 students -10hrs

a. Survey and interviews of successful entrepreneurs in nearby areas.
b. Community development programme in rural areas.
c. Instrumentation Engg. Job survey in NE region
d. Repairing work of instruments and controllers

EXAMINATION SCHEME (Practical assessment)

Total Internal assessment of 25 marks is to be carried out by the teachers.

Distribution of marks: - Activities = 10, Group discussion = 5, field visit =5,

Guest lecture attendance and report =5.

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