

**PROGRAMME OUTCOMES OF ELECTRICAL ENGINEERING**

List	POs description
PO-1 Basic Knowledge	Competence to apply basic knowledge of mathematics, applied Sciences, engineering drawing for the solution of electrical engineering problems.
PO-2 Discipline Knowledge	Ability to formulate , analysis, problems of electrical engineering with the leverage of core and elective subjects of electrical engineering relevant to present engineering and technical national as well as global scenario.
PO-3 Practical Knowledge	Sufficient to conduct experiments, testing, and measurements to analysis and interpret data, installation and stewardship of various electrical equipments and machines.
PO-4 Use of Engineering tools and develop co-curricular Skill activities	Ability to use to days state of art engineering techniques and tools for co- curricular skills activity in house wiring installation, testing, estimating and repairing of electrical machines and also monitoring, control and acquisition of data .
PO-5 Life -long learning	Competency in application of computer, recognize the need for and have the preparation and ability to engage in independent life- long learning in the context of changing technological scenarios.
PO-6 Extra Curricular activities	Appreciate for enhancement of literary , cultural ,ritual and social instincts in real sense by allowing to be involved in departmental wall magazine , institute week celebration, teachers day celebration etc. and also participate in NCC camp ,inter polytechnic meet etc.
PO-7 Effective communication	Ability to apply written, oral and graphical communication in both technical and non technical environments and ability to use appropriate technical literature, entrepreneurship development, knowledge and understanding principle of management.
PO-8 Ethical responsibility	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-9 Individual and team works	Inter disciplinary Subjects, individual and group project, individual seminar, industrial visits, industrial training and ability to take part as a team leader.
PO-10 Environment and sustainability	Ability to consider the impact of engineering solution on environment and the need of sustainable development to ensure optimal survival of the nature.

## COURSE STRUCTURE OF 3<sup>RD</sup> SEMESTER (ELECTRICAL)

Sl no	Code no	Subject	Contact hours /week		Evaluation scheme										
					Theory (Th)						Practical (Pr)			Total Marks (Th+Pr)	Credit
			L	T	P	ESE	Sessional(SS)			Pass (ESE+SS)	Practical Test(PT)	Practical Assessment (PA)	Pass (PT+PA)		
							TA	HA	Total (TA+HA)						
1	CO-301	Computer application and 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 – 305	Elements of electronics and Devices	3		3	70	10	20	30	33/100	25	25	17/50	150	5
5	El - 301	Principles of Electrical engineering	3	1	3	70	10	20	30	33/100	25	25	17/50	150	4
6	Me-304	Elements of mechanical engineering	3		3	70	10	20	30	33/100	25	25	17/50	150	4
7	El - 310	Professional practice –I	1		2						25	25	17/50	50	2

Interdiscipline branches subjects:

8	EL/ET -304 OR EL-304	Fundamentals of electrical and electronics engg. OR Elements of electrical engg.				3		3	70	10	20	30	33/100	25	25	17/50	150	4
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# 1. Course Title–Computer Application & Programming.

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

2: **Course Code – Co-301**

3: **Semester- 3<sup>rd</sup>**

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:**

1. On completion of the course students will be able to:
2. Explain the basics of a computer hardware and software
3. Solve problems related to number systems
4. Define basics of Operating System
5. Familiarize with networking components
6. Write simple C programs

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

7: **Teaching Scheme (in hours):**

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

8: **Examination Scheme :**

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

## 9: Detailed Course Content:

Unit	Topic/Sub-Topics	Intended Learning Outcome	Hours
1	<b>Computer Architecture:</b> Brief history, Charles Babbage Machine, Von Neuman Architecture, block diagram, memory & its different types, I/O devices, Role of O.S., computer languages, translator software, editor. Data, different types of data, information and its characteristics	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	<b>Number System and codes:</b> 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.	1. Define decimal, binary, octal & hexadecimal number systems. 2. Convert between different number systems. 3. Define 1's & 2's complements. 4. Subtract using 1's & 2's complements. 5. Describe some different codes.	8
3	<b>Introduction to Operating System:</b> Definition, single user and multi-user OS, different function performs by OS, various popular OS like DOS, Windows, UNIX/LINUX. DOS and UNIX commands.	1. Define operating system. 2. Operate different commands of DOS, Windows & UNIX/ LINUX.	5
4	<b>Computer Network and the Internet:</b> Definition, necessity of network, different		6

	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.	<p>1 Define network.</p> <p>2 Describe different types of network.</p> <p>3 Define network topology.</p> <p>4. Describe different network devices.</p> <p>5. Define internet &amp; describe different internet services.</p> <p>6. Explain use of different browsers &amp; search engines.</p>	
<b>5</b>	<b>Introduction to C programming:</b> 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.	<p>1. Write algorithm and flow charts for simple programs.</p> <p>2 Define basic terminology of C language.</p> <p>3 Write small program using C language.</p> <p>4 Write diversified solutions using C language.</p> <p>5 Differentiate between IF..Else and Switch statement.</p>	<b>15</b>
	<b>Internal Assessment</b>		<b>3</b>

**Intellectual Skills :**

Logical reasoning

Relating programming concepts in problem solving

**Motor Skills :**

Learn to use and handle a computer and its peripherals.

**List of Lab Exercises :**

I. Basic commands for computer system maintenance.

II. Preparation of Documents

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

**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	✓		✓	
<b>Total</b>		Σ b=42	100				

K = Knowledge C = Comprehension A =Application

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

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

## Detailed Table Of Specifications

Unit	Topics	Objective				Short					Descriptive				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Computer Architecture	7			7	5				5	4				4
2	Number Systems & Codes	4			4	2				2	4		4		8
3	Introduction to Operating Systems	4			4	2				2	4				4
4	Computer Network & the Internet	5			5	3				3	3		4		7
5	Introduction to C Programming	5			5	3				3	3		4		7
<b>Total</b>		25			25	15				15	18		12		30

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

**12: Suggested Implementation Strategies:**

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

**13: Suggested Learning Resources :**

1. Fundamentals of Computer, Rajaraman, PHI
  2. It Tools and Applications, DOEACC "O" Level, Firewall Media
  3. Let us C by Y. Kanetkar, BPB
  4. Programming in ANSI C / E. Balagurusamy / Tata McGraw-Hill
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## 2.Course Title– Engineering Economics and Accountancy (All Branches)

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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<sub>1</sub> = Define some important economic and accounting terms.
- CO<sub>2</sub> = explain some basic economic laws.
- CO<sub>3</sub> = Describe overall economic environment.
- CO<sub>4</sub> = explain double entry system of book keeping.
- CO<sub>5</sub> = record business transactions under double entry system of book keeping
- CO<sub>6</sub> = define financial statements.

6. Teaching Scheme (in hours)

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

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)
Part – A : Engineering Economics				<b>21 hrs</b>
1.0	Introduction to Economics :	i) Definition of Economics, its utility and scope of study ii) Definition of Engineering Economics ii) Meaning and concepts of Utility, Consumption, Value, Price, Goods and National Income, inflation iii) Wants – Definition and characteristics iv) Wealth & Welfare– Definition, meaning and types	i) explain core economic terms concepts and theories	5
2.0	<b>Demand and Supply :</b>	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	<b>Production :</b>	i) Meaning and factors of production ii) Factors determining efficiency of labour	i) Define factors of production ii) Explain formation of	5

		<ul style="list-style-type: none"> <li>iii) Savings, investment and capital formation</li> <li>iv) Meaning of production function</li> </ul>	capital	
4.0	<b>Money:</b>	<ul style="list-style-type: none"> <li>i) Meaning of money</li> <li>ii) Types of money</li> <li>iii) Functions of money</li> </ul>	i) Understand meaning and functions of money	2
Chapter No.	<b>Chapter Title</b>	Content	Intended Learning Outcomes	Duration (in hours)
5.0	<b>Banking Organisation :</b>	<ul style="list-style-type: none"> <li>i) Central Bank – its functions</li> <li>ii) Commercial banks – its functions</li> </ul>	i) Distinguish the functions of different banks	3
6.0	Pricing	<ul style="list-style-type: none"> <li>i) Objectives of pricing policy</li> <li>ii) price determinants</li> <li>iii) Price discrimination</li> </ul>	i) explain pricing policy	2
<b>Part – B : Accountancy</b>				<b>21 hrs</b>
7.0 (A)	<b>Introduction to Book-Keeping and Accounting:</b>	<ul style="list-style-type: none"> <li>i) Definition &amp; objectives of Book-keeping</li> <li>ii) Need and advantages of Book-keeping</li> <li>iii) Definition of Accounting</li> <li>iv) Difference between Book-keeping and Accounting</li> <li>v) Double Entry System – main features</li> </ul>	<ul style="list-style-type: none"> <li>i) Define Double Entry System of Book Keeping</li> <li>ii) State its objectives, features merits and demerits</li> </ul>	3

		vi) Advantages and disadvantages of Double Entry System		
(B)	<b>Introduction to Computerised Accounting System:</b>	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	<b>Transaction:</b>	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	<b>Journal and Ledger</b>	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	<b>Cash Book:</b>	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	<b>Trial Balance &amp; Errors in Accounting:</b>	i) Meaning and objects of Trial Balance ii) Main features and advantages	i) Explain meaning and features of	3

		of Trial Balance iii) Preparation of Trial Balance iv) Types of errors in Accounting	Trial balance	
Chapter No.	<b>Chapter Title</b>	Content	Intended Learning Outcomes	Duration (in hours)
12.0	<b>Components of Final Accounts:</b>	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
	<b>Total</b>			<b>45 hrs</b>

## 9. TABLE OF SPECIFICATIONS for Engineering Economics &amp; 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
<b>Total</b>		<b>42hrs</b>	<b>100</b>	<b>41</b>	<b>24</b>	<b>5</b>	<b>0</b>

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

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

### 10 Distribution of Marks:

#### DETAILED TABLE OF SPECIFICATIONS FOR EEA

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand Total
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
1	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
	<b>Total</b>	<b>20</b>	<b>5</b>	<b>0</b>	<b>25</b>	<b>11</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>10</b>	<b>16</b>	<b>5</b>	<b>0</b>	<b>31</b>	<b>70</b>



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:Book list**

Sl. No.	Title of Book	Name of Author(s)	Publisher
1	Introductory Micro Economics	Sandeep Garg	DhanpatRai Publication Pvt. Ltd. New Delhi
2	Introductory Macro Economics	Sandeep Garg	DhanpatRai Publication Pvt. Ltd. New Delhi
3	Theory and Practice of Accountancy	B. B. Dam R. A. Sarda R. Barman B. Kalita	Capital Publishing Company, Guwahati – 5
4	Book-Keeping & Accountancy	Juneja, Chawla &Saksena	Kalyani Publisher, New Delhi - 110002
5	Tally. ERP 9 For Beginners	Tally Solutions Pvt. Ltd.	Sahaj Enterprises, Bangalore

b.List of Journals

c.Manuals

d.Others

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## 3 Course Title– Mathematics-III

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1 Course Title: Mathematics – III

2 Course Code : Sc – 303

3 Semester : Third Semester

4 Aim of the course:

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

5. Course Outcome:

- a) On completion of the course, students will be able to
- b) Recognize and differentiate functions having two or more variables.
- c) Form and solve first and higher order ordinary differential equations having differential coefficients.
- d) Calculate the measures of central tendency and measures of dispersion from statistical data.
- e) Determine the correlation co-efficient of bivariate distribution.
- f) Calculate the probability of occurrences of events under different conditions.
- g) Solve simultaneous equations using matrices and also solve two variable linear programming models by the graphical solution method.

6. Teaching scheme( in hours):

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

## 7. Examination Scheme:

Theory			Total Marks 100
ESE Full Marks	Sessional Full Marks	Pass Marks (ESE+Sessional)	
70	30	33	

## 8. Detailed Course Content:

Chapter No.	Chapter Title	Contents	Intended learning outcomes	hours
		GROUP-A: DIFFERENTIAL CALCULUS Hours: 2                      Marks: 5		
A1	Partial differentiation	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	Definition, classification, order and degree of a Differential Equation. 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 higher degree	3.1. Left hand side resolved into factors, 3.2. Equations solvable for x, 3.3. Equations solvable for y, 3.4. Clairaut's equations.	Solution of different types of first order and higher degree ordinary	4

			differential equations.	
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, completesolution 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	Graphs of Trigonometric functions.	Tracing of curves (trigonometric )	2
D2	Matrix	2.1. Transpose of a matrix, 2.2. Adjoint of a square matrix	1. Use of matrices for solving	

		2.3. Inverse of a matrix 2.4. Solution of Simultaneous Linear equations. 2.5. Characteristic Equations.	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	1+1=2	2	3	

	<b>Dispersion</b>				
<b>C3</b>	<b>Correlation</b>			<b>3</b>	
<b>C4</b>	<b>Probability</b>	<b>1+1=2</b>	<b>2</b>		
<b>D1</b>	<b>Graphics</b>	<b>1+1=2</b>		<b>3</b>	
<b>D2</b>	<b>Matrix</b>	<b>1+1=2</b>	<b>2</b>	<b>3</b>	
<b>D3</b>	<b>LPP</b>	<b>2</b>		<b>3</b>	
		<b>25</b>	<b>18</b>	<b>27</b>	<b>70</b>

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

**10. Suggested Learning Resources:**

**1. Applied Mathematics (vol. I&II) by R . D. Sharma**

**2. Engineering Mathematics by H .K. Das**

**3. Mathematics for Polytechnics by S.P.Deshpande.**

**4. An Introduction to polytechnic mathematics Vol-II by Parbin Ahmed, Ajanta Choudhury, Geetali Das**

Annexure-I

TABLE OF SPECIFICATIONS FOR THEORY

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

K = Knowledge    C = Comprehension    A = Application

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

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

## DETAILED TABLE OF SPECIFICATIONS FOR THEORY

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

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

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

## 4. Course Title– Principle of Electrical Engineering

### Course Title: Principle of Electrical Engineering

2. Course Code: EI - 301

3. Semester: 3<sup>rd</sup>

4. Rationale of the Subject:

This is a basic technology subject. This subject will help the students to develop certain technology related skill. This subject includes DC,AC circuit, magnetism, electromagnetism etc. This is one of the important core engineering subjects for electrical engineers. The main objective of this subject is to enhance the basic knowledge and skill. This course is designed to impart basic knowledge of Electrical Engineering to Electrical Diploma student.

5. Aim:-

1. This is a basic technology subject in electrical engineering.
2. This subject helps the student to enhance basic knowledge and skill of the student in electrical engineering.

6. COURSE OBJECTIVES: - The student will be able to-

1. Enhance the fundamental concept in electrical engineering.
2. Know magnetism, electromagnetism, electromagnetic induction, electrostatic.
3. Know energy conversion principle.
4. Know fundamental of AC, phasor algebra, ac series circuit and significance of power factor.

COURSE OUTCOMES:-

OUTCOMES NOS.	COURSE OUTCOMES (COs)
1. CO-301.1	After successfully completion of the course ,student will able to know- - The basic knowledge of electricity,current,voltage,power, energy and behaviour of circuit components resistance, inductance and capacitance.
2. CO-301.2	- Ohms law and realize the limitation of Ohms law due to temperature dependence. Series and parallel circuit.



3.	CO-301.3	- Faradays laws of Electromagnetic induction, Lenz's law, Flemings right and left hand rules and uses of appropriate laws and solve numerical problems. Self and mutual inductance, B-H curve, Hysteresis and eddy current loss.
4.	CO-301.4	- Capacitor and its construction and finding out capacitance of condenser made of using uniform dielectric medium , composite electric medium, medium partly air.
5.	CO-301.5	- Know the energy conversion principle and its application.
6.	CO-301.6	- Know the fundamental concept of A.C,phasoralgebra,a.c series circuit and concept of power factor.

## 7. Pre-Requisite:-

1. Conductor, insulator
2. Resistance, inductance and capacitance
3. Simple differential, integral calculus, matrix.

## 8. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3	1	3	7

## 9. Examination Scheme:

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

## 10. Detailed Course Content:

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Fundamental Concept	1.1 Concept of current, voltage, resistance 1.2 Work, power, energy and relationship between work, power and energy 1.3 Resistance in series and parallel 1.4 Ohm's law and problem 1.5 Kirchhoff's laws and problem	6
2.0	Magnetism and Electromagnetism	2.1 Magnetic circuit parameter 2.2 Direction of magnetic field in straight conductor, coil, solenoid etc. 2.3 Force on current carrying conductor lying in magnetic field, force between two parallel conductors, mmf, magnetizing force, flux, flux density, reluctance, permeability, 2.4 Series and parallel magnetic circuit, related problems 2.4 hysteresis and hysteresis loop	6
3.0	Electromagnetic Induction	3.1 Electromagnetic induction 3.2 Faraday's law, Lenz Law, direction of induced Emf and current 3.3 Statically and dynamically induced Emf 3.4 Self and mutual inductance	5
4.0	Energy Conversion Principle	4.1 Law of conversion of energy 4.2 Role of electrical energy and its uses 4.3 Electromechanical energy conversion principle 4.4 Condition of production of Emf, rotor action 4.5 Single excited and doubly excited field theory	5
5.0	Electrostatic	5.1 Coulomb's law of electrostatic 5.2 Electric field, electric field strength, electric potential and potential difference between two points 5.3 Capacitor, capacitance, energy stored in a capacitor 5.4 Capacitance of parallel plate capacitor with uniform dielectric medium and composite medium, calculation.	5
6	AC Fundamentals	6.1 Definitions, Equations, Cycle, Time period, Frequency, Amplitude, Phase, Phase difference, RMS value, Average value, Maximum values, form factor, Crest factor, Simple	4

		problem	
7	Phasor Algebra	7.1 J operator 7.2 Rectangular, polar and trigonometrical form of phasor 7.3 Addition, subtraction, multiplication and division of phasor	3
8	AC Series Circuit	8.1 Definitions – Inductance, Inductive reactance, Capacitance, Capacitive reactance, impedance 8.2 A. C. through pure resistance, pure inductance and pure capacitance 8.3 A. C. through R—L, R—C and R—L – C series circuit and their problems 8.4 Resonance and problems	8
9	CLASS TEST		3

## 11. 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	Fundamental concept	6	14	14	2	1	7	
2	Magnetism & electromagnetism	6	14	14	7	1	2	
3	Electromagnetic induction	5	12	12	2		6	
4	Energy conversion principle	5	12	12	3	1	4	
5	Electrostatic	5	12	12	3	1	4	
6	A.C fundamental	4	10	10	4	2	1	
7	Phasor algebra	3	07	06	1	1	3	
8	A.C series circuit	8	20	20	8	2	4	
	Total	42	100	100	30	9	31	

## 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	Fundamental concept	2	1	1	4			2		2			4		4
2	Magnetism and electro – magnetism	2	1	1	4	2		1		3	3				3
3	Electromagnetic induction	2		2	4								4		4
4	Energy conversion principle	1		1	2	2	1			3			3		3
5	Electrostatic	1	1		2	2				2			4		4
6	A.C fundamentals	2	1	1	4	2	1			3					
7	Phasor algebra	1			1		1			1			3		3
8	A.C series circuit	2	1	1	4	2	1			3	4		3		7
	Total				25					17					28

13. Suggested Implementation Strategies: This subject will develop the foundation of the electrical diploma students. Therefore more tutorial assignments are to be given the students. Experiments performed in the laboratory will help the students in developing the skill.

## 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
6. Theory and Performance of Electrical Machines by J B Gupta

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## 4. Course Title– Principle of Electrical Engineering Laboratory

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3<sup>rd</sup> Semester

CODE No. EI – 301P

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

Pass Marks: 17/50

Skills to be developed:-

a) Intellectual Skills:-

1. Skill of properly interpretation of results.
2. Skill of selection and identification of instruments.

b) Motor Skill:-

1. Skill of connecting the instruments properly.
2. Skill of taking reading accurately.
3. Skill of drawing phasor 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.

Reference Book:

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

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

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

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## 5. Course Title– Elements of Electronic and Devices

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1.Course title- Elements of Electronics and Devices

2.Course code- EI-305

3.Semester- 3<sup>rd</sup>

4. Rationale of the subject – This subject is the base of all advance electronics. It starts with semi -conductor physics and P-N junction which makes the student to follow the functioning of all semi-conductor based devices. Understanding of this subject will provide skill to the student for troubleshooting and testing of some basic electronic components and circuits.

5. Aim:-

This subject is the base of all advance electronics. It starts with semi -conductor physics and P-N junction which makes the student to follow the functioning of all semi-conductor based devices. Understanding of this subject will provide skill to the student for handling and testing of some basic electronic components and circuits.

6. COURSE OBJECTIVES:-

The student will be able to

- A. Describe the formation of P-N junction
- B. Draw the characteristic of basic electronic components like diode, transistor etc.
- C. Draw and describe the basic circuit of rectifier, filter and amplifier.
- D. Testing of diode and transistor.
- E. Construction and performance of different types of oscillator.
- F. Performance of UJT, FET, MOSFET.
- G. Performance of SCR, DIAC, TRIAC.

5(a) COURSE OUTCOMES:-

CO305.1 –to enable one to identify and measure the value of different resistors, capacitors, diodes and transistors.

CO305.2 -To enable one to study and draw the characteristics curve of diodes.

CO305.3- To enable one to classify and study the different types of transistors in different modes.

CO305.4-To enable one to classify and analyze different types of amplifiers and oscillator circuits.

CO305.5- To enable one to identify and study the special semiconductor devices.

## 6. Pre- requisite

A. knowledge of semiconductor physics

## 7. Teaching scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week		3 hrs/week	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			
	70	TA	HA	33/100	25	25	17/50	150
	10	20						

## 9. Detailed Course Content

Chapter no.	Chapter Title	Content	Duration Hours
1.	semiconductor	Introduction of valve tubes and classification Definition, energy band diagram, intrinsic and extrinsic semiconductor, doping, P-type, N-type semiconductor PN junction diode, forward bias & reverse bias characteristics of PN junction diode, half and full wave rectifier circuits, filter circuits.	08
2	Electronic devices	Resistor and capacitor-types, color codes and uses, Zener diode, tunnel diode, photodiode. Cathode ray oscilloscope, Multimeter-construction, working principles, uses	06
3	Transistor	Physical construction of bipolar PNP and NPN transistor, biasing circuit configuration (CB CE CC), their input and output characteristics. Application of transistor as an amplifier. Concept of Load line, Q-point and phase reversal in amplification	08

4	Transistor amplifier	Different types of amplifier – class A, <b>B,C,AB</b> amplifier, push pull amplifier, Multistage amplifier –RC coupled, transformer coupled, and direct coupled amplifier.	06
5	Feedback circuit and oscillator	Types of feedback-positive and negative feedback, their comparison. Condition of oscillations, tank circuit, types of oscillator-Hartley, Colpitt, Crystal Oscillator, their advantages, disadvantages and application	05
6	Special semiconducting devices	Construction, operation and application of FET ,MOSFET, UJT, SCR, DIAC, TRIAC	06
7	Integrated circuits	Introduction and familiarization with some commonly used IC's	03
8	Class test		03

## 10. Table of specification for theory:

Sr. No	Topic (a)	Time allotted in hours (b)	Percentage Weightage (c)	Modified Percentage Weightage (d)	K	C	A	HA
1	Semiconductor	8	19	19	8	1	5	
2	Electronics devices	6	14.2	14.2	2	0	8	
3	Transistor	8	19	19	6	1	6	
4	Transistor amplifier	6	14.2	14.2	3	2	5	
5	Feedback circuit and	5	12	12	2	1	5	



	oscillator							
6	Special semiconductor devices	6	14.2	14.2	8	0	2	
7	Integrated circuit	3	7	7	2	0	3	
Total		$\Sigma b=42$	100	100	31	5	34	

11. Detailed table of specification for Examination:

SL No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Semiconductor	2	1	2	5	2				2	4		3		7
2	Electronics devices	1		2	3	1		2		3			4		4
3	Transistor	2	1	2	5						4	0	4		8
4	Amplifier	1		2	3	2	2			4	0		3		3
5	Feedback circuit And oscillator	2	1	2	5								3		3

6	Special semiconductor Devices	2		2	4	2				2	4				4
7	Integrated circuit				0						2		3		5

12. Suggested Implementation strategies:—

The teacher should bring electronic components and devices in the class and explain and make the students familiar with them. Also, the students should be encouraged to do some small project work.

10. Reference book

1. Principle of Electronic by V. K. Mehta, S. Chand
2. Electronic Principle by S.K. Sahdev, Dhanpat Rai & Co
3. Electronic Principle by Malvino

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## 5.Course Title– Elements of Electronic and Devices Laboratory

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### ELEMENTS OF ELECTRONICS AND DEVICES- LAB

Code: EI-305

Total marks: 50

Practical: 25

Sessional: 25

Pass marks: 17/50

Skills to be developed-

Intellectual skills:

- 1.To locate the faults in circuit
- 2.Identification of various components

Motor skills:

- 1.Ability to draw the circuit diagram.
- 2.Ability to interpret the circuits

List of Practical (at least five experiments are to be performed)

- a.Testing of resistor, capacitor, diode and transistor using multimeter .
- b.Characteristics of PN junction diode.
- c.Characteristics of zener diode.
- d.Input and output characteristics of transistor in CB, CE, CC mode
- e.Study of Hartley, Colpitt oscillator
- f.Study of single stage amplifier.
- g.Test the characteristics of DIAC, TRIAC

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## 6.Course Title– Element of Mechanical Engineering.

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

### 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
<b>Total</b>		<b>45</b>	<b>97</b>	<b>25</b>	<b>27</b>	<b>45</b>

### 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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# 6.Course Title– Element of Mechanical Engineering (Practical)

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## Elements of Mechanical Engineering Laboratory CO-----Outcome based objectives:

After performing the experiments the students will be able to

- a. Identify the mountings and accessories of a boiler
- b. Know the working principle of a steam engine
- c. Explain the working principle of an SI Engine
- d. Explain the working principle of an CI Engine
- e. 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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## 7. Course Title– Professional Skill-I.

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### PROFESSIONAL SKILL –I

3<sup>rd</sup> SEMESTER, ELECTRICAL ENGINEERING

CODE: EL-310

#### THEORY SCHEME:

Theory: 1hr/week

Practical: 2hrs/week

Credit: 2

#### PRACTICAL SCHEME:

Practical assessment: 25 marks

Practical test: 25 marks

#### 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 electrical engineering.

Activities:

1. INDUSTRIAL/FIELD VISIT: - - 10 HRS.

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 power distribution sub-station (APDCL) or grid substation and observe substation equipments and power distribution system.
- b. Transformer and other electrical equipments manufacturing and repairing workshop and observe the repairing of different parts.
- c. Low and high voltage Cable manufacturing company.
- d. Nearby electrical workshop for observation of installation and identifications of various electrical 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. Non destructive testing
- d. Solid waste power generation.
- e. Computer networking and MAT lab.
- f. 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 electrical engineering field.
- b. Current news items
- c. Current and historical events related to social, cultural and environmental.
- d. Discipline and housekeeping.
- e. Rural electrification system.
- f. 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 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,

Group discussion = 5,

Field visits=5 and

Guest lecturer attendance and Report= 5

**COURSE STRUCTURE OF 4TH SEMESTER (ELECTRICAL)**

Sl no	Code no	Subject	Contact hours /week			Evaluation scheme										Total Marks (Th+Pr)	Credit
						Theory (Th)					Practical (Pr)						
			L	T	P	ESE	Sessional(SS)			Pass (ESE+SS)	Practical Test(PT)	Practical Assessment (PA)	Pass (PT+PA)				
							TA	HA	Total (TA+HA)								
1	EL - 401	Electrical circuit and network	3		3	70	10	20	30	33/100	25	25	17/50	150	5		
2	EL - 402	Electrical and Electronics drawing and design			6						100	50	50/150	150	4		
3	EL-403	Electrical measurement and measuring instruments –I	3	1	3	70	10	20	30	33/100	25	25	17/50	150	4		
4	EL-404	Electrical Machine -I	3	1	3	70	10	20	30	33/100	25	25	17/50	150	4		
5	EL - 405	Electrical Engineering material	3			70	10	20	30	33/100				100	3		
6	EL 406	Digital electronics	3			70	10	20	30	33/100				100	3		
7	El - 410	Professional practices -II	1		2						25	25	17/50	50	2		

# 1. Course Title: Electrical Circuit & Network

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1. Course Code: EI - 401

2. Semester: 4<sup>th</sup>

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 Objectives : The student will be able to -

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

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

3. Interpret the performance of AC parallel circuit.

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

5. Understand the behavior of circuit in transient condition.

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

5(a) COURSE OUTCOMES:-

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

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

CO 2: Comprehend the theorems of AC network.

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

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

CO 5: Know AC transient.

6. Pre-Requisite:

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

7. Teaching Scheme (in hours per week):

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

8. Examination Scheme:

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

9. Detailed Course Content:

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	D. C Network Theorem( With independent 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 dependent 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

## 10.

circuit and network)

## TABLE OF SPECIFICATIONS FOR THEORY (Electrical

Sr. No	Topic (a)	Time allotted in hours(b)	Percentage Weightage(c)	Modified Percentage Weightage(d)	K	C	A	HA
1	DC network theorem( With independent Source)	9	21	21	6	1	8	
2	DC network theorem (with dependent source)	4	10	10	2	1	4	
3	AC network theorem	8	18	18	7	1	5	
4	Single phase AC parallel	7	17	17	7	1	4	

	circuit							
5	Three phase circuit	5	12	12	3	1	4	
6	Transient	4	10	10	1	1	5	
7	Application of Mat lab	5	12	12	3	1	4	
	Total	42	100	100	29	7	34	
	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 ( With independent Source)	2	1	1	4			2		2	4		5		9
2	DC network (with dependent source)	2	1	1	4								3		3
3	AC network theorem	2		1	3	1	1			2	4		4		8
4	Single phase AC parallel circuit	2	1		3	2				2	3		4		7
5	Three phase circuit	2	1	2	5	1		2		3					
6	Transient	1	1	1	3								4		4
7	Application of MATLAB	1	1	1	3	2				2			3		3
	Total				25					11					34



## 12. Suggested Implementation Strategies:

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

## 13. Suggested Learning Resources:

Book List: 1. Circuit Theory by A. Chakrabarti

2. Circuits & Network by A. Sudhakar, Shyammohan S. Palli

3. Electrical Circuit Analysis by H. Chandragupta

4. Electrical Circuit by Nilsson J. W, Riedel S. A.

5. Electrical Technology Vol.-I by B. L. Thereja & A. K. Thereja.

6. Basic Electrical Engineering by V. K. Mehta & Rohit Mehta.

7. Getting Started with Matlab: A quick Introduction for Scientist and Engineers: Rudra Pratap



# 1. ELECTRICAL CIRCUIT AND NETWORK LABORATORY

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4<sup>th</sup> Semester

CODE No. EI – 401P

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

Pass Marks: 17/50

Skills to be developed:-

a) Intellectual Skills:-

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

b) Motor Skill:

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

List of practical

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

Reference Book:

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

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

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



## 2. COURSE TITLE: - ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS. –I

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2) Course Code: - EL- 403

3) Semester: - 4<sup>th</sup>.

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)
1.	Student will be able to learn– 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.
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7. Pre-requisite –

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

8. Teaching Scheme (In hrs):-

Lecture	Tutorial	Practical	Total
03	01	03	07

9. 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		25	25			
70	10	20						

10. Detailed course content:-

Chapter No	Chapter Title	Contents	Duration s (hrs)
1.0	Unit, dimensions and Standards	1.1 Fundamental unit, absolute and derived units, CGS, MKS, RMKS, RMKSA, SI, unit. 1.2 Dimensional analysis. 1.3 Standards and classification of standard.	5 hrs
2.0	Measurement and instrumentation system	2.1 Method of measurement, Role of instrument. Selection of instrument and type of instrument static and dynamic characteristics	4hrs
3.0	Electromechanical instruments	3.1 Classification – 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	4.1 Measurement 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	5.1 D.C. and A.C. potentiometer, basic circuit, applications,	4 hrs

6.0	A.C. Bridge	standardization, advantages. 6.1 Fundamentals 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	7.1 Construction and working principle of different type of ammeter and voltmeters 7.2 Extension of range – shunt and multiplier. 7.3 CT and P.T., Ratio error, Phase angle error, simple problems.	6 hrs
8.0	Class test		3 hrs

## 11. TABLE OF SPECIFICATIONS FOR THEORY (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	4	
2	Measurement and instrumentation	4	10	10	2	1	4	
3	Electromechanical instruments	8	18	18	7	1	5	
4	Measurement of resistance	5	12	12	4	1	3	
5	Potentiometer	4	10	10	3	2	2	
6	A.C bridge	10	24	24	9	1	7	
7	Measurement of current and voltage	6	14	14	3	1	6	
	Total	42	100	100	31	8	31	
	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	Measurement & instrumentation	2	1	1	4								3		3
3	Electromechanical instruments	2		2	4	2	1			3	3		3		6
4	Measurement of resistance	1	1	1	3			2		2	3				3
5	Potentiometer	1	1	2	4	2	1			3					
6	A.C bridge	1		1	2	2	1	2		5	6		4		10
7	Measurement of current and voltage	1	1	1	3	2		1		3			4		4
	Total				25					17					28

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	Ram. B	- DhanpatiRai Publications, New Delhi

6.	&microcontrollers Modern electronic Instrumentation & measurement techniques	Albert D. Helfrick William David	- Prentic-Hall India (P) Ltd, New Delhi.
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## 2.ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENT–I LABORATORY

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Code = EL-403 (P)

Total Marks =50

Practical/ Viva = 25

Pass Marks = 17/50

Sessional = 25

Skills to be developed –

Intellectual skills :- I. Identification of instruments

II. Selection of instruments for particular applications

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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# 1.Course Title :- ELECTRICAL MACHINE –I

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2. Course Code: - EI-404

3.Semester: - 4<sup>th</sup>

**4.Rationale** :- Through this course contents, a student will deal with various types of Electrical D.C. & A.C. Machines which are employed in industries power sectors, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to detect faults, repair, installation and maintenance of these machines and give suggestions to improve their performances. In this subject included some special type of machines which have higher efficiency compact sizes and useful for specific applications in production, processing and fabrications etc.

**5Aims** :- 1.Students will be able to analyze the construction, operation, characteristic of D C generator, motor and transformer.

2.Knowledge gained from the subject will be helpful for uses, testing and maintenance of the electrical machines as machine operator, supervisors and controllers etc.

6. COURSE objectives:- Students will be able to –

Know the constructional details, working principles and operation of DC machine and transformer.

Starting, running and controlling of the machines for particular works properly.

Evaluate the performances of DC machines and transformer by conducting various tests.

Decide the suitability of DC generator, motor and transformer for particular purpose .

Details specifications of dc machines and transformers as per requirement.

## COURSE OUTCOMES:-

Sl. no	COURSE OUTCOMES (COs)
1	After successfully completion of the course ,Student will able to know - CO-1 Constructional details, working principle , operation and various application of d.c generator . Effects of armature reaction , improvement of commutation process.
2	CO-2 Calculation of different losses ,efficiency , voltage build up ,Evaluate of performances .

3	CO-3 Working of d.c motor , types ,voltage equation , calculation of armature torque and shaft torque ,application of different type of d.c motor.
4	CO-4 Starting and speed control of d.c motor .different losses and motor efficiency .
5	CO-5 Working and construction of single phase transformer , EMF equation , behaviour of no-load and loaded transformer .
6	CO-6 Testing of transformer ,calculation of different losses ,efficiency, voltage regulation, all day efficiency ,and rating of transformer .
7	CO-7 3-phase transformer construction , and its different connection and uses.
8	CO-8 Working and construction and application of special type machine like brushless dc motor ,d.c servomotor, printed circuit motor , Practical used of auto transformer ,CT and PT,welding transformer, induction heating transformer , phase shift transformer .

7. Prerequisite: - Knowledge of –

I.Principles of electrical engineering.

II. Electro mechanical energy conversion principle.

III. Basic electronics engineering.

8. Teaching Scheme (In Hrs):-

Lecture	Tutorial	Practical	Total
03	01	03	07

9. Examinationscheme:-

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

## 10. Course Contents:-

Chapter No	Chapter Title	Contents	Duration hrs
1.0	D.C. Generator	1.1 Principle of operation of d.c. generator. Construction, simple lap and wave winding, 1.2 E.M.F equation, 1.3 Types of generator, its electrical connections with voltage equation, its relating problems 1.4 Equalizing ring and dummy coil 1.5 performance, characteristics, critical resistance and critical speed, voltage build-up 1.6 armature reaction, its effects and methods of reduction 1.7 commutation, Process, Methods of improving commutation, 1.8 different losses, Power stages, efficiency, solve related problems and applications.	9hrs
2.0	D.C. Motor	2.1 Principle of operation of d.c. motor, construction, 2.2 Back emf, Types, its connections, Voltage equation, Conditions of Maximum power, 2.3 Torque equation. Losses, power stages and efficiency, & related problems. 2.4 Motor characteristic, methods speed control of different motor. 2.5 Motor Starter, types, construction 2.6 Testing of d.c. machines – Brake test, Swinburne test and Hopkinson test 2.7 applications of different d.c. motor.	9hrs
3.0	Single Phase Transformer	3.1 Working principle of a transformer, 3.2 construction, types of transformer 3.3 EMF equation, Transformer on no-load and its phasor diagram, solving problems. 3.5 Transformer on load, Voltage drop and its phasor diagram. 3.6 Losses in transformer, its related problems. 3.7 Open circuit and short circuit test. Calculation of efficiency, Regulation. Condition of maximum efficiency, simple Problems, Equivalent circuit of transformer 3.8 All day efficiency, equivalent circuit, and transformer rating.	9hrs

4.0	Three Phase Transformer	4.1 Construction of 3-phase transformer and its accessories, 4.2 connections of 3-phase transformer, 4.3 Power and distribution transformer construction, 4.4 Cooling of transformer, 4.5 Conditions for parallel operation.	5hrs
5.0	Special d.c. machine	5.1 Third Brush Generator, permanent magnet d.c. motor, Brushless d.c. motor, construction, application 5.2 D.C. servo motor, construction, application 5.3 Printed circuit d.c. motor. Constructions and applications.	5hrs
6.0	Special Transformer	6.1 Auto- transformer, construction, uses. 6.2 C.T and P.T. 6.3 Welding transformer, 6.4 Induction heating transformer, Furnace transformer, phase shift transformer. Construction & application of each.	5hrs
7.0	Class test		3hrs

## 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	D.C Generator	9	21	21	8	2	5	
2	D.C Motor	9	21	21	8	2	5	
3	Single phase transformer	9	22	22	7	3	5	
4	3-phase transformer	5	12	12	5	1	2	
5	Special d.c machines	5	12	12	4	2	3	
6	Special transformer	5	12	12	4	1	3	

Total	42	100	100	36	11	23	
Class test	3						

## 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	D.C Generator	2	2	2	6	2				2	4		3		7
2	D.C Motor	2	2	2	6	1				1	5		3		8
3	Single phase transformer	1	2	2	5	2	1			3	4		3		7
4	3-Phase transformer	1	1	2	4						4				4
5	Special D.C machines	1	1		2		1			1	3		3		6
6	Special transformer	1	1		2						3		3		6
	Total				25					7					38

## 13. Suggested Implementation Strategies:-

Department should arrange practical training for skill development in repairing & rewinding and various connections of 3-phase power and distribution transformer.

## 14. Learning Resources:-

Book list:-

Sl No	Title of Books	Author	Publisher
1	Electrical Technology	B.L. Theraja and A.K. Theraja.	S. Chand & Co. New Delhi
2	Vol-II-	J.B. Gupta	S.K. Kataria & Sons, New Delhi
3	Electrical Machines – A Text Book of	K.R. Siddhapura & D.B. Raval	Vikas Publication house pvt ltd., Noida, U. P.
4	Electrical Machine –	Tarlok Singh.	S.K. kataria & Sons, New Delhi
5	Electrical Machines –II –	S.K. Bhattacharjee	-
6	Electrical Machines- Electrical Machines	Ashfaq Hussain	Dhanpat Rai & Co., New Delhi

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## 3. Electrical Machines –I Laboratory.

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Total Marks -50.

Practical -25 Pass Marks = 17/50

Sessional -25

2. Course Code =EL-404 (P)

3. Semester = 4<sup>th</sup>.

Skills to be developed:-

A) Intellectual skills: 1) Identification skills

2) Analytical skills

B) Motor skills: 1) Connection skills

2) Operating skills

3) Testing and measurement skills.

<b><u>Experiment No.</u></b>	<b><u>Title of the experiments</u></b>
1	Study of 3 point and 4 point starter.
2	Speed control of D.C. shunt motor by (a) Flux control (b) by armature control method
3	Swinburne test of a DC shunt motor to find efficiency.
4	Load Characteristics of DC Shunt motor.
5	Efficiency of DC motor –generator set.
6	Open circuit characteristic of a DC shunt generator.
7	Brake test of DC shunt motor.
8	Determination of Transformation ratio of single phase transformer.
9	Polarity test of a single phase transfer.
10	Open circuit and short circuit test of single phase transformer and determination of efficiency and regulation.



**Reference Books-**

- 1) Lab manual on basic Electrical Engg and Electrical measurement –By S.K. Bhattacharjee, K.M. Rastogy.
- 2) Lab courses in Electrical Engineering – By S.G. Tarnekar, P.K. Kharbandha.
- 3) A Text Book of Practical in Electrical Engineering by Dr. N. K. Jain

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## 4. Course Title: Electrical Engineering Materials

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1. Course Code: EI - 405

2. Semester: 4<sup>th</sup>

3. Rationale of the Subject:

Conductor, insulator, semiconductor, magnetic materials are always used in electrical and electronics engineering. Therefore it is essential for quality assessment of these materials. In this subject, effort is made to develop skill in the electrical diploma students to inspect and test the electrical and electronics materials.

5. Aim:-

1. To develop knowledge on properties, characteristics, applications and limitations of electrical engineering materials.

2. To develop skill to inspect and to test the electrical and electronics materials.

6. COURSE OBJECTIVES:-

The students will be able to

1. Know insulator, semiconductor and conductor

2. Know conducting, insulating, semiconducting, dielectric and magnetic materials; their physical, mechanical, and electrical properties.

3. Know different types of constructional material, uses and testing.

4. Practical uses of various materials in different fields.

6(a) COURSE OUTCOMES :-

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

CO 1: Know properties of conductor, insulator and semiconductor.

CO 2: Understand the properties of different conducting, insulating, semiconducting and magnetic material.

CO 3: Assess the quality of these materials.

CO 4: Learn different types of constructional materials, use and testing.

CO 5: Know the practical uses of various materials in different electrical engineering field.

## 7. Pre-Requisite:-

1. Basic electrical engineering.

## 8. Teaching Scheme (in hours per week)

Lecture	Tutorial	Practical	Total
3			3

## 9. Examination Scheme:

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

## 10. Detailed Course Content:

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Conducting Materials	1.1 Electron theory of metal 1.2 Resistance and resistivity, linear and non-linear resistance 1.3 Properties of conducting material – low resistivity material and high resistivity materials 1.4 Different conducting materials like copper, aluminum, ACSR, AAC, silver, carbon, tungsten, eureka, constantan, manganin, invar 1.5 Thermocouple, superconductor, annealing 1.6 Materials used in house wiring	9
2.0	Semiconducting Material	2.1 Introduction, commonly used semiconducting material, application of semiconducting materials 2.2 energy level diagram of conductor, semiconductor and insulator 2.3 Formation of p-n junction.	

		<p>2.4 Characteristics of different semiconducting materials (germanium and silicon)</p> <p>2.5 Simple idea and application of thermistor, photoconductive cell, photovoltaic cell, varistor, LCD and strain gauge</p> <p>2.6 Introduction and application of Hall-Effect Generator piezo-electric materials</p> <p>2.7 Printed circuit board (PCB), types and uses, the process of preparing PCB, advantages of using PCB</p>	9
3.0	Insulating Materials	<p>3.1 Classification based on physical state and on thermal basis</p> <p>3.2 Properties of insulating materials</p> <p>3.3 Properties and application of different insulating materials</p> <p>3.4 Hygroscopicity, effect of moisture on insulating material, impregnation</p>	7
4.0	Dielectric Material	<p>4.1 Dielectric strength, factors affecting dielectric strength, dielectric loss, factors affecting dielectric loss, dissipation factor, dielectric constant</p> <p>4.2 Polarization</p> <p>4.3 Charging and discharging of dielectric, different dielectric (solid, liquid, gaseous)</p>	3
5.0	Magnetic Material	<p>5.1 Magnetic field strength, unit pole, flux, magnetic circuit, MMF, permeability, residual magnetism, retentivity, coercive force, curie temperature, magnetostriction.</p> <p>5.2 Classification based on permeability, electromagnet and uses</p> <p>5.3 Aging and its affect on permanent magnet losses in ferromagnetic material,</p> <p>5.4 Hysteresis, hysteresis loop, hysteresis loss, factors on which hysteresis loss depends, eddy current loss</p> <p>5.5 electrical sheet metal, permanent magnetic material, magnetization curve for ferromagnetic material</p> <p>5.6 Soft and hard magnetic material, effect of silicon on ferromagnetic material, pure alloy, carbon steel, ferrite</p> <p>5.7 Magnetic memory devices used in computer</p>	8
6.0	Electric Hardware	<p>6.1 Different types of electric hardware like terminals, connectors, switches, fuses and fuse wire, characteristics, specification, applications of all these</p>	

		6.2 Solder – composition, types, different soldering techniques, 6.3 Flux – composition, types, application	3
7.0	Constructional Materials	7.1 Physical properties of constructional materials like iron, steel 7.2 Bearing materials with reference to the electrical engineering practice 7.3 Concept of non – destructive test and method adopted for testing of different materials	3
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	Conducting Materials	9	21	21	6	2	7	
2	Semiconducting Material	9	21	21	4	2	8	
3	Insulating Materials	7	17	17	3	3	6	
4	Dielectric Material	3	7	7	2		3	
5	Magnetic Material	8	20	20	5		5	
6	Electric Hardware	3	7	7	6	1	1	
7	Constructional Material	3	7	7	4		2	
	Total	42	100	100	30	8	32	
	Class test	3						

## 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	Conducting material	2	2	2	6	2		1		3	2		4		6
2	Semiconducting material	2	2	2	6			2		2	2		4		6
3	Insulating material	1	1	2	4		2			2	2		4		6
4	Dielectric material	1		1	2	1				1			2		2
5	Magnetic material	1		2	3			1		1	4		2		6
6	Electric Hardware	1	1		2	2		1		3	3				3
7	Constructional material	1		1	2			1		1	3				3
	Total				25					13					32

13. Suggested Implementation Strategies: The teacher may bring different electrical and electronics materials, components, and devices in the class room at the time of taking the class. He should make the students familiar with these.

## 14. Suggested Learning Resources:

Book List: Electrical Engineering Materials – TTTI Madras

Electrical and Electronics Engineering Materials – J B Gupta

Electrical Engineering Materials – P L Kapoor

Electrical Engineering Materials – J Dekker

Electrical Engineering Materials – Raina, Bhattacharjee

Electrical Engineering Materials – Navneet Gupta

Electronic Engineering Materials and Devices by John Allison

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## 5. Course Title: Electrical & Electronics Drawing and Design

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2. Course Code: EI - 402

3. Semester: 4<sup>th</sup>

4. Rationale of the Subject:

Drawing is said to be the language of engineers and technician. Therefore, it is necessary for a polytechnic pass out in electrical engineering to understand, interpret electrical engineering drawing. They should have the ability to communicate through drawing. They should know to prepare drawing of electrical circuits, motor parts, transformer parts, earthing etc. The content included in this subject is to develop requisite skill and knowledge of electrical drawing in electrical diploma students.

5. Aim:-

1. Drawing indicates the symbolic representation and position of the components in a system.
2. To enable the students to draw and understand different symbols, parts of electrical and electronics devices and machines etc. It helps in troubleshooting, maintenance of the system.
3. To enable to identify the sequential flow of current, power and measure voltage, current at various points of the system.
4. To enable the students to know the use of Auto CAD.

6. COURSE OBJECTIVES:-

The students will be able to

1. Draw and understand the working of the system and its components
2. Find the different points of the circuit diagrams or layout for troubleshooting and maintenance.
3. Use drawings to measure various quantities in the system to find out the fault.
4. Use the graphic software to draw the circuit, components etc.

6. (a) COURSE OUTCOMES :-

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

CO 1: Develop requisite skill and knowledge of Electrical Engineering Drawing.

CO 2: Draw and understand the working of the system and its components.

CO 3: Use the circuit diagram or layout for trouble shooting and maintenance and find out fault.

CO 4: Use drawing to measure various quantities in the system.

CO 5: Use the graphical software to draw the circuit, components etc.

### 7. Pre-Requisite:-

1. Basic electrical engineering
2. Engineering graphic.

Practical:-

Skills to be developed:-

Intellectual skills---

1. Identification skill
2. Analytical skill

Motor skill ----

1. Draw the different components and parts of the system properly.
2. Problem solving skill.

8. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
-	-	6	6

### 9. Examination Scheme:

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional (SS)		50/150	PT	PA	150	4	
	TA	HA						
100	20	30						



**10. Detailed Course Content:**

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Symbols and Notation	1.1 Electrical and Electronics symbol used as per IS standard	9
2.0	Electrical Machine Drawing	2.1 Orthographic view of DC machine, AC machine and Transformer, parts, sectional view etc.	15
3.0	Winding	3.1 Skeleton of DC and AC winding of different types	15
4.0	Electrical Wiring	4.1 Service connection, house wiring, industrial wiring, terminal marking 4.2 Connection of motor starter 4.3 Control panel wiring diagram	12
5.0	Sub-Station	5.1 Pole mounted, foundation mounted and under ground	9
6.0	Electronic Drafting	6.1 Circuit diagram of rectifier, amplifier and oscillator 6.2 Preparation of drawing, layout of printed circuit board for given circuit	12
7.0	Transformer Design	Three phase transformer design (shell and core), Estimation of losses, efficiency and regulation for design parameters, heating and cooling of transformer, design of tank and cooling tube, estimation of transformer oil, testing of oil.	12
CLASS TEST			6

**11. TABLE OF SPECIFICATIONS FOR THEORY (Electrical & electronics drawing and design)**

Sr no	Topic (a)	Time allotted in hrs (b)	Percentage Weightage (c)	Modified % weightage (d)	K	C	A	HA
1	Symbols and notation	9	11	11	7	4		
2	Electric machine drawing	15	18	18	2	13	3	
3	Winding	15	18	18	4	10	4	
4	Electric Wiring	12	14	14	6	2	6	
5	Sub-station	9	11	11	4	7		
6	Electronic Drafting	12	14	14	2	6	6	
7	Transformer Design	12	14	14	3	3	8	
	Total	84	100	100	28	45	27	
	Class test	6						

## 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	Symbols and notation	2			2	3	4			7	2				2
2	Electric machine drawing	2			2		4	3		7		9			9
3	Winding	2	2		4	1		4		5	1	8			9
4	Electric wiring	2	2		4	2				2	2		6		8
5	Sub-station	2	2		4	2				2		5			5
6	Electronic drafting	2		2	4			4		4		6			6
7	Transformer design	2	3		5	1		2		3			6		6
	Total				25					30					45

13. Suggested Implementation Strategies: The teacher may show models and parts of the machine which will help the students to develop skill. Computer software may be used for this subject. Use of software for electrical & electronics drawing will help the students.

## 14. Suggested Learning Resources:

Book List: Electrical Design and drawing by Raina & Bhattacharya

Electrical Drawing by K L Narang

Electrical Drawing and Estimating by C R Dargan

A.C. Machine: M.G. Say

Electrical Power: S.L. Uppal, Khanna Publisher

Suggestion: The examination time of this paper will be four hours. Out of four hours, one hour will be allotted for simple question on design of transformer. The student may be allowed to use data table for the question on design of transformer.

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## 6. Course title- Digital Electronics

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1 **Course code-** EI-406

2 **Semester-** 4th

3 **Rationale of the subject**–The subject of Digital electronics holds applications in all branches of engineering. This subject will impart in depth knowledge of number systems, logics of Combinational and Sequential circuits and also about various & recent memory devices. The concept of Digital Electronics will be implemented in all processor.

4 **Aim of the subject:-**

- a. It intends to teach the basic digital circuits and their applications, D/A, A/D converters etc.
- b. Understanding of the subject will provide skill to the student to operate digital instruments as the applications of digital instruments, microprocessor, computers etc. are increasing very fast in present age.

5. **Objective:-**

Student will be able to

- A .Understand various Number system
- B .Learn the different digital logic gates
- C. Learn arithmetic circuits –adder/Subtractor
- D.Understand digital logic circuit, flip flop, counter, resistor, D/A and A/D converter
- E. Understand the various display circuits

6. **Pre-requisite:-**

- a. Knowledge of basic electronics
- b. Knowledge of analog and digital electronics

7. **Teaching scheme (in hours)**

Lecture	Tutorial	Practical	Total
3 hours/week			3 hours

## 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	33/100			100	3	
	70	10		20				

## 9. Detailed Course Content

Chapter no.	Chapter Title	Content	Duration
1.	Number System	Understanding number system, Binary, Octal, Decimal, Hexadecimal number system and their conversion. Different coding system i.e. binary, BCD, Excess 3, Grey, ASCII and Parity Code	6
2.	Logic gates	Symbolic representation & and truth table for logic gates - OR, AND, NOT, NOR, NAND, X-OR, X-NOR, Universal logic gates, realization of logic circuit from their logic expression. Logic families-RTL, DTL, TTL, CMOS.	7
3.	Boolean Algebra	Boolean Algebra theorem, De-Morgan's Theorem, simplification of Boolean expression by algebraic and K Map method. Don't care condition	5
4.	Combinational logic	- Half Adder, full Adder, Half Subtractor, Full Subtractor, multiplexer, Demultiplexer, encoder, decoder	5
5.	Flip-Flops	Flip-Flops: Latch, R-S, J-K, T, D, Flip-Flops, Master Slave J-K Flip-Flops	4
6.	Register and Counters	Shift Register, Serial In serial out (SISO), Serial in parallel out (SIPO), Parallel in serial out (PISO), Parallel in Parallel out (PIPO), Counters:- Synchronous counter, asynchronous counter, ring counter, Up/Down Counter	4
7.	Data Converter & Memory Devices	Basic concept of D/A and A/D converter Classification and characteristics of Memories, ROM- Architecture, types and application, RAM- Static and Dynamic,	6

		Magnetic Memories: Magnetic tape, Disk, Hard Disk, Floppy Disk, Optical Disk (CDs),	
8.	Display	Construction, Working and operating Principle of LED, LCD, Seven Segment, Dot Matrix and Alphanumeric Display	5
	Class test		3

**10. TABLE OF SPECIFICATIONS FOR THEORY**

Sr no	Topic (a)	Time allotted in hrs (b)	Percentage Weightage (c)	Modified % weightage (d)	K	C	A	HA
1	Number system	6	14	14	4	3	3	
2	Logic gates	7	17	17	4	1	7	
3	Boolean algebra	5	12	12	5	1	2	
4	Combinational logic	5	12	12	2	6		
5	Flip-Flops	4	9	9	3	1	3	
6	Register and counter	4	9	9	2	1	4	
7	Data converter and memory devices	6	14	14	1	3	6	
8	Display	5	13	13	7	1		
	Total	42	100	100	28	17	25	

**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	Number system	2	1		3	2	2			4	4		3		3
2	Logic gates	3	1	2	6	1		2		3			3		3
3	Boolean algebra	1	1		2	2		2		4	2				2
4	Combinational logic	1	2		3	1	2			3		2			2
5	Flip-Flop	1	1		2	2		3		5					
6	Register and counter	1		1	2						1	1	3		5
7	Data converter and memory devices	1	1	2	4		2			2			4		4
8	Display	2	1		3		2			2		3			3
	Total				25					23					22

12. Suggested Implementation Strategies: The digital system in microprocessor has significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge. Mini project should be given to students as assignments.

13. Suggested Learning Resources:

1. Modern Digital Electronics- R.P. Jain
2. Digital Principles and Application- Malvino and Leach
3. Digital System- Ronald Tocci
4. Digital Fundamentals- Thomas I. Floyd
5. Digital Electronics- Douglas V. Hall

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# 7. PROFESSIONAL SKILLS-II

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4<sup>th</sup> SEMESTER, ELECTRICAL ENGINEERING

Code no:-EL-410

TEACHING SCHEME:

Theory: 1 hr/week

Practical: 2hrs/week

Credit: 2

EXAMINATION SCHEME:

Practical assessment: 25 marks

Practical test: 25 marks

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 electrical engineering up to 4<sup>th</sup> 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 generating /grid substation for observing for installation, maintenance and earthing system of various electrical equipments.

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) Load dispatch centre.

e) An industry automation in manufacturing.

f) Signalling system of a railway station.

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

Any TWO of the following areas:-

a) Substation grounding system.

b) Protection of electrical equipments from lightning.

c) Role of power factor improvement as a tool in reducing cost of generation.

d) Power transformer protection, installation and testing

e) Automatic meter reading/ automatic energy meter.

f) Super conductor.

g) Role of micro, small and medium enterprise in Indian economy.

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, rewinding and testing of fan motor /any 1-phase motor.

c) Fabrication of lead acid tubular battery.

d) Seminar on non conventional sources and uses.

e) Seminar on energy efficient devices.

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



- g) Water supply scheme/ problems of drinking water in rural area.
- h) Computer security

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## COURSE STRUCTURE OF 5<sup>TH</sup> SEMESTER (ELECTRICAL)

Sl no	Code no	Subject	Contact hours /week			Evaluation scheme									
						Theory (Th)					Practical (Pr)			Total Mark s (Th+ Pr)	Credit
			L	T	P	ES E	Sessional(SS)			Pass (ESE+ SS)	Practical Test(PT)	Practical Assesse ment (PA)	Pass (PT+ PA)		
							TA	HA	Total (TA+ HA)						
1	EL-501	Electrical Power	3		3	70	10	20	30	33/100	25	25	17/50	150	4
2	EL-503	Electrical Measurement and measuring instruments- II	3		3	70	10	20	30	33/100	25	25	17/50	150	5
3	EL-504	Electrical Machine –II	3	1	3	70	10	20	30	33/100	25	25	17/50	150	4
4	EL/Me/Au/IP E-505	Non - conventional energy sources	3			70	10	20	30	33/100				100	3
5	ET-502	Microprocessor	3		3	70	10	20	30	33/100	25	25	17/50	150	4
6	EI-510	Professional practices-III	1		2						25	25	17/50	50	2
7	<b>Optional subject (any one)</b>														
i)	EL-502	Control system	3			70	10		20	30	33/100			100	3
ii)	EI-506	Power electronics	3			70	10		20	30	33/100			100	3

# 1. Course Title: - CONTROL SYSTEM

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1. Course Code: - EL-502

2. Semester: - 5<sup>th</sup>

**3. Rationale:** -control system play a vital role in our day to day life. Automatic control system plays an important role in the advancement and improvement of engineering skills of electrical diploma engineer in the field power system and in the process industries. Automatic control system saves manpower, reduces cost of production, increase the accuracy of power supply system so that the knowledge of this subject is required to have deeper grasp of the control techniques or environment as need to be studied in the subject.

4) Aims:-

1. Since control system plays an important role in the field of the modern industries and power system. So the subject is to give the students basic concept of control system and analysis of circuit using transfer function and block diagram representation.

2. To study the time response and frequency response for stability analysis of the system.

5. COURSE OUTCOMES (CO):- Students will be able to –

1. Know the basic elements of control system, feedback system and uses.

2. Know the application of Laplace transform and inverse Laplace transform; find the Transfer function and drawing of Block diagram representation of electrical circuit.

3. Stability analysis of control system by time domain and frequency domain approach.

6) Pre-requisite –

1. Differential, Integral and Differential equation.

2. Electrical circuit and network.

7. Teaching Scheme (In Hrs):-

Lecture	Tutorial	Practical	Total
03hrs/week			03hrs/week

## 8. Examination scheme:-

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

## 9. Details course content:-

Chapter NO	Chapter Title	Content	Duration (in hrs)
1.0	Introduction to automatic control system	1.1 Basic elements of control system, definitions, classification of control system. Open loop and closed loop systems, 1.2 concept of feedback, effect of feedback, adv&disadv. of feedback, servo mechanism, 1.3 standard test signals –step, ramp & parabolic function. Functional block diagram of a control system, time lag, dead time, hysteresis, self regulating and non self regulating systems, practical examples of the above.	8hrs
2.0	Laplace Transform	2.1 Laplace transform, inverse Laplace transform, Laplace transform of standard input signals- unit step function, ramp function, parabolic function, exponential function, sine wave, cosine wave, hyperbolic sine wave, hyperbolic cosine wave, 2.2 Laplace transform of derivatives, Laplace transform of integral, problems.	6hrs
3.0	Transfer function	3.1 Transfer function, impulse response and transfer function, properties of transfer function, advantage & disadvantage of transfer function, 3.2 poles and zero of transfer function – representation of poles & Zero on S- Plane, Characteristic equation, problem of above.	10hrs
4.0	Block diagram	4.1 Basic elements of Block diagram, properties of block diagram. Significance of block diagram, procedure for drawing of Block diagram. 4.2 Block diagram of open loop and closed loop control system, Block diagram reduction. Problems of above.	4hrs
5.0	Control system component	5.1 Components of automatic control system, synchros, error detectors, 5.2 servo motors, power actuators, and servo mechanism.	3hrs
6.0	Time Domain analysis	6.1 Classification of time responses-transient responses & steady state response, system time response.	2hrs

7.0	Introduction to stability analysis	7.1 Characteristic equation, stability of control system, necessary condition for stability. 7.2 Nyquist criteria, Bode plots, gain margin and phase margin. 7.3 Determination of transfer function and drawing of Bode Plot using Mat lab (for assignment only, no theory question)	9hrs
8.0	Class test		3hrs

## 10. TABLE OF SPECIFICATIONS FOR THEORY

Sr no	Topic (a)	Time allotted in hrs (b)	Percentage weightage (c)	Modified % weightage (d)	K	C	A	HA
1	Introduction to automatic control system	8	19	19	4	2	7	
2	Laplace transform	6	14	14	4	0	6	
3	Transfer function	10	24	24	10	1	6	
4	Block diagram	4	10	10	2	0	5	
5	Control system component	3	7	7	2	1	2	
6	Time domain analysis	2	5	5	3	0	0	
7	Introduction to stability analysis	9	21	21	8	2	5	
	Total	42	100	100	33	6	31	
	Class test	3						

## 11. DETAILED TABLE OF SPECIFICATION FOR THE EXAM:

Sl no.	Topics	Objective type				Short answerType					Essay type				
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T
1	Introduction to automatic control system	2	1	2	5	2	1	1		4			4		4
2	Laplace transform	1		2	3						3		4		7
3	Transfer function	4	1	1	6	2		1		3	4		4		8
4	Block diagram			2	2	2				2			3		3
5	Control system component	2	1	1	4			1		1					
6	Time domain analysis	1			1	2				2					
7	Introduction to stability analysis	2	2		4	2				2	4	5			9
	Total				25					14					31

## 12. Suggested learning Resources:-

Sl No	Ref. Books	Authors	Publication
1	Control System	S.P. Mehar	S.K. Kataria & Sons, New Delhi
2	Control System	Smarajit Ghos	-
3	Modern Control Engineering	Katsuhiko Ogata	Prentice Hall of India, New Delhi
4	Control System Engineering	Nagarath I. J., & Gopal M.	New age Publisher, New Delhi
5	Modern Control System Analysis and Design using Mat lab and Simulink	R.H. Bishop	Wesley and Longman Pub.Co.
6	Dynamic Simulation of Electric Machinery using Mat lab / Simulink	C.M. Ong	Web Book

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## 2. Course Title: - ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS-II

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1. Course Code: - EL – 503

2. Semester: - 5<sup>th</sup>

3. 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.

4) 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 .

5) 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):-

Lecture	Tutorial	Practical	Total
03		03	06

## 8. Examination scheme:-

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

## 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	3 hrs
4.0	Electronics Instrument	4.1C.R.O, its application, study of front panel, Measurement of phase, frequency, Lissajous pattern, B-H loop. 4.2D.V.M. , T.V.M, FET Voltmeter, 4.3 Q- meter.	8 hrs
5.0	Primary sensing	5.1Primary sensing element :- Diaphragm bellow, Bourdon	10 hrs



	element and transducer	tube, 5.2 transducer :- basic requirement, selection of transducers, advantages, classification – resistive, inductive, capacitive, magnetic, photo electric, piezo electric transducer, thermistor, thermocouple, 5.3 strain gauge, LVDT. Measurement of pressure, temperature, flow, liquid level etc.	
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	7.1 Principle of microprocessor based instrument, 7.2 Type of control – Lumped digital control and distributed digital control, Block diagram of both controls. 7.3 Application 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 THEORY:-

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	2	4	
2	Measurement of energy	4	10	10	2	3	2	
3	Instruments for special purpose	3	7	7	2	3	0	
4	Electronic Instrument	8	19	19	2	5	6	
5	Primary sensing element and transducer	10	24	24	8	4	5	
6	Data transmission and telemetry	6	14	14	5	5		
7	Microprocessor based instrumentation system	5	12	12	7	1		
	Total	42	100	100	30	23	17	
	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	2		4	2				2			4		4
2	Measurement of Energy	2	1		3		2	2		4					
3	Instrumentation for special purpose	2			2		3			3					
4	Electronic Instrument	2	2		4		3	0	0	3			6		6
5	Primary sensing element and transducer	4	2		6	2	2			4	2		5		7
6	Data transmission and telemetry	2	1		3	3				3		4			4
7	Microprocessor based instrumentation system	2	1		3	5				5					
	Total				25					24					21

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 -	-Dhanpat Rai, New Delhi
2.	-Electrical measurement and measuring instrument	M.L. Anand -	
3.	-Electrical measurement and measuring instrument	S.K. Sahdev -	-S.K. Kataria sons, New Delhi
4.	-Electrical measurement and	J.B. Gupta -	-Unique international publication, Jalandhar.

5.	instrumentation -Fundamentals of microprocessor & microcontrollers	Ram. B	- S.K. Katari & Sons, New Delhi
6.	-Modern electronic Instrumentation & measurement techniques	Albert D. Helfrick and William David	- Dhanpati Rai Publications, New Delhi - Prentice-Hall India (P) Ltd, New Delhi.

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## 2. ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENT –II LABORATORY.

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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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## 3. Course Title: - ELECTRICAL MACHINE-II

1. Course Code: - EL-504

2. Semester: - 5<sup>th</sup>.

**3. Rationale:** - Electrical Machine in the heart of Electrical Engineering. Mainly Machines play important role in industry for production, processing, fabrication and also domestic and commercial appliances. Similarly Alternator also plays an important role for mega generation of Electrical power. Course content of this subject gives full knowledge about starting, running and controlling the electrical machine from no-load to full load efficiently. Explanation of practical aspects of the subject will make the student capable of performing various tests on the machines as per latest BIS.

4. Aims: - a) To study construction, working principle and operation of AC machines and some other special machines.

b) Various application, their testing and maintenance.

5. COURSE OUTCOMES (CO):- Students will be able to –

- 1) Know the constructional details and working principle of various types of AC machines
- 2) Operate given machine properly.
- 3) Testing and performances analysis of the machines
- 4) Selection of motors of proper rating for particular use.

COURSE OUTCOMES:-

Sl.no	COURSE OUTCOMES (COs)
1	After completion of the course ,Student will be able to learn – CO-1 The constructional details and working principles of Induction motor, alternator and synchronous motor.
2	CO-2 Starting, testing and performance analysis of different a.c machines.
3	CO-3 Selection of motor of proper ratings for particular uses.
4	CO-4 Calculation of Voltage regulation and parallel operation of alternator.
5	CO-5 Construction and working and uses of special a.c machines like a.c series motor, universal motor. Schragemotor, repulsion motor, servo motor, linear induction motor.

6. Pre- requisite – a) AC fundamentals    b) knowledge of 3-phase circuit  
 c) Principle of electrical engineering    d) Basic knowledge of electronic engineering.

7. Teaching Scheme (in hrs).

Lecture	Tutorial	Practical	Total
03	01	03	07

8. Examination Scheme:-

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

9. Course contents:-

Chapter No	Chapter Title	Contents	Duration (in Hrs)
01	Poly phase induction motor.	1.1. Production of rotating magnetic field in 3-phase supply, working principle 1.2. construction of 3-phase induction motor, Types of rotor 1.3. slip speed, frequency of rotor current, solving problems 1.4. Relationship between torque and rotor power factor, starting torque, maximum starting torque, effect of change of supply voltage. Torque under running condition, maximum running torque, torque- slip Characteristic, solving problems 1.5. Power stages, different losses, Gross torque developed, Induction motor as transformer, problems, equivalent circuit, maximum power output and corresponding slip, 1.6. No- load test and Blocked rotor test, 1.7. Starting of induction motor, different types of starter, its construction 1.8. Speed control of induction motor.	10 hrs
02	Single phase of induction motor	2.1 Principle and construction, double field revolving theory, methods of starting, 2.2 Types, construction, performance, characteristic and applications of each type.	8 hrs

03	Alternators	3.1 Construction, type of rotor, principle of alternator, 3.2 Pitch factor, distribution factor, short pitch coil, 3.3 EMF equation, solving problems 3.4 Alternator on load, armature reaction, synchronous reactance, synchronous impedance, vector diagram of loaded alternator for lagging, leading and unity p.f, solving problems 3.5 Open circuit and short circuit test. 3.6 Voltage regulation by synchronous impedance, A-T, Zero p.f. method, relating problems, 3.7 Synchronisation, parallel operation of alternator, conditions of parallel operation.	10 hrs
04	Synchronous motor	4.1 Working principle and construction, 4.2 starting method, effect of change in excitation on armature current and P.F, 4.3 Power developed by a synchronous motor, 4.4 V-curve, synchronous condenser, 4.5 comparison of 3-phase induction motor and synchronous motor, 4.6 hunting effect.	7 hrs
05	Commutator motor	5.1 Construction and working of A.C. series motor, universal motor, uses 5.2 Schrage motor, construction, uses 5.3 repulsion type motor, construction, uses	4 hrs
06	Special A.C. machine	6.1 Construction & uses of Linear induction motor, 6.2 Stepper motor, construction, uses 6.3 A.C. servo motor, construction, uses.	3hrs
07	Class test		3hrs

## 10. TABLE OF SPECIFICATIONS FOR THEORY

Sr no	Topic (a)	Time allotted in hrs (b)	Percentage Weightage (c)	Modified % weightage (d)	K	C	A	HA
1	Poly phase induction motor	10	24	24	6	3	8	
2	Single phase induction motor	8	19	19	5	2	6	

3	Alternator	10	24	24	4	4	9	
4	Synchronous motor	7	16	16	4	2	5	
5	Commutator motor	4	10	10	5	2		
6	Special A.C machines	3	7	7	4	1		
7	Total	42	100	100	28	14	28	
8	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	Polyphase induction motor	4	1	2	7	2	2			4			6		6
2	Single phase induction motor	2		2	4	2	2			4	1		4		5
3	Alternator	2	2	2	6	2		3		5		2	4		6
4	Synchronous motor	2		2	4	2	2			4			3		3
5	Commutator motor	1		1	2		2			2	3				3
6	Special A.C machines	1		1	2	3				3					
	Total				25					22					23

## 12. Suggested Implementation Strategies:-

Department should arrange for give also wide practical knowledge for operating, detecting various faults, repairing, rewinding and assembling the different parts of the machine for skill development.

## 13. Learning resources:-

## Book list-

Sl No	Title of Books	Author	Publisher
1	Electrical Technology	B.L. Theraja and A.K. Theraja.	S. Chand & Co. New Delhi
2	Vol-II-	J.B. Gupta	S.K. Kataria & Sons, New Delhi
3	Electrical Machines – A Text Book of	K.R. Siddhapura & D.B. Raval	Vikas Publication house pvt ltd., Noida, U. P.
4	Electrical Machine –	Tarlok Singh.	



5	Electrical Machines –II –	S.K. Bhattacharjee	S.K. kataria& Sons, New
6	Electrical Machines- Electrical Machines	AshfaqHussain	Delhi - DhanpatPRai& Co., New Delhi

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## 2. Electrical machine –II (Lab)

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Code–EL-504 (P)

Total Marks:- 50

Practical: - 25

Pass Marks: - 17/50

Sessional: - 25

### 1. Skills to be developed –

- A) Intellectual skills – a) Identification skills.  
b) Analytical skills.
- B) Motor skills -- a) Connecting skills  
b) Operating skills.  
c) Measurement and Testing skills.

#### List of the practical

1. Study of starter of 3-phase induction motor (Auto transformer/star-delta starter)
2. Study of resistance starter and starting of slip ring I.M.
3. Determination of Efficiency by No-load test and blocked rotor test on an induction motor.
4. Slip –torque characteristic of 3-phase induction motor.
5. Measurement of slip of a 3 phase induction motor
6. Study of capacitor start single phase induction motor and calculate starting and running current.
7. Study and starting of universal motor.
8. Determination of the regulation and efficiency of alternator from the open circuit and short circuit test.
9. Determination of the magnetization curve of an alternation at rated speed and half rated speed.
10. Study and starting of a 3-phase synchronous motor.

#### Reference books:-

- 1) Laboratory Course in Electrical Engineering – S.G. Tarnekar, P.K. Kharbandha
- 2) Laboratory Manual on basic Electrical Engineering and electrical measurement – By S.K. Bhattacharjee, K.M. Rastogy.
- 3) A Text Book of Practical in Electrical Engineering by Dr. N. K. Jain

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## 4. Course Title: Electrical Power

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1. Course Code: EI- 501

2. Semester: 5<sup>th</sup>

3. Rationale of the Subject:

After the privatization and globalization of economy, electrical power generating stations are coming up more rapidly. State electricity boards are also taking initiative to construct new power stations. The majority polytechnics pass out of electrical engineering get employment in private and public sector. They have to perform various activities in the field of generation, transmission and distribution of electrical power. In this subject, all these are included and necessary efforts are made to develop skill in the student in above mentioned field.

4. Aim:-

1. This is the main technology subject in Electrical Engineering. Power System depends on generation, transmission, distribution of power, substation, types of generating plant, control and atomization and control of power plant and substation. System stability is another main factor to be considered.

2. To develop knowledge and skill to supervise the functioning of the power system for safe operation.

3. To help for further studies in distribution and utilization of power.

5. Objective:-The students will be able to

1. Know different types of generating plans, working principle, fuels, suitable sites, economics of generation, use of PLC in atomization control of power plant.

2. Know substation and use of SCADA in control of substation.

3. Know AC transmission, HV DC transmission, and mechanical design of transmission line.

4. Know power system stability.

5(a) COURSE OUTCOMES:-

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

CO 1: Know different types of generating plants, fuels, working principle, suitable sites and economics of generation.

CO 2: Understand the use of PLC in atomization of control of power plant.

CO 3: Know the substation and use of SCADA in control of substation.

CO 4: Understand AC and HV DC transmission, mechanical design of transmission line.

CO 5: Know power system reliability.

6. Pre-Requisite:-

1. Energy conversion
2. Conductor, insulator, transformer, constructional materials.

7. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3		3	6hrs/week

8. Examination Scheme:

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

9. Detailed Course Content:

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Generation of Electrical Power	1.1 Types of power station, general feature, advantages and disadvantages, essential equipments and layout of thermal, hydro, nuclear, and diesel power station and site selection 1.2 Principle and type of cogeneration 1.3 Layout of control room, control room equipment and application thereof 1.4 Layout and equipment of switchyard at power station	8

		1.5 Grid or Inter connected system and load transfer	
2.0	Economics of Generation and Economic Load Dispatch	2.1 Load curves, load duration curve, integrated load duration curve 2.2 Connected load, maximum demand, demand factor, average load, load factor, diversity factor, plant capacity, plant capacity factor, utilization factor, cold reserve, hot reserve, spinning reserve, base load, peak load 2.3 Cost of generation, selection of unit size and operation schedule	6
3.0	Transmission of Electrical Power	3.1 Typical layout of AC power supply scheme, various transmission system, advantages, disadvantages, 3.2 High transmission voltage – advantages, economic choice of transmission voltage 3.3 Elements of transmission line, economic size of conductor, Kelvin's law, its limitation 3.4 Over head line conductor materials and their properties, insulator 3.5 Classification of over head transmission line, resistance, inductance and capacitance of transmission line, performance of short and medium transmission line, nominal T and $\pi$ method, voltage regulation and efficiency, 3.6 Corona, Skin effect and Ferranti effect, 3.7 Introduction to FACTS, types and benefit 3.8 Introduction to load dispatch centre and PLCC	7
4.0	Mechanical Design of Transmission Line	4.1 Line support, type of supports and their application, spacing between conductors Length of span, sag in over head lines, calculation of sag when supports are at equal and unequal levels, effect of wind and ice loading over the line conductors, stringing chart, sag templates	5
5.0	HVDC Transmission	5.1 Advantages and disadvantages of DC transmission, 5.2 Layout scheme and principle of high voltage DC transmission 5.3 DC link configuration, HVDC convertor station, comparison between constant current and constant voltage HVDC system	4
6.0	Substation	6.1 Classification of substation, layout, 6.2 Busbar arrangement, substation equipment in details 6.3 Substation control using SCADA	4
7.0	Power System Stability	7.1 Introduction, stability conditions, stability limit, swing equation, equal area criterion, methods of improving system stability	4
8.0	PLC	8.1 Introduction to PLC and area of application of PLC 8.2 Basic of PLC	

		8.3 Advantages of PLC over other controller 8.4 System components of PLC 8.5 Introduction to power plant atomization and control using PLC	4
CLASS TEST			3

## 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	Generation of electrical power	8	19	19	4	2	7	
2	Economics of generation and economic load dispatch	6	14	14	2	4	4	
3	Transmission of Electrical power	7	16	16	5	1	6	
4	Mechanical design of transmission line	5	12	12	1	4	3	
5	HVDC Transmission	4	10	10	2	2	3	
6	Sub-station	4	10	10	5		2	
7	Power system stability	4	10	10	4	1	2	
8	PLC	4	9	9	1	2	3	
	Total	42	100	100	24	16	30	
	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	Generation of Electrical power	2	2		4	1		2		3	1		5		6
2	Economics of generation & economic load dispatch	1	2		3	1	2			3			4		4
3	Transmission of electric power	2			2	2	0	2		4	1	1	4		6
4	Mechanical design of transmission line	1	2		3		2			2			3		3

5	HVDC Transmission	1	2		3					1		3		4
6	Sub –station	2		2	4					3				3
7	Power station stability	2	1		3		2		2	2				2
8	PLC	1	2		3							3		3
	Total				25					14				31

## 12. Suggested Implementation Strategies:

It is necessary to visit different types of generating station, substation. This is a descriptive and practice oriented course. The field visit will help the students to know the operation of different equipments and devices practically. After the visit, students may be asked to submit report and give seminar.

## 13. Suggested Learning Resources:

Book List: 1. Power System Operation and Control by S. Sivanagaraju, G. Sreenivasan

2. Electric Power Transmission and Distribution System by S. Sivanagaraju, S. Satyanarayana

3. Electrical Power System - Theory and Practice by M. N. Bandyopadhyay

4. A Text Book on Power System Engineering by Chakraborty, Soni, Gupta,  
Bhatnagar

5. Principle of Electrical Power by V. K. Mehta

6. Generation of Electrical Energy by B R Gupta

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## 4. ELECTRICAL POWER LABORATORY

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CODE - E1 – 501P

Practical Marks =25, Practical assessment = 25 Pass Marks = 17/50

Skill to be developed

1. Intellectual skills:-

1. Interpret results.
2. Identification of equipments and instruments.
3. Selection of equipments and instruments.

2. Motor skills:-

1. Accuracy in measurement.
2. Making proper connection.

List of Experiments:-

1. Open circuit test of a single phase transformer
2. Short circuit test of a single phase transformer
3. Determination of voltage regulation and efficiency of a single phase transformer
4. Polarity test of a single phase transformer
5. Parallel operation of single phase transformer
6. Calibration of current transformer and potential transformer
7. Parallel operation of Shunt generator.
8. Parallel operation of alternator set
9. Transformer oil test
10. Study and connections of 3-phase transformer.

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## 5. Course title- POWER ELECTRONICS

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1. Course code- El - 506

2. Semester- Fifth

3. Rationale of the subject – Developments in electronics has their own impact in other fields of engineering. Today all controls and drives for the electrical machines are formed by electronic components and there are many electronic devices available to handle electric power in terms Kilo-Ampere and Kilo- Volts. This subject gives a comprehensive knowledge about the devices and circuits used in electrical power control.

4. Aim:-

- A. The field of electrical engineering is generally segmented into three major areas- Electronics, Power & control.
- B. This subject is the combination of these three areas. Now a days all the industrial drives to run a machine and to control it as per requirement are based on Power electronics.
- C. Understanding of the subject will provide skill to the students for trouble shooting & testing of power semiconductor devices, solid state DC & AC motor drives.

5. Objective- Students will be able to:-

- A. Describe the power semiconductor devices & draw their characteristics.
- B. Describe the inverter, converter & chopper circuit.
- C. Explain the operation in the DC & AC motor drives.

COURSE OUTCOMES:-

- CO506.1 - To enable one to apply the knowledge of safety measures.
- CO506.2 -To enable one to understand the basics of power semiconductor devices.
- CO506.3- To enable one to analyze the working of different inverters.
- CO506.4-To enable one to describe the operations of different power supplies.
- CO506.5-To enable one to explain the operation of power electronics.

6. Pre-requisite:

- A. Knowledge of Applied Electronics.
- B. Knowledge of DC & AC Motor operation to run their drives.

## 7. Teaching scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hours/week		-	3 hours

## 8. Examination Scheme

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

## 1. Detailed Course Content

Chapter no.	Chapter Title	Content	Duration
1.	Thyristor	Construction, Characteristics(Forward and reverse characteristics), concept of holding and latching current, application of SCR, triggering of SCR, methods of triggering a SCR, gate characteristics, general layout of gate triggering circuits, R-C, UJT. Firing circuit, commutation of SCR, methods of commutating a SCR, series and parallel operations of SCR, protection of SCR against overvoltage, over-current, dv/dt and di/dt protection.	9 hours
2.	Power Transistors and Thyristors	Characteristics and application of bipolar junction transistor, power MOSFET (enhancement type), UJT, Gate Turn of Thyristor(GTO), light activated SCR(LASCR) and reverse conducting SCR, characteristics and applications of Diac and Triac	9 hours
3.	Controlled rectifier	Phase controlled rectifier operations on resistive and resistive inductive loads, use of free-wheeling diode, single phase controlled and fully controlled bridge rectifiers, expression for average and rms value of output voltage, simple numerical problems on controlled rectifiers	9 hours

4.	Inverters	Single phase series and parallel inverters, output voltage and current wave forms, principle of operation of bridge inverters, concept of voltage source, current source and pulse width modulated bridge inverters, performance parameters	9 hours
5.	Power supplies	D.C and A.C power supplies, Switched mode power supplies, resonant power supplies	6 hours
6	Class test		3hours

## 10. TABLE OF SPECIFICATIONS FOR THOERY:-

Sl no	Topic (a)	Time allotted in hrs (b)	Percentage Weightage (c)	Modified % weightage (d)	K	C	A	H A
1	Thyristor	9	21	21	7	6	2	
2	Power transistors & Thyristors	9	22	22	7	2	6	
3	Controlled rectifier	9	22	22	6	7	2	
4	Inverters	9	21	21	7	2	6	
5	Power supplies	6	14	14	3	5	2	
	Total	42	100	100	30	22	18	
	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	Thyristor	2	2	2	6	3				3	2	4			6
2	Power transistor & Thyristor	4		2	6	2	2			4	1		4		5
3	Controlled rectifier	2	2	2	6	2	3			5	2	2			4
4	Inverter	2		1	3	4		2		6	1	2	3		6
5	Power supplies	2		2	4	1	2			3		3			3
	Total				25					21					24

## 12. Suggested Implementation Strategies:-

A project work will be assigned to students by the subject faculty. It will be of 10 marks and will be evaluated by the faculty itself. The topic of the subject will be decided by the faculty and students will work in a group of 3-5 on each topic. The topic should be related to the subject taught by the faculty and should have proper utility and importance to enhance his/her practical skill and knowledge.

13. Suggested Learning resources:

1. Power Electronics, Circuit Devices and Applications, by M.H.Rashid, PHI, 1988
2. Power Electronics by V Subrahmanyam, New age Inc. Publishers
3. Power Electronics by P.C. Sen, Tata McGraw Hills

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## 6. Course Title : Microprocessors

1. **Course Code** : ET-502
2. **Semester** : 5<sup>th</sup> Semester
3. **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.

#### 4. COs and ILOs:

ET-603	Microprocessor	Course Outcome (CO)	Intended Learning Outcome (ILO)
		<p><b>CO-1 To become familiar with microprocessor and various Computer languages</b></p> <p><b>CO-2 To become familiar with the architecture and Instruction set of Intel 8085 microprocessor.</b></p>	<p><b>For CO1: After completion of this course students will be able to-</b></p> <p><b>ILO1:</b> Define microprocessor.</p> <p><b>ILO 2:</b> State different generations of microprocessor.</p> <p><b>ILO 3:</b> Explain the Block diagram of Micro Computer system.</p> <p><b>ILO 4:</b> Define Machine language, Assembly Language &amp; High-level languages.</p> <p><b>ILO 5:</b> State the memory structure of microprocessor</p> <p><b>For CO-2: After completion of this course students will be able to-</b></p> <p><b>ILO 1:</b> Describe 8085 Architecture with its functional components.</p> <p><b>ILO 2:</b> Explain various types of buses.</p> <p><b>ILO 3:</b> Describe registers of 8085 along with their functions.</p> <p><b>ILO 4:</b> Classify the flags of 8085 along</p>

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

		<p><b>CO-4: To understand the architecture and instruction set of Intel 8086/8088 to utilize it in programming.</b></p> <p><b>CO-5: To familiarize with interfacing of various peripheral devices with 8085 microprocessor.</b></p>	<p><b>ILO 6:</b> Describe the operation of Subroutine.</p> <p><b>For CO-4: After completion of this course students will be able to-</b></p> <p><b>ILO 1:</b> Describe 8086 Architecture with its functional components.</p> <p><b>ILO 2:</b> Describe registers and flags of 8086 along with their functions.</p> <p><b>ILO 3:</b> Explain Special purpose registers.</p> <p><b>ILO 4:</b> Describe memory segmentation of 8086 microprocessor.</p> <p><b>ILO 5:</b> State 8086 instructions for Data transfer operation, Arithmetic operation, Logical operation, Branching operation, Machine control operation and String operation.</p> <p><b>ILO 6:</b> Write simple programs using assemblers</p> <p><b>For CO-5: After completion of this course students will be able to-</b></p> <p><b>ILO 1:</b> Explain the concept of Interfacing I/O Devices.</p> <p><b>ILO 2:</b> Define Direct I/O &amp; Memory mapped I/O techniques.</p> <p><b>ILO 3:</b> Describe Modes of operation of Programmable peripheral interface (PPI) 8255 IC with Pin diagram.</p> <p><b>ILO 4:</b> Describe Programmable DMA controller 8257 with Pin diagram.</p> <p><b>ILO 5:</b> Explain the DMA operations and DMA channels with suitable sketch.</p>
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			<p><b>ILO 6:</b> Describe the operation of Programmable Interrupt Controller 8259 with Pin diagram.</p> <p><b>ILO 7:</b> Explain the internal block diagram of Programmable Interrupt Controller 8259 with suitable sketch.</p>
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Chapter	ChapterTitle	Content	Duration
<b>1.0</b>	Introduction	<p>1.1.Introduction to microprocessor, Different Generations of microprocessor.</p> <p>1.2.Blockdiagram of Micro Computer system, description of each block.</p> <p>1.3.Computerlanguages-Machinelanguage,Assembly language, High-level languages.</p> <p>1.4. Memory revisit, memory structure, memory expansion, memory organization</p>	<b>3</b>



<b>2.0</b>	8-bit Microprocessor Architecture	<p>2.1. Introduction to 8085 microprocessor, Different Types of bus and their functions.</p> <p>2.2. Microprocessor operations, descriptions of different control signals.</p> <p>2.3. Programmable registers of 8085, Accumulator, General-purpose registers, Program counter and stack pointer, Using the stack</p> <p>2.4. 8085 flags and their utilities.</p> <p>2.5. Pin diagram of 8085, description of the pins.</p> <p>2.6. Demultiplexing of A<sub>0</sub>-A<sub>7</sub> bus.</p> <p>2.7. Generation of Read/Write control signals.</p> <p>2.8. Timing diagram and machine cycles.</p>	<b>10</b>
<b>3.0</b>	Instructions and Programming	<p>3.1. 8085 instructions and their classification; Data transfer, Arithmetic, Logical, Branching and looping, Machine control instructions.</p> <p>3.2. Writing Assembly language programs for Addition, subtraction, Multiplication, division, Logic operations, Block data transfer, Comparison of numbers, Rotate.</p> <p>3.3. Handling carry and using flags in programs, Writing programs to use stacks.</p> <p>3.4. Subroutines, Writing subroutines and calling it in the main program, delay subroutines.</p> <p>3.5. Addressing modes</p>	<b>10</b>

<b>4.0</b>	16bit Microprocessor 8086	<p>4.1. Introduction to 8086 microprocessor; modes of operations.</p> <p>4.2. Internal registers of 8086, General purpose registers, Index registers, Pointer registers, Special purpose registers, segment registers and flags.</p> <p>4.3. Understanding memory segmentation and using register values.</p> <p>4.4. 8086 instructions for Data transfer operation, Arithmetic operation, Logical operation, Branching operation, Machine control operation and String operation</p> <p>4.5. Writing simple programs, using assemblers.</p>	<b>10</b>
<b>5.0</b>	Interfacing Peripherals	<p>5.1. Basic Interfacing concepts, Interfacing I/O devices.</p> <p>5.2. Input/Output techniques, Direct I/O and memory mapped I/O.</p> <p>5.3. Programmable peripheral interface (PPI) 8255 IC, different ports, Modes of operation, Control word registers.</p> <p>5.4. Programmable DMA controller 8257, DMA channel and DMA operations.</p> <p>5.5. Programmable Interrupt Controller 8259, pin diagram, internal block diagram, operations.</p>	<b>9</b>

**7. 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	16bit Microprocessor 8086	6	4	7	17
5	Interfacing Peripherals	4	3	8	15
	Total	25	15	30	70

### 8.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

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## 6.MICROPROCESSOR LAB

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- 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.

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## 7. NON CONVENTIONAL ENERGY

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<b>Subject Title</b>	<b>: No Conventional Energy</b>		
<b>Subject Code</b>	<b>: EI/Me/Au/IPE-505</b>		
<b>Hours Per Week</b>	<b>: 03</b>		
<b>Hours Per Semester</b>	<b>: 45</b>		
<b>Class test</b>	<b>: 03</b>		
<b>Total Hours</b>	<b>: 48</b>		
<b>Full marks(Theory)</b>	<b>: 70</b>		
<b>Sessional Marks</b>	<b>: 30</b>		
<b>Class hours</b>	<b>L</b>	<b>T</b>	<b>P</b>
	<b>3</b>	<b>0</b>	<b>0</b>

### Outcome based course objectives

After studying the course the students will be able to

1. Know the details of Non Conventional energy sources and its uses
2. Explain the principle of solar energy collection
3. Apply solar energy storage system for day to day uses
4. Know the principle of wind energy conversion system
5. Explain the principle of ocean thermal energy conversion
6. Explain the principle of biomass conversion for storing and utilizing of energy
7. Know about the geothermal energy
8. Apply the principle of thermal energy storage system
9. Know about the chemical storage system

### COURSE CONTENTS

#### 1.0 Introduction to Non-Conventional Energy Sources

- 1.1 Energy consumption
- 1.2 Energy Sources & their Availability
- 1.3 Importance of Non Conventional Energy sources.

#### 2.0 Solar Energy Engineering

- 2.1 Introduction
- 2.2 Solar Constant
- 2.3 Solar Radiation at the Earth's surface
- 2.4 Solar Radiation Measurements
- 2.5 Solar Energy Collectors
  - 2.5.1 Principles of Conversion of Solar Radiation into heat
  - 2.5.2 Flat Plate Collectors – Types, Applications & Advantages
  - 2.5.3 Concentrating Collectors – Focusing & non-focusing types
  - 2.5.4 Advantages & Disadvantages of concentrating collectors over flat plate collectors.

2.6 Applications of Solar Energy - Water Heating, Air Heater, Solar Cooker, Solar Pond, Solar Photovoltaic and Solar Distillation.

### **3.0 Wind Energy Engineering**

- 3.1 Introduction
- 3.2 Basic Principles of Wind energy conversion
  - 3.2.1 The nature of wind
  - 3.2.2 The power in the wind (No derivations)
  - 3.2.3 Forces on the Blades (No derivations)
- 3.3 Site Selection considerations
- 3.4 Basic components of a wind energy conversion system (WECS)
- 3.5 Wind energy collectors (Wind mill)
  - 3.5.1 Horizontal Axis Machines
  - 3.5.2 Vertical Axis Machines
- 3.6 Advantages & Limitations of WECS.

### **4.0 Ocean Energy Engineering**

- 4.1 Introduction
- 4.2 Ocean Thermal Energy Conversion (OTEC)
  - 4.2.1 Introduction to OTEC
  - 4.2.2 Methods of OTEC
  - 4.2.3 Site Selection for OTEC
  - 4.2.4 Prospects of OTEC in India.
- 4.3 Tidal Energy
  - 4.3.1 Introduction
  - 4.3.2 Basic Principles of Tidal Power
  - 4.3.3 Components of Tidal Power Plants
  - 4.3.4 Schematic Layout of Tidal Power house
  - 4.3.5 Operation methods of utilization of Tidal energy (single and double basin arrangement)
  - 4.3.6 Advantages & Limitations of Tidal power
  - 4.3.7 Prospects of Tidal Energy in India.

### **5.0 Geothermal Energy Engineering**

- 5.1 Introduction
- 5.2 Nature of Geothermal fields
- 5.3 Geothermal Sources
- 5.4 Hydro thermal Sources
  - 5.4.1 Vapour dominated systems
  - 5.4.2 Liquid dominated systems
- 5.5 Prime movers for geothermal energy conversion

### **6.0 Bio Energy Engineering**

- 6.1 Introduction
- 6.2 Biomass conversion techniques
- 6.3 Biogas Generation.
- 6.4 Factors affecting biogas Generation
- 6.5 Types of biogas plants

6.6 Advantages and disadvantages of types of biogas plants

## 7.0 Direct Energy Conversion Systems

7.1 Magneto Hydro Dynamic Generator

7.1.1 Introduction

7.1.2 Basic principle

7.1.3 MHD Systems (open cycle & closed cycle)

7.1.4 Advantages of MHD

7.2 Thermo-Electric power

7.2.1 Basic Principles

7.2.2 Thermo electric power generator

7.2.3 Thermo Electric materials & selection of materials

7.3 Thermoionic Generation

7.3.1 Introduction

7.3.2 Thermoionic emission & work function

7.3.3 Basic Thermoionic generator

## 8.0 Chemical Energy Sources

8.1 Fuel cells

8.1.1 Introduction

8.1.2 Fuel cells – Principles of operation, classification & Types

8.1.3 Applications of fuel cells

8.2 Hydrogen Energy

8.2.1 Introduction

8.2.2 Principles of operation

8.2.3 Applications

Reference:

1. Non conventional Energy sources by G.D.Rai, Khanna Publishers
2. Solar Energy by S P Sukhatme Tata McGraw Hill
3. Solar Energy Utilization G D Rai Khanna Publishers
4. Power Plant Technology by M M EI Wakil ,Tata McGraw Hill

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## 8. PROFESSIONAL SKILLS – III

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5<sup>th</sup> SEMESTER, ELECTRICAL ENGINEERING

CODE NO= EL-510

TEACHING SCHEME:

Theory: 1hr/week

Practical: 2 hrs/week

EXAMINATION SCHEME:

Practical assessment: 25 marks

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 electrical engineering up to 5<sup>th</sup> 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 5<sup>th</sup> Semester final examination (during term vacation) in thermal, hydal power generating station/Grid substation.  
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 electrical equipments.



- c. Visit to observe nearest transmission line installation / street solar lighting connection/ wiring system of multi-storeyed building
  - d. An electrical machine manufacturing industry
  - e. A wind mill / Hybrid power station of wind and solar
  - f. Industry of power electronics devices.
  - g. Transformer repairing workshop
  - h. 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. Modern trends in AC machine
  - c. Automotive wiring and lighting
  - d. Digital metering
  - e. Mini hydal project on N.E region for power generation.
  - f. Safety precaution and first aids from electrical fire
  - g. Indian electricity rules.
  - h. Social networking- effects and utility.
  - i. 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 construction and operation of DC and AC machine
  - b. Electrical drive and braking system.
  - c. Maintenance and installation of solar equipments.
  - d. Seismic consideration of substation.
- Searching websites: [www.electrical4u.com](http://www.electrical4u.com), [www.indiabix.com](http://www.indiabix.com), [www.careerride.co](http://www.careerride.co)

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

- a. Modern House wiring installation and testing.
- b. Dismantling, repairing, rewinding and assembling of 3-phase/1-phase motor.
- c. Take measurement and prepare drawings/sketches of different dismantling machine parts
- d. Seminar on any field of electrical engineering
- e. Survey for energy saving in the institute.
- f. Survey and interview of successful entrepreneurs in nearby areas.
- g. Biomass energy
- h. Automatic speed controller of motor.
- i. Make a market survey of all transducer available, their specification, manufacturers name, cost etc. prepare power point presentation.
- j. Collect information from market regarding specification and cost of items used in electrical wiring for domestic, commercial and industry use.

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## COURSE STRUCTURE OF 6<sup>TH</sup> SEMESTER (ELECTRICAL)

Sl no	Code no	Subject	Contact hours /week			Evaluation scheme									
						Theory (Th)					Practical (Pr)			Total Marks (Th+Pr)	Credit
			L	T	P	ESE	Sessional(SS)			Pass (ESE+S S)	Practical Test(PT)	Practical Assessment (PA)	Pass (PT+PA)		
							TA	HA	Total (TA+HA)						
1	HU-601	Industrial Management and Entrepreneurship	3	1		70	10	20	30	33/100				100	3
2	EL-601	Electrical estimating, costing and contracting	4		3	70	10	20	30	33/100	50	50	33/100	200	5
3	EL-602	A.C Distribution & Utilization	3	1		70	10	20	30	33/100				100	3
4	El - 603	Switchgear and Protection	4			70	10	20	30	33/100				100	4
5	EL-604	Installation and Maintenance	3	1		70	10	20	30	33/100				100	3
6	EL-611	Project & Seminar		1	6						100	50	50/150	150	3
7	El-612	General viva		2							50		17/50	50	2
8	El - 610	Professional practices -IV	1		2						25	25	17/50	50	2
Total			19	5	11									850	25
			35												

# 1. Course Title : Industrial Management and Entrepreneurship

1. Course Code: **Hu – 601**

2. Semester: **VI**

3. **Aim of the Course:**

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

4. **Course Outcomes:**

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

- CO<sub>1</sub> = explain managerial activities.
- CO<sub>2</sub> = describe leadership qualities and decision making process.
- CO<sub>3</sub> = state the elements of costs.
- CO<sub>4</sub> = explain important industrial laws.
- CO<sub>5</sub> = define different forms of business organisations
- CO<sub>6</sub> = identify entrepreneurial abilities for self employment through small scale industries.

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

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

6. **Examination Scheme:**

Theory				Practical		Total Marks
Examination Full Marks	Sessional Full Marks	Total Marks	Pass Marks	Examination	Sessional	

70	30	100	33	--	--	--	--	100
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## 7. Detailed Course Content:

Chapter No.	Chapter Title	Content	Intended Learning Outcomes	Duration (in hours)
				<b>42 hrs</b>
1.0	<b>Introduction to Management :</b>	i) Meaning and Concept ii) Functions of Management iii) Principles of Management	i) Explain functions and principles of management	3
2.0	<b>Leadership Decision Making &amp; Communication :</b>	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	<b>Introduction to Cost :</b>	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	<b>Human Resource Management:</b>	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	i) State selection procedure of employees  ii) Distinguish Time rate and Piece rate	5

		Piece rate v) Labour Turnover – definition, its causes, impact and remedy	system of wage payments  iii) Explain causes and impact of labour turnover	
5.0	<b>Industrial Legislation :</b>	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	<b>Production Management :</b>	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	<b>Marketing Management:</b>	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	<b>Entrepreneur and Entrepreneurship:</b>	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	<b>Forms of Business Organization:</b>	<p>i) Sole Trader – meaning, main features, merits and demerits</p> <p>ii) Partnership – definition, features, merits and demerits</p> <p>iii) Joint Stock Company – Definition, types, features, merits and demerits</p>	<p>i) Differentiate different forms of Business organization</p> <p>ii) compare and contrast features, merits and demerits of different business organizations.</p>	5
10.0	<b>Micro and Small Enterprises:</b>	<p>i) Definition of Micro &amp; Small enterprises</p> <p>ii) Meaning and characteristics of Micro and Small enterprise</p> <p>iii) Scope of SSI with reference to self-employment</p> <p>iv) Procedure to start SSI – idea generation, SWOT analysis</p> <p>v) Selection of site for factories</p>	<p>i) Define micro and small enterprises</p> <p>ii) Explain the procedure to start a small enterprise</p>	4
11.0	<b>Support to Entrepreneurs</b>	<p>a) Institutional support:</p> <p>i) Introduction</p> <p>ii) Sources of information and required application forms to set up SSIs</p> <p>iii) Institutional support of various National &amp; State level organizations – DICC, NSIC, IIE, MSME - DI, Industrial Estates</p> <p>b) Financial support: i) Role of Commercial banks, RRB, IDBI, ICICI, SIDBI, NEDFi, and State Financial Corporations</p> <p>ii) Special incentives and subsidies for Entrepreneurship</p>	<p>i) identify the supporting agencies to entrepreneurs</p> <p>ii) Explain the role of financial support organizations</p>	5

		Development in the North East	
	Class Test		3 hrs
	Total		<b>45 hrs</b>

(9) TABLE OF SPECIFICATIONS for Industrial Management &amp; 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 Organization	5	12	3	5	0	0
10	Micro & Small Enterprises	4	9.5	4	3	0	0

11	Support to Entrepreneurs	5	12	4	4	0	0
Total		42	100	39	31	0	70

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

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

10. Distribution of Marks:

DETAILED TABLE OF SPECIFICATIONS FOR IME

Sl. No	Topic	OBJECTIVE TYPE				SHORT ANSWER TYPE					ESSAY TYPE					Grand Total
		K	C	A	T	K	C	A	HA	T	K	C	A	HA	T	
1	Management	1	0	0	1	1	0	0	0	1	0	3	0	0	3	5
2	Leader & Decision	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
	<b>Total</b>	<b>20</b>	<b>5</b>	<b>0</b>	<b>25</b>	<b>12</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>7</b>	<b>21</b>	<b>0</b>	<b>0</b>	<b>28</b>	<b>70</b>

K = Knowledge                      C = Comprehension      A = Application

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

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

**11. Suggested learning Resource:**

a. **Book list :**

Sl. No.	Title of Book	Name of Author(s)	Publisher
1	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
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- b. List of Journals
- c. Manuals
- d. Others

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## 2. Course title- Electrical Estimating, Costing and Contracting

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1. Course code- EL-601
2. Semester- 6th
3. Rationale:—The contents of this subject have been designed to provide knowledge of IE rule, wiring design and design considerations of residential electrical installation, estimate the materials required for different installation.
4. Aim of the subject:-
  - A. Knowledge of electrical engineering drawing, IE rules, different types of electrical installation and their design considerations equip the students with the capability to design and prepare working drawing of different installation projects.
  - B. Understanding of the methods and procedure of estimating the material required will also help the student to work as a supervisors.
5. COURSE OBJECTIVES: – Students will be able to:
  - A. State IE rules related to electrical installation and testing.
  - B. Understand the concept of contracts, contractors, tender and tender document and its related procedures
  - C. State and describe the basic term, general rules, circuit design procedure, wiring design and design considerations of residential electrical installations
  - D. Estimate the quantity of material required for earthing
  - E. Familiarize the types of wiring
  - F. Estimate the materials required for overhead and underground distribution system.
  - G. Estimate the materials required for electrical substation

### COURSE OUTCOMES:-

- CO501.1 - To enable one to apply the knowledge of IE rules and summarize the importance of estimation and specification.
- CO501.2 -To enable one to understand the concept of contracts, contractors, tender and tender document and its related procedures.
- CO501.3- To enable one to draw the wiring plan for residential buildings, prepare the schedule of materials with specifications.
- CO501.4-To enable one to estimate the materials required for overhead and underground distribution system.
- CO501.5-To enable one to estimate the materials required for transmission lines and substations.

CO501.6-To enable one to repair the different electrical equipments

## 6. Pre-requisite:-

- A. Basic electrical engineering
- B. Engineering graphics

## 7. Teaching scheme (in hours)

Lecture	Tutorial	Practical	Total
4hrs/week	-	3hrs	7hrs/week

## 8. Examination Scheme

Theory			Pass marks (ESE+SS)	Practical		Pass marks (PT+PA)	Total marks (Th+Pr)	Credit
ESE	Sessional(SS)		33/100	PT	PA	33/100	200	5
	TA	HA		50	50			
70	10	20						

## 9. Detailed Course Content

Chapter no.	Chapter Title	Content	Duration(hours)
1.	Elements of estimating	Principles, purpose of estimating and costing, good estimator, items and specifications, essentials of estimating and costing market survey, price list and net prices, preparation of list of materials, calculations of material and labour cost, contingencies, overhead charges, profit and total cost, quotations-comparative statement and orders, purchase procedures.	4 hours
2.	Principles of Contracting	Legal aspects of contract, SOR, tender, tender procedure, guidelines, preparations of a simple tender, process for passing the tender, terms and contradictions of a contract.	4 hours
3	Estimating and Costing of domestic and industrial Wiring	Types of domestic and industrial electrical fittings used including MCB, LED Bulb etc, procedure adopted, comparison and selection of appropriate wiring, looping and ring system, Indian electricity rules, code of practice, selection of number of circuits, size of wire, domestic and industrial wiring, planning for domestic and industrial	8 hours

		wiring, wiring diagrams, estimation of residential wiring and industrial wiring including estimation of earthing.	
4	Estimating and costing of service connection	Procedure for preparing estimate for giving service connection to domestic and industrial consumers including materials, sketches and its cost both for overhead and underground connections. Laying of underground cable.	8 hours
5.	Estimation Of overhead and underground Distribution System	Procedure for preparing estimates for overhead and underground distribution system for a given load and for the given distance of distribution line including sketch and list of material required. Main components of overhead lines. Cost of materials and work for overhead and underground lines up to 11 kv only.	8 hours
6.	Estimation of Small Sub-stations	Estimation of materials required for a small distribution substation (indoor and outdoor type-platform and pole mounted). Costing of materials and work of above substations.	5 hours
7.	Estimating and Costing of repair and maintenance and electrical devices and equipments	Estimating the cost of repair including material, labour cost, testing cost, testing cost along with details of fault finding, in case of some domestic appliances like hot plates, electric iron, mixer, fan, single phase transformers, starter, rewinding, etc.	5 hours
8	Class test		3 hours

## 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	Elements of estimating	4	10	10	5	0	1	
2	Principles of contracting	4	10	10	5	1	0	
3	Estimating and costing of domestic & industrial wiring	8	19	19	4	1	10	
4	Estimating and costing of service connection	8	19	19	4	1	10	
5	Estimation of overhead and underground distribution system	8	19	19	6	1	8	

6	Estimating of small substation	5	11	11	4			
7	Estimating & costing of repair and maintenance of electrical devices and equipments	5	12	12	1	1	7	
	Total	42	100	100	29	05	36	
	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	Elements of estimating	2		1	3	1				1	2				2
2	Principles of contracting	2	1		3	1				1	2				2
3	Estimating & costing of domestic and industrial wiring	2	1	2	5		2			2			8		8
4	Estimating & costing of service connection	2	1	2	5	2				2			8		8
5	Estimating of overhead & underground distribution system	2	1	2	5	2				2		6			8
6	Estimating of small substation	1			1	1				1	2				2
7	Estimating & costing of repair and maintenance of electrical devices and equipments		1	2	3	1				1			5		5
	Total				25					10					35

## 12. Suggested Implementation Strategies:-

The students should be taken to a newly constructed building to estimate the materials required for wiring. Teacher should encouraged them to draw single line wiring diagram, transmission line, distribution line structure using CAD

## 13. Reference Books-

1. J.B. GUPTA. "Electrical Installation Estimating and Costing" S.K. Kataria and Sons New Delhi
2. Uppal. "Electrical Installation Estimating And Costing"
3. Surjeet Singh. "Electrical Estimating And Costing" DhanpatRai
4. S.K. Bhattacharya, "Electrical Engineering Drawing and Design Estimating", Wiley Eastern Ltd. New Delhi
5. Surjeet Singh, "Electrical Design and Drawing" S.K. Kataria And Sons New Delhi
6. O.P. Soni, "Electrical Engg. Design And Drawing" SatyaPrakashan Delhi

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## 2. Electrical Estimating and Costing Laboratory

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Practical: - Full Marks 100 Practical/ Viva= 50, Sessional =50

Pass marks = 33/100

Code EL – 601(P)

1. Drawing, estimating and costing of electrical installation of the institute from suppliers pole to the institution distribution board (service connection)
  2. Designing of light and fan scheme for a institutional or commercial building.
  3. Rewinding & repairing of I-phase & 3-Phase motor.
  4. Rewinding & repairing of fan motor, regulators and other electrical appliances.
  5. Practice on different types of House Wiring installation and testing .
- .....



### 3. Course Title: AC Distribution and Utilization

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1. Course Code: EI- 602

2. Semester: 6<sup>th</sup>

3. Rationale of the Subject:

The amount of use of electrical energy reflects the economical condition of a nation. The demand of electric energy is gradually increasing in developed countries. Electricity is the basic need of human being as well as industry. Therefore, economical distribution of energy is important. The power station and power industry require skilled technician to distribute electric energy to the consumer. Electric energy is utilized in different ways like heating, welding, illumination, electric drives etc. Therefore students should know the principle, construction, and operation of these. Essential efforts are made to develop above skill in the students.

4. Aim:-

1. To study distribution system and automation of distribution system using SCADA
2. To study different methods of power factor improvement and different methods of tariff.
3. To study the importance of the good illumination.
4. To study electric heating, welding, electric drives and electrochemical works.

5. Objective:- The student will be able to

1. Know the different types of distribution system and role of SCADA in automation of distribution system.
2. Explain the importance of good illumination.
3. Compare different types of electric heating and welding.
4. Know different methods of power factor improvement, tariff and application of tariff to the consumer.

5(a) COURSE OUTCOMES:-

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

CO 1: Understand the different types of distribution system and role of SCADA in atomization of distribution system.

CO 2: Know the importance of good illumination.

CO 3: Know different types of electric heating and welding and know to compare them.

CO 4: Understand different types of electric drives and electrochemical power.

CO 5: Know different methods of power factor improvement, tariff and application.

CO 6: Learn construction, laying, advantages and disadvantages of underground cable.

6. Pre-Requisite:-

1. Electrical Technology

2. AC, DC machine

7. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
3hrs	1hrs		4 hrs

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				100	3

9. Detailed Course Content:

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	AC Distribution	1.1 Primary and Secondary distribution system, design considerations in a distribution system 1.2 Distribution system losses, factors effecting distribution system losses, methods for reduction of losses 1.3 Scheme of connections, single phase AC distribution fed at one end –	8

		power factor is specified wrt receiving end voltage and power factor refers to the respective load point, simple problem	
2.0	SCADA System for Electrical Distribution	2.1 Introduction to SCADA 2.2 Components of typical SCADA system 2.3 Automation of electrical distribution system 2.4 Advantages of implementing SCADA system for electrical distribution	5
3.0	Power Factor Improvement	3.1 Causes of low power factor, disadvantages of low power factor 3.2 Methods of improving power factor 3.3 Most economical power factor when the KW demand is constant, most economical power factor when the KVA maximum demand is constant	5
4.0	Electrical Tariff	4.1 Points to be considered for fixing a tariff, 4.2 Different types of tariff and calculation	4
5.0	Cables	5.1 General construction of cables, types of cables and application 5.2 Advantages and disadvantages of underground cables over overhead line 5.3 Insulating materials for cables 5.4 Determination of maximum current carrying capacity of cables 5.5 Cables for low voltage AC distribution and service mains 5.6 Laying of cables 5.7 Faults, faults finding methods	5
6.0	Electric Heating and Welding	6.1 Advantages of electric heating 6.2 Different types of electrical heating with principle and comparison 6.3 Design of resistance heating element, 6.4 Construction and application of resistance furnaces, induction heating, dielectric heating, arc furnace, indirect arc furnace 6.5 Heating of building and air-conditioning 6.6 Classification of electric welding and equipments, ultrasonic welding	5
7.0	Electric Drives	7.1 Group and individual drive, advantages of electric drives 7.2 Starting and running characteristics of motor 7.3 Speed control of DC and AC motors 7.4 Selection of motor for different industrial work	4
8.0	Illumination	8.1 Definition of various terms used in illumination and polar curve. 8.2 Laws of illumination, Lambert's law, simple problems 8.3 Requirement for good lighting, scheme for domestic, commercial, industrial, workshop and street lighting	3
9.0	Electro Chemical Power	9.1 Electrolysis, Faraday's laws of electrolysis 9.2 Electroplating, Electro-forming, Electro-typing, Anodizing	3
CLASS TEST			3

## 10. TABLE OF SPECIFICATIONS FOR THOERY

Slno	Topic (a)	Time allotted in hrs (b)	Percentage Weightage (c)	Modified % weightage (d)	K	C	A	HA
1	A.C distribution	8	19	19	4	3	6	
2	SCADA system for electrical distribution	5	12	12	5	1	2	
3	Power factor improvement	5	12	12	3	1	4	
4	Electrical Tariff	4	10	10	4		3	
5	Cables	5	12	12	3	3	3	
6	Electric heating and welding	5	12	12	5		4	
7	Electric drives	4	10	10	4	3		
8	Illumination	3	7	7	3	2		
9	Electro chemical power	3	6	6	4			
	Total	42	100	100	35	13	22	

## 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	A.C distribution	2	1	2	5	1	2			3	1		4		5
2	SCADA system for electrical distribution	1		2	3	1				1	3	1			4
3	Power factor improvement	2	1		3	1				1			4		4
4	Electrical Tariff	2			2	2		3		5					
5	Cables	1	1		2	1	2			3	1		3		4
6	Electric heating & welding	2		2	4	2		2		4	1				1
7	Electric drives	2	1		3		2			2	2				2
8	Illumination	1	2		3	2				2					
9	Electro- chemical power					2				2	2				2
	Total				25					23					22

12. Suggested Implementation Strategies: Practical examples will help in this course. In classroom teaching, the teacher should show models, charts, video films etc time to time. Visit to industry also helps the students. Students may be given the assignment to draw the layout of distribution system and load survey of local area.

### 13. Suggested Learning Resources:

#### Book List:

1. Electrical Power System - Theory and Practice by M. N. Bandyopadhyay
2. Electric Power Transmission and Distribution System by S. Sivanagaraju, S. Satyanarayana
3. Utilisation of Electric power and electric traction by J B Gupta
4. A Text Book on Power System Engineering by Chakraborty, Soni, Gupta, Bhatnagar

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## 4. Course Title: Switchgear and Protection

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1. Course Code: EI - 603

2. Semester: 6<sup>th</sup>

3. Rationale of the Subject:

In a power system, different types of fault occur regularly. There for safety of equipments and human being are the major criteria in a power system. For this reason, switchgear and various protective scheme applied to different equipments, machines, bus bars, transmission line, distribution lines are essential. The technician working in various area of a power system should have operating skill of switchgear and protective scheme. The student will be able to know the working principle, construction and procedural aspects of various equipments, devices etc used in switchgear protection scheme. This course will also help the students in operating various switchgears applied in power system.

4. Aim:-

1. To identify various components of switchgear and protection system.
2. To develop skill in operating various control and switchgear used in power system.
3. To develop skill to take remedial measures for faults/abnormalities developed in power system using appropriate instruments or devices.

5. Objectives:-

The student will be able to

1. Identify various components of switchgear and control panel.
2. Know the construction and working of different components used in protective system.
3. Know the principles, concepts and procedural aspects of switchgear and protective system.
4. Decide the sequence of operation of switchgears.
5. Identify faults and repairs.

5(a) COURSE OUTCOMES:-

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

CO 1: Learn to identify various components of switchgear and control panel.

CO 2: Know the construction and working principle of different components, devices used in protective system.

CO 3: Understand the principle, concept and procedural aspects of switchgear and protective system.

CO 4: Know the sequence of operation of switchgear.

CO 5: Identify faults and repair.

CO 6: Get the operating skill of switchgear and protective system.

6. Pre-Requisites:-

1. Power system.

2. Fundamentals of AC, DC machines.

7. Teaching Scheme (in hours per week):

Lecture	Tutorial	Practical	Total
4 hrs	-	-	4 hrs

8. Examination Scheme:

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

9. Detailed Course Content:

Chapter No	Chapter Title	Content	Duration (in hours)
1.0	Elements of Protection	1.1 Normal and abnormal condition of power system, effects of abnormality,	

		1.2 Types of fault, causes of fault and its remedies 1.3 Short circuit current, harmful effects of short-circuit current on power system 1.4 Function of protective system, basic elements of protective system, back up protection	4
2.0	Relays	2.1 Concept of term protective relay, general principle of operation of relay – over current, over voltage, earth fault etc , basic terms used in relay operation, time and current setting 2.2 Electromagnetic relays, Induction relays –types, construction and working principle 2.3 Idea of static relay, comparison with electromagnetic relay. 2.4 Construction and working principle of directional relay, non directional relay, power relay, and thermal relay,	8
3.0	Neutral Earthing	3.1 Importance of neutral earthing, methods, comparison of different methods, application	3
4.0	Circuit Interrupting Devices	4.1 Necessity of circuit interrupting devices, different circuit interrupting devices, difference between switch, isolator and circuit breaker 4.2 Isolators, requirement and types 4.3 Function and construction of fuse, HV and LV fuse, their characteristics, types, rewirable, cartridge, HRC fuse.	5
5.0	Arc Formation Process	5.1 Arc phenomenon, principle of arc extinction, method of arc extinction – zero current interruption and other arc interruption process 5.2 Different terms – restriking voltage, arc voltage, recovery voltage, RRRV, current chopping, resistance switching, capacitive current braking, circuit breaker ratings	4
6.0	Circuit Breaker	6.1 Working principle of circuit breaker, 6.2 brief review of air circuit breaker, air blast circuit breaker 6.3 Bulk oil circuit breaker, minimum oil circuit breaker 6.4 SF <sub>6</sub> circuit breaker, vacuum circuit breaker 6.5 Merits and demerits of different types circuit breaker 6.6 Contacts, classification and application switchgear, specification of CG	8
7.0	Protection Scheme	7.1 Protection of alternator: abnormality and fault in an alternator, over current protection, differential protection, field failure protection, protection against unbalanced loading, Merz price protection 7.2 Protection of transformer: abnormality, over current protection, differential protection, earth fault protection, Buchholz relay 7.3 Transmission line and feeder protection; causes and different types of protection needed, over current protection, differential protection, distance protection for radial, parallel and ring feeder, differential pilot wire protection Translay Scheme	6



8.0	Over Voltage Protection	8.1 Causes of over voltage, damages, method of reducing over voltage, function of ground wire 8.2 Mechanism of lightning 8.3 Construction and application of different type of lightning arresters- rod gap, horn gap thyrite arrester and surge absorber,	4
CLASS TEST			3

## 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	Element of protection	4	10	10	4	3		
2	Relays	8	19	19	4	3	6	
3	Neutral earthing	3	7	7	1		4	
4	Circuit interrupting devices	5	12	12	3	5		
5	Arc formation process	4	10	10	4	3		
6	Circuit breaker	8	19	19	5	4	4	
7	Protection scheme	6	14	14	3	7		
8	Over voltage protection	4	9	9	5	2		
	Total	42	100	100	29	27	14	
	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	Elements of protection	2			2	2				2		3			3
2	Relays	2	1	2	5		2			2	2		4		6
3	Neutral earthing			2	2	1		2		3					
4	Circuit interrupting devices	2	2		4	1				1		3			3
5	Arc formation	2	1		3	2				2		2			2
6	Circuit breaker	2	2		4	2				2	1	2	4		7
7	Protection Scheme	2	2		4	1	2			3		3			3
8	Over voltage protection	1			1	1	2			3	3				3
	Total				25					18					27

## 12. Suggested Implementation Strategies:

Besides the class room activity, field visit will help the students to develop the operating skill on different equipments and devices used in switchgear and protection scheme. Visit to power station, substation and industry helps the students to develop skill in case of switchgear and protection scheme.

## 13. Suggested Learning Resources:

Book List: Principle of Power System by V K Mehta and Rohit Mehta

Switchgear and Protection by S SRao

Electrical Power System by C L Wadhaw

Power System Engineering by Nagrath& Kothari

Switchgear and Protection by J B Gupta

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## 5. Course title- Installation and maintenance of electrical equipments

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1. Course code-EI- 604

2. Semester- Sixth

3. Rationale of the subject:-

Modern industries require highly skilled technicians/engineers basically expert in electrical installation, testing, and commissioning the different electrical machines/equipments. This syllabus has been designed to provide certain guidelines and principles regarding the above activities. Appropriate field trips will reinforce the learning.

4. Aim:-

- A. This is technology level subject with application in industry, commercial, public utility departments such as Electricity Board etc.
- B. After studying this subject, students will be able to inspect, test, install, commission and locate the fault of electrical machines as per IS.

5. Objectives:-

The student will be able to:

- A. Know safety measures and state safety precautions
- B. Test single phase, three phase transformer, DC & AC machine as per IS.
- C. Identify/Locate common troubles in electrical machines & switch gear.
- D. Plan & carry out routine & preventive maintenance.
- E. Install LV switchgear & maintain it.
- F. Ascertain the condition of insulation & varnishing if necessary
- G. Identify faults & measures to repair faults.

COURSE OUTCOMES :-

- CO604.1 - To enable one to apply the knowledge of safety measures and safety precautions in electrical field.
- CO604.2 -To enable one to apply the knowledge of testing of single phase, three phase transformer, DC & AC machine as per IS.
- CO604.3- To enable one to identify/locate common troubles in electrical machines & switch gear.
- CO604.4-To enable one to plan & carry out routine & preventive maintenance of different transformers, substations, etc.
- CO604.5-To enable one to install different types of rotating machines, transformers, switchgear, etc.

- CO604.6-To enable one to identify faults & measures to repair faults.

## 6 Pre requisite:-

- knowledge of basic electrical engineering
- Knowledge of electrical equipments

## 7. Teaching scheme (in hours)

Lecture	Tutorial	Practical	Total
3 hrs/week	1 hr		4 hrs

## 8 .Examination Scheme:

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

## 9. Detailed Course Content

Chapter no.	Chapter Title	Content	Duration (Hours)
1.	Tools and Accessories	Tools, accessories and instruments required for installation, maintenance and repair works, safety codes	02
2	Installation	Inspection procedure of machine/transformer on arrival and before installation, storage Basics of civil foundation of heavy electrical equipments ,installation procedure of rotating machine/equipments, method of drying out of machines,	04
3	Commissioning	Test required before Commissioning of electrical machines a. Mechanical fixture and alignment b. Electrical Tests c. Initial Precaution for Starting or charging	05
4	Earthing	Necessity of earthing, types of earthing, earth electrode,	

		permissible earth resistance, improvement of earth resistance, double earthing, measurement of earth resistance.	05
5	Testing and maintenance of insulation	Instruments used for measuring insulation resistance ,reason for deterioration of insulation resistance ,polarization index ,properties of good insulating oil, filtration of insulating oil, testing of insulating oil a)acidity test b) sludge test c)crackle test d)flash point test . Measurement of internal temperature of winding and vacuum impregnation.	08
6	Maintenance	Types of maintenance, advantages of preventive maintenance , preventive maintenance schedule of transformer, induction motor, transmission line, circuit breaker, underground cable	08
7	Trouble shooting	Trouble shooting, Procedure for analysis of trouble shooting, causes of faults in electrical equipments, common fault in domestic electrical appliances, troubleshooting chart for DC and AC machines, remedial measures to be taken.	05
8	Electrical accidents and safety measures	Causes and effects of and electrical accidents, factors affecting the severity of electric shock, awareness of safety measures , Indian electricity rule-1956, treatment of electric shock, method of artificial respiration, electric safety tools and equipments, classification of fires, firefighting equipments, and application,	05
9	Class test		03

## 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	Tools and accessories	2	5	5	2		1	
2	Installation	4	10	10	8			
3	Commissioning	5	12	12	8	1	1	
4	Earthing	5	12	12	7	1		
5	Testing and maintenance of insulation	8	19	19	8	2	4	
6	Maintenance	8	19	19	9	2	3	
7	Trouble shooting	5	11	11	5	1		
8	Electrical accidents & safety measures	5	12	12	5	1	1	
	Total	42	100	100	52	8	10	
	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	Tools and accessories			1	1	2				2					
2	Installation	2			2	2				2	4				4
3	Commissioning	2	1	1	4	2				2	4				4
4	Earthing	2	1		3						5				5
5	Testing & maintenance of insulation	2	2	1	5	2				2	4		3		7
6	Maintenance	2	2	1	5	2		2		4	5				5
7	Trouble shooting	1	1		2						4				4
8	Electrical accidents and safety measures	1	1	1	3						4				4
	Total				25					12					33

## 12. Suggested implementation strategies—

This subject needs theoretical and practical inputs. Demonstration at actual site may be arranged for conceptual understanding. The student should be taken to actual workplace and explained various test procedures.

## 13. Suggested learning Resources:

1. Testing, commissioning, operation & maintenance of electrical equipment-S. Rao, Khanna Pub
2. Installation commissioning & maintenance of electrical equipments –Tarlok Singh
3. Operation and maintenance of electrical equipment vol. 1-2—B.S Rao
4. Electrical installation and fault location –McMillan, London

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## 6. Project works for Six Semester.

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Code No. Project , Seminar =El – 611

GV= El-612

Total Marks for project , Seminar & GV = 200

Project viva / presentation = 50

General Viva =50

Project assessment: 100

Pass Marks = 66/200

### **S/No Title of the project**

1. Fabrication of Automatic Star-delta Starter
2. Erection/Installation & commissioning of rating electrical machines with panel board fittings.
3. Energy audit for the workshop of your institution and to suggest remedies to have low electricity bill.
4. To survey the load of given area in a village or small colony or institute, calculate the effective load and find out the sizes of the cables/conductors and rating of the transformer for the proposed distribution system.
5. To prepare a proposal for substation of your institute, calculating the total load
6. S.C.R. operated illumination controller.
7. S.C.R. based or automatic speed controller for D.C./ A.C motor.
8. Project relating to microprocessor/microcontroller.
9. Project relating to solar energy or other non conventional energy.
10. Project relating to electrical Machines.

**Suggestion:** 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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## 7. PROFESSIONAL SKILL-IV

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6<sup>TH</sup> semester, Electrical Engineering

CODE NO: EL-610

TEACHING SCHEME:

Theory: 1hr/week

Practical: 2hrs/week

Credit: 2

EXAMINATION SCHEME:

Practical assessment: 25 marks

Practical test: 25 marks

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:-
- Acquire information from different sources.
  - Prepare notes for given topic.
  - Presentation on given topic in a seminar.
  - Interact with peers to share thoughts.
  - 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. (Any ONE)

- Visit to nearest hydro / thermal generating station for operation & maintenance.
- Visit to grid substation for transmission and distribution of power and observe the maintenances of circuit breaker and relays, power transformer.
- Local electrical equipments manufacturing company.
- Visit to locomotive traction substation.



2. Guest lecturers from field / industry / professional. (Any TWO) ----6hrs
- a. Smart grid substation.
  - b. Protection of 3-phase induction motor and submersible pump from single phasing.
  - c. Substation protection
  - d. SCADA communication protocol.
  - e. CAD of electrical machine parts.

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

3. Group discussion: - Any two topics by each group of 4-5 students. -10hrs
- a. Load shading and remedial measures.
  - b. Disaster management
  - c. Advantages and disadvantages of big dam for power generation in NE region
  - d. Transmission and distribution system in NE region.
  - e. Power Losses in transmission and distribution system
4. Information search: - (Any TWO) ----4 hrs
- a. Smart feeder
  - b. Gas insulated transmission line
  - c. Smart grid substation.
  - d. PLC in operation of electrical devices.
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. Load survey on nearby area for electrification.
  - d. Repairing of any 1-phase / 3-phase motor.

#### 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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