

**K. S. R. M. COLLEGE OF ENGINEERING (AUTONOMOUS) KADAPA**  
**Course Structure for B. Tech (Regular) (2015-16)**  
**ELECTRICAL AND ELECTRONICS ENGINEERING (E.E.E)**

**B. Tech - I Sem**

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1521101	Mathematics-I	BS	3	1	0	30	70	3
2	1521102	Mathematics-II	BS	3	1	0	30	70	3
3	1503103	Engineering Graphics	BS	1	0	3	30	70	3
4	1524104	English - I	BS	4	0	0	30	70	3
5	1505105	Programming in C	ED	3	1	0	30	70	3
6	1501106	Environmental Studies	HS	4	0	0	30	70	3
7	1505107	Programming in C Lab	ED	0	0	3	50	50	2
8	1599108	Engineering Workshop	ED	0	0	3	50	50	2
Total				18	03	09	280	520	22

**B. Tech - II Sem**

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1522201	Engineering Physics	BS	3	1	0	30	70	3
2	1521202	Mathematics-III	BS	3	1	0	30	70	3
3	1523203	Engineering Chemistry	BS	3	1	0	30	70	3
4	1524204	English - II	HS	4	0	0	30	70	3
5	1502205	Electrical Circuits	PJ	3	1	0	30	70	3
6	1525206	Human Values & Professional Ethics	HS	4	0	0	30	70	3
7	1524207	English Language and Communication Skills Lab	HS	0	0	3	30	70	2
8	1599208	Physics & Chemistry Lab	BS	0	0	3	50	50	2
Total				18	04	6	280	520	22

### B. Tech – III Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1521301	Mathematics-IV	BS	3	1	0	30	70	3
2	1511302	Fluid Mechanics & Hydraulic Machinery	PN	4	0	0	30	70	3
3	1504303	Electronic Devices and Circuits	PJ	4	0	0	30	70	3
4	1502304	Electromagnetic Fields	PJ	3	1	0	30	70	3
5	1502305	Network Theory	PJ	3	1	0	30	70	3
6	1502306	Electrical Machines - I	PJ	3	1	0	30	70	3
7	1511307	Fluid Mechanics & Hydraulic Machinery Lab	PN	0	0	3	50	50	2
8	1502308	Electrical Circuits and Simulation Lab	PJ	0	0	3	50	50	2
Total				20	04	06	280	520	22

### B. Tech – IV Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1514401	Analog Electronic Circuits	PJ	3	1	0	30	70	3
2	1504402	Switching Theory & Logic Design	PJ	3	1	0	30	70	3
3	1502403	Generation of Electrical Power	PJ	3	1	0	30	70	3
4	1502404	Electrical & Electronics Measurements	PJ	3	1	0	30	70	3
5	1502405	Electrical Machines - II	PJ	3	1	0	30	70	3
6	1502406	Power Systems - I	PJ	3	1	0	30	70	3
7	1514407	Electronic Devices and Circuits Lab	PJ	0	0	3	50	50	2
8	1502408	Electrical Machines – I Lab	PJ	0	0	3	50	50	2
Total				18	06	06	280	520	22

## B. Tech – V Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1525501	Managerial Economics And Financial Analysis	HS	3	1	0	30	70	3
2	1502502	Control Systems	PJ	3	1	0	30	70	3
3	1502503	Power Electronics	PJ	3	1	0	30	70	3
4	1502504	Power Systems - II	PJ	3	1	0	30	70	3
5	1502505	Electrical Machines - III	PJ	3	1	0	30	70	3
6	1502506	<b>MOOC I</b>	PJ	3	1	0	30	70	3
7	1502507	Electrical Measurements Lab	PJ	0	0	3	50	50	2
8	1502508	Electrical Machines – II Lab	PJ	0	0	3	50	50	2
Total				18	06	06	280	520	22

## B. Tech – VI Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1514601	Linear & Digital Integrated Circuit Analysis	PJ	3	1	0	30	70	3
2	1514602	Micro Processors & Microcontrollers	PJ	3	1	0	30	70	3
3	1502603	Power Semiconductor Drives	PJ	3	1	0	30	70	3
4	1502603	Power Systems - III	PJ	3	1	0	30	70	3
5	1502604	Power System Operation & Control	PJ	4	0	0	30	70	3
6	1502605	<b>MOOC- II</b>	PJ	4	0	0	30	70	3
7	1524606	Advanced English communication Lab(Audit Course)	HS	0	0	3	50*	-	-
8	1502607	Power Electronics & Simulation Lab	PJ	0	0	3	50	50	2
9	1502608	Control Systems & Simulation Lab	PJ	0	0	3	50	50	2
Total				19	05	09	280	520	22

### B. Tech – VII Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1525701	Management Science	HS	3	1	0	30	70	3
2	1502702	Advanced Control Systems	PJ	3	1	0	30	70	3
3	1502703	HVDC Transmission	PJ	3	1	0	30	70	3
4	1502704	Switch Gear & Protection	PJ	3	1	0	30	70	3
5	1502705	Electrical Distribution Systems	PJ	3	1	0	30	70	3
		<b>CBCC-I</b>							
6	1502706	High Voltage Engineering	PJ	3	1	0	30	70	3
	1502707	Principles of Power Quality	PJ	3	1	0	30	70	3
	1502708	Reliability Engineering & Applications to Power Systems	PJ	3	1	0	30	70	3
7	1514709	Micro Processors & Micro Controllers Lab	PJ	0	0	3	50	50	2
8	1502710	Power Systems Simulation Lab	PJ	0	0	3	50	50	2
Total				20	06	06	280	520	22

### B. Tech – VIII Semester

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1	1502801	Utilization of Electrical Power	PJ	3	1	0	30	70	3
2	1502802	FACTS	PJ	3	1	0	30	70	3
3	1502803	Energy Auditing and Demand Side Management	PJ	3	1	0	30	70	3
		<b>CBCC-II</b>							
4	1502804	Special Electrical Machines	PJ	3	1	0	30	70	3
	1502805	Switch Mode Power Converters	PJ	3	1	0	30	70	3
	1502806	Electrical Machine Design	PJ	3	1	0	30	70	3
5	1502807	Seminar	PJ	0	0	-	50	-	2
6	1502808	Comprehensive Viva	PJ	0	0	-	50	-	2
7	1502809	Project Work	PJ	0	0	-	50	50	10
Total				12	4	0	270	330	26

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521101	BS	Mathematics-1	3	1	0	30	70	3

**Objectives:**

\* To make the students to understand differential equations and to make use these equations not only in mathematics but also in solving engineering problems.

\* To make the students to understand the importance of differential calculus double integrals and triple integrals.

**Unit I:** Differential equations of first order and first degree: Exact, Non exact, Linear and Bernoulli equations. Applications: Orthogonal trajectories, Newton's law of cooling, Law of natural growth and decay.

**Unit II:** Linear differential equations of second and higher order with constant coefficients and R.H.S term of the type  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x$ ,  $e^{ax} V(x)$ ,  $xV(x)$  - Method of variation of parameters.

**Unit III:** Simple examples of Taylor's and Maclaurin's series – Functions of two or more variables Jacobians – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**Unit IV:** Curvature: Curvature of a curve – Curvature of a circle – Radius of a curvature – Centre of Curvature – Equation to the circle of curvature. Curve tracing – Cartesian, polar and parametric curves.

**Unit V:** Multiple Integrals: Evaluation of double integrals in Cartesian coordinates, and polar coordinates - Change of variables in double integrals - Change the order of integration in double integrals - Evaluation of triple integrals in Cartesian and polar coordinates - Change of variables in triple integrals.

**Text Books:**

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publishers-42 edition.
2. Higher Engineering Mathematics, B.V. Ramana, Mc. Graw Hill Education (India) Pvt. Ltd

**Reference Books:**

1. Advanced Engineering Mathematics, Erwin Kreyszig, Willey Publications, 9<sup>th</sup> edition- 2013
2. Engineering Mathematics Volume-1, Dr. D.S Chandra Sekharaiah, Prism Books Pvt. Ltd.
3. Advanced Engineering Mathematics by N. Bali, M Goyal, Firewall Media 7<sup>th</sup> edition.
4. Engineering Mathematics, Volume – I & II, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher Ist Edition (2010).

**Outcomes:**

Students are able to understand and apply differential equations in solving hydro dynamics and fluid mechanics problems

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521102	BS	Mathematics-2	3	1	0	30	70	3

**Objectives:**

\* To make the students to understand Fourier series and apply them in solving problems.

\* To inculcate the concept of partial differential equations and its application to solve wave equation and heat equations.

\* To make the students to understand Laplace transforms and inverse Laplace transforms.

\* The students gain the knowledge about vector differentiation and vector integration.

**Unit I:** Vector calculus - Vector differentiation: Scalar point function - Vector point function -Vector operator Del – Gradient – Divergence - Curl . Vector integration: Line, Surface and Volume integrals .Green’s theorem in a plane, Stoke’s theorem and Gauss-divergence theorems (Statements only). Applications of Green’s , Stoke’s and Gauss divergence theorems.

**Unit II:** Laplace transforms of standard functions – Properties of Laplace Transforms - Transforms of derivatives and integrals- Evaluation of integrals by Laplace transforms – Unit step function – Second shifting theorem – Dirac’s delta function. Laplace transform of periodic functions.

**Unit III:** Convolution theorem. Inverse Laplace Transforms – Applications of Laplace transforms to ordinary differential equations.

**Unit IV:** Fourier series: Determination of Fourier coefficients - Fourier series - Even and odd functions - Fourier series in an arbitrary interval - Functions having points of discontinuity- Half range Fourier sine and cosine expansions.

**Unit V:** Partial Differential Equations: Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Method of separation of variables. Solution of one dimensional wave equation - Solution of one dimensional heat equation.

**Text Books:**

- 1..Higher Engineering Mathematics, Dr. B.SGrewal, Khanna Publishers-42 edition.
- 2.Higher Engineering Mathematics, B.V.Ramana, Mc. Graw Hill Education (India) Pvt. Ltd.

**Reference Books:**

5. Advanced Engineering Mathematics, Erwin Kreyszig, Willey Publications, 9<sup>th</sup> edition- 2013
6. Engineering Mathematics Volume -1, Dr. D.S Chandra Sekharaiah, Prism Books Pvt. Ltd.
7. Advanced Engineering Mathematics by N. Bali, M Goyal, Firewall Media 7<sup>th</sup> edition.
8. Engineering Mathematics, Volume – I & II , E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher Ist Edition (2010).
9. Fourier Series and Integral Transforms by Prof. S. Sreenadh, S. Ranganatham, Dr. M.V.S.S.N. Prasad, Dr. V. Ramesh Babu – S. Chand & Company Pvt. Ltd.

**Outcomes:**

- Students are able to apply Fourier series in harmonic analysis.
- Students are able to understand wave equation and heat equations and solve them by the method of separation of variables.
- Students are able to understand Laplace transforms and vector calculus concepts and their applications.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1503103	ED	Engineering Graphics	1	0	3	30	70	3

**COURSE OBJECTIVE:**

By studying the engineering drawing, a student becomes aware of how industry communicates technical information. Engineering drawing teaches the principles of accuracy and clarity in presenting the information necessary about objects.

- This course develops the engineering imagination i.e., so essential to a successful design. Learning techniques of engineering drawing changes the way one thinks about technical images.
- It is ideal to master the fundamentals of engineering drawing first and to later use these fundamentals for a particular application, such as computer aided drafting. Engineering Drawing

is the language of engineers and by studying this course, engineering students will eventually be able to prepare drawings of various objects being used in technology.

**UNIT-1:**

INTRODUCTION TO ENGINEERING DRAWING

Principles of Engineering Graphics and their significance- Drawing instruments and their use- Conventions in Drawing- Lettering- BIS Conventions.

Curves used in Engineering Practice: (a) Conic sections –General methods only  
(b) Cycloid, Epicycloids and Hypocycloid  
(c) Involute

**UNIT- II:** PROJECTION OF POINTS AND LINES: Principles of orthographic projection- conventions- First and Third angle projections. Projections of points, Lines inclined to one or both planes, Problems on projections, Finding True lengths & traces.

**UNIT- III:** PROJECTION OF PLANES: Projections of regular plane surfaces/figures, Projection of planes using auxiliary planes.

PROJECTIONS OF SOLIDS: Projections of regular solids inclined to one or both planes..

**UNIT- IV** SECTIONS OF SOLIDS: Section planes and sectional views of right regular solids- Prism, Cylinder, Pyramid and Cone. True shape of sections

**UNIT- V** ORTHOGRAPHIC PROJECTIONS: Conversion of isometric projections/views to Orthographic Views- Conventions.

TEXT BOOKS:

1. Engineering Drawing, N.D.Bhat, Charotar Publishers
2. Engineering Drawing, K.L. Narayana,P.Khanniah, Scitech Pub.
3. Engineering Drawing, Basant Agrawal,C.M.Agrawal, Tata McGraw-Hill

REFERENCES:

1. Engineering Drawing, Shah and Rana, 2/e,Pearson Education
2. Engineering Drawing,B.V.R. Guptha,J.K.Publishers
3. Engineering Drawing and Graphics, Venugopal, New age Publishers
4. Engineering Drawing, Johle, Tata McGraw-Hill

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1524104	HS	English-1	4	0	0	30	70	3

Objectives:

- To improve the language, proficiency of the students in English with an emphasis on LSRW Skills.
- To develop an awareness in the students about the significance of silent reading and comprehension.
- To equip the students to study academic subjects with greater facility through theoretical and practical components of the syllabus.
- To develop study skills as well as communication in formal and informal situations.
- To enable students to express themselves fluently and appropriately in social and professional contexts.

- To develop an awareness in the students about writing as an exact and formal skill.

#### UNIT – I

An Astrologer's day – R.K. Narayan  
 My struggle for an education – Booker T. Washington  
 Grammar – Identification and Interchange of parts of speech.

#### UNIT – II

Building A New State – Dr. A.P.J. Abdul Kalam  
 The Happy Prince – Oscar Wilde  
 Grammar – Reading comprehension

#### UNIT – III

The woodrose – Abburi Chayadevi  
 Mokshagundam Visveswaraiah – A Biography  
 Grammar – Vocabulary

#### UNIT – IV

Homi Jehangir Baba – A Biography  
 If – Rudyard Kipling  
 Grammar – Transformation sentences

#### UNIT – V

Remedial Grammar

#### Reference Books

1. Glossary of Grammatical Terms – Geogrey Leech
2. Practical English Usage – Michal Swan
3. English Grammar and Composition - Wren and Martin
4. Advanced English Grammar & Composition – M.P. Bhatia
5. English Improvement Course – Dhillon

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1505105	ED	Programming in C	3	1	0	30	70	3

#### Course Objectives:

- To understand the syntax and semantics of C programming language and other features of the language
- To learn logical skills for solving problems, implement them using C language

#### UNIT I

**Introduction to Computers:** Computer Systems, Computing Environment, Computer Languages, Creating and Running Programs, System Developments, Algorithms, Flowcharts.

**Introduction to the C Language:** Introduction, C programs, Identifiers, Types, Variables, Constants, Input and Output, Programming Examples.

#### UNIT II

**Structure of C program:** Expressions, Precedence and Associativity, Evaluating Expressions, Type Conversion, Statements, Sample Programs.

**Selections and Making Decisions:** Logical Data and Operators, Two-way Selection, Multiway Selection.



### UNIT III

**Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updation, Event and Counter Controller Loop, Loops in C, Looping Applications

**Functions:** Introduction, User Defined Functions, Inter-Function Communication, Standard Functions, Scope, Programming Examples.

### UNIT IV

**Arrays:** Introduction, Two Dimensional Arrays, Multi-Dimensional Arrays, Inter Function Communication, Array Applications, Exchange(Bubble) Sort, Binary Search, Linear Search.

**Strings:** String Concepts, C Strings, Sting Input/output Functions, Arrays of Strings, String Manipulation Functions, String/Data Conversion.

### UNIT V

**Enumerated, Structure, and Union Types:** The Type Definition, Enumerated Types, Structure, Unions, Programming Applications.

**Bitwise Operators:** Exact Size Integer Types, Logical Bitwise Operators, Shift Operators, Mask, Introduction to Pointers and File management.

#### TEXT BOOKS:

1. Computer Science, A Structured Programming Approach Using C, Behrouz A. Forouzan & Richard F. Gilberg, Third Edition, Cengage Learning
2. Programming in ANSI C, E. Balagurusamy, Fifth Edition, McGraw Hill.

#### REFERENCE BOOKS:

1. How to solve it by Computer by R.G. Dromey, Pearson
2. Computer Fundamentals and C Programming, Second Edition, Dr. P. Chenna Reddy.
3. Programming in C: A Practical Approach, Ajay Mittal, Pearson.
4. The C programming Language, B. W. Kernighan and Dennis M. Ritchi, Pearson Education.
5. Problem Solving and Programming Designs in C, J. R. Hanly and E.B. Koffman.,
6. Programming with C Rema Theraja, Oxford
7. Problem Solving with C, M.T.Somashekara, PHI
8. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press
9. Programming with C, R.S.Bickar, Universities Press

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1501106	HS	Environmental Studies	4	0	0	30	70	3

#### Unit I

Multidisciplinary nature of environmental studies: Definition, scope and importance – Need for public awareness; Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems; (a) Forest resources – Use and over-exploitation, deforestation, case studies – Timber extraction, mining, dams and their effects on forest and tribal people; (b) Water resources – Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems; (c) Mineral resources – Use and exploitation, environmental effects of extracting and using mineral resources, case studies; (d) Food resources : World food problems, changes caused by agriculture and

overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies; (e) Energy resources – Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies; (f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; equitable use of resources for sustainable lifestyles

#### Unit II

Ecosystems: Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystems (a) Forest ecosystem, (b) Grassland ecosystem, (c) Desert ecosystem, (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

#### Unit III

Biodiversity and its conservation: Introduction – Definition : genetic, species and ecosystem diversity; Biogeographical classification of India; Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity

#### Unit IV

Environmental Pollution: Definition – Cause, effects and control measures of (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution, (g). Nuclear hazards; Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides

#### Unit V

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns; • Environmental ethics : Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies; Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness

Human Population and the Environment: Population growth, variation among nations – Population explosion – Family Welfare Programme; Environment and human health; Human Rights; Value Education; HIV/AIDS; Women and Child Welfare; Role of Information Technology in Environment and human health, case studies; Field work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain - Visit to a local polluted site-Urban/Rural/Industrial/Agricultural; Study of common plants, insects, birds; Study of simple ecosystems-pond, river, hill slopes, etc.

#### TEXTBOOKS:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Benny Joseph, Mc. Graw Hill Publications.
3. Principles and a basic course of Environmental science for under graduate course by Kousic, KouShic.
4. Text book of Environmental Sciences and Technology by M.AnjiReddy, BS Publication.

REFERENCES:

1. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
2. Environmental Studies by AninditaBasak – Pearson education
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1505107	ED	Programming in C Lab	0	0	3	50	50	2

Objectives:

- To make the student learn C Programming language.
- To make the students solve problems, implement them using C language.

The Student is expected to solve at least 12 assignments from different concepts (every year 12 different experiments).

SAMPLE LIST OF EXPERIMENTS:

1. Practice DOS/LINUX commands necessary for design of C programs.
2. Write, edit, debug, compile and execute sample C programs to understand the programming environment.
3. a) Write a C program to find the sum of the individual digits of a given number.  
b) Write a C program to check whether a given number is a palindrome or not.
4. a) Write a C program to generate & print first n terms of the Fibonacci sequence.  
b) Write a C program to find the roots of a quadratic equation.
5. a) Write a C program to compute the factorial of a given number.  
b) Write a C program to generate all the prime numbers within a given range
6. a) Write a C program to generate PASCAL triangle.  
b) Write a C program to find the GCD of two integers.
7. a) Write a C program to evaluate the function Sin(x) as defined by the infinite series expression.

$$\sin(x) = \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

- b) Write a C program to find the square root of a given number.
8. a) Write a C program to find both smallest and largest number in a list of integers.  
b) Write a C program to perform multiplication of two matrices.
9. Write a C program to read a matrix and perform the following operations.
  - i) Print transpose of a matrix.
  - ii) Removal of duplicates from an ordered array.
10. a) Write a C program to perform arithmetic operations using functions.  
b) Write a C program to find the factorial of a given number using recursive function.
11. a) Write a C program to count the number of vowels, constants, blank spaces, digits and special characters in a given string.

- b) Write a C program to check whether a given string is palindrome or not.
12. Write a C program to read two strings and perform the following operations without using built-in string library functions.
- String length determination.
  - Comparison of two strings.
  - Concentration of two strings.
  - String reversing.
12. Write a C program to define a structure with the following members.

Roll No., Name, marks in Sub1, Sub2, Sub3. Read the n students records and find the total marks of each student and print the result in the following format.

Roll No.	Name	Sub1	Sub2	Sub3	Total Marks	Result
1234	XXX	40	50	90	180	Distinction

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1599108	ED	Engineering Workshop	0	0	3	50	50	2

### PART A – Engineering Workshop

Objectives: The budding Engineer may turn out to be a technologist, scientist, entrepreneur, practitioner, consultant etc. There is a need to equip the engineer with the knowledge of common and newer engineering materials as well as shop practices to fabricate, manufacture or work with materials. Essentially he should know the labor involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work. Hence engineering workshop practice is included to introduce some common shop practices and on hand experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students.

#### 1. TRADES FOR EXERCISES:

- Carpentry shop– Two joints (exercises) involving tenon and mortising, groove and tongue: Making middle lap T joint, cross lap joint, mortise and tenon T joint, Bridle T joint from out of 300 x 40 x 25 mm soft wood stock
- Fitting shop– Two joints (exercises) from: square joint, V joint, half round joint or dove tail joint out of 100 x 50 x 5 mm M.S. stock
- Sheet metal shop– Two jobs (exercises) from: Tray, cylinder, hopper or funnel from out of 22 or 20 guage G.I. sheet
- House-wiring– Two jobs (exercises) from: wiring for ceiling rose and two lamps (bulbs) with independent switch controls with or without looping, wiring for stair case lamp, wiring for a water pump with single phase starter.
- Foundry– Preparation of two moulds (exercises): for a single pattern and a double pattern.
- Welding – Preparation of two welds (exercises): single V butt joint, lap joint, double V butt joint or T fillet joint

#### REFERENCE BOOKS:

1. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
2. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas
3. Dictionary of Mechanical Engineering, GHF Nayler, Jaico Publishing House

## **PART B – IT Workshop**

### **Course Objectives:**

- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations.
- To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system.
- To learn about Networking of computers.

**Task 1: Learn about Computer:** Identify the internal parts of a computer, and its peripherals.

Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

**Task 2: Assembling a Computer:** Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.

**Task 3: Install Operating System:** Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process. Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

**Task 4: Networking:** Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimping activity, logical configuration etc should be done by the student. The entire process has to be documented.

**Task 5: Word Processor:** Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered.

**Task 6: Presentations:** creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting

text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

**REFERENCE BOOKS:**

1. 1. Introduction to Computers, Peter Norton, Mc Graw Hill.
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams”, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI.
5. Trouble shooting, Maintaining & Repairing PCs”, Bigelows, TMH

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1522201	BS	Engineering Physics	3	1	0	30	70	3

Course Objective:

- To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications.
- To enlighten the periodic arrangement of atoms in crystals, direction of Bragg planes, crystal structure determination by X-rays and also to know the role of ultrasonic's in non-destructive testing..
- To get an insight into the microscopic meaning of conductivity , classical and quantum free electron model, the effect of periodic potential on electron motion, evolution of band theory to distinguish materials and to understand electron transport mechanism in solids.
- To open new avenues of knowledge and understanding on semiconductor based electronic devices, basic concepts and applications of semiconductor and magnetic materials have been introduced which find potential in the emerging micro device applications.
- To give an impetus on the subtle mechanism of superconductors in terms of conduction of electron pairs using BCS theory, different properties exhibited by them and their fascinating applications. Considering the significance of microminiaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterials, their synthesis, properties and applications in modern emerging technologies are elicited.

#### UNIT – 1: PHYSICAL OPTICS, LASERS AND FIBRE OPTICS

PHYSICAL OPTICS :- Interference, Interference in thin films by reflection – Newton's Rings-Fraunhofer diffraction due to single slit, double slit and diffraction grating.

LASERS:- Introduction –characteristics of laser-Spontaneous and stimulated emission of radiation-Einstein's coefficients-population inversion – Excitation mechanisms and optical resonator-NDYAG laser – He-Ne laser- Application of lasers.

FIBER OPTICS:- Introduction-Construction and working principle of optical fiber-Numerical aperture and acceptance angle- Types of optical fibers- Block diagram of Optical fiber communication system- Applications of optical fibers.

#### UNIT – 2: CRYSTALLOGRAPHY AND ULTRASONICS

CRYSTALLOGRAPHY:- Introduction –Space lattice –unit Cell lattice parameters- Bravais lattice – Crystal systems- Packing fractions of SC, BCC and FCC – Directions and planes in Crystals – Miller indices – InterPlanar spacing in cubic crystal – X-ray diffraction – Bragg's law powder method.

ULTRASONICS:- introduction- production of ultrasonic's by piezoelectric method- properties and detection- applications in non –destructive testing.

#### UNIT-3: QUANTUM MECHANICS AND ELECTRON THEORY

QUANTUM MECHANICS: Introduction to matter waves – de'Broglie hypothesis – Schrodinger's time independent wave equation – Physical Significance of wave function – Particle in one dimensional infinite potential well .

ELECTRON THEORY: Classical free electron theory – Sources of electrical resistance – Equation for electrical conductivity – Quantum free electron theory – Fermi-Dirac distribution - Kronig-Penny model (qualitative) – Origin of bands in solids – Classification of solids in to conductors, semiconductors and insulators .

#### UNIT- 4: ENGINEERING MATERIALS

MAGNETIC MATERIALS:- Introduction and basic definitions- Origin of Magnetic moments- Bohr magneton- Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials- Hysteresis- Soft and hard magnetic materials and applications of magnetic materials.

SUPERCONDUCTORS: Introduction- effect of magnetic field-Meissner effect- Type I and Type II Superconductors- Flux quantization- London penetration depth- ac and dc Josephson effects- BCS theory(Qualitative)- Applications of superconductors.

#### UNIT- 5: PHYSICS OF SEMICONDUCTORS AND NANO MATERIALS

SEMICONDUCTOR PHYSICS: Introduction- Intrinsic and extrinsic semiconductors- Drift and diffusion currents and Einstein's equation- Hall effect- Direct and Indirect band gap semiconductors- Formation of P-n junction.

PHYSICS OF NANO-MATERIALS:- Introduction- Significance of Nano-scale and types of nano-materials- physical properties: optical, thermal, mechanical and magnetic properties- Synthesis of nano-materials: ball mill, chemical vapour deposition and sol-gel-Applications of nano-materials.

Text Books:

1. Engineering Physics by K. Thygarajan, Mac Graw – Hill Publishing Co. New Delhi.
2. Engineering Physics by P.K. Palanisamy, Scitech Publications.
3. Engineering Physics by S. Mani Naidu, Pearson edition.

Reference Books:

1. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish University Press, I Edition, 2009.
2. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning, I Edition, 2012
3. Engineering physics – M.N. Avadhanulu and P.G. KshirSagar, Chand and Co, Revised Edition, 2013.
4. Solid State Physics – A.J. Dekkar, McMillan Publishers, Latest edition, 2012.
5. Engineering Physics – Gaur and Gupta Dhanapati, Rai Publishers , 7<sup>th</sup> Edition, 1992.
6. Text book of Nanoscience and Nanotechnology: B S Murthy, P.Shankar, Baldev Raj B B Rath, James Murday, University Press, I Edition, 2012.

Outcome:

- The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fibre optics.
- The important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction are focused along with ultrasonic non-destructive technique.
- The discrepancies between the classical estimates and laboratory observations of physical properties exhibited by materials would be lifted through the understanding of quantum picture of subatomic world.
- The electronic and magnetic properties of materials were successfully explained by free electron theory and focused on the basis for the band theory.
- The properties and device applications of semiconducting and magnetic materials are illustrated.
- The importance of superconducting materials and nanomaterials along with their engineering applications are well elucidated.



Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521202	BS	Mathematics-3	3	1	0	30	70	3

**Objectives:**

\* This course aims at providing the students with the concepts of matrices and basics of linear algebra which will be useful in solving simultaneous linear equations.

\* Our emphasis will be more on logical and problem solving development in Numerical methods and their applications in solving Engineering problems when analytical methods fails.

**Unit I :** Matrices: – Rank – Echelon form – Normal form – Solution of linear system of equations: Consistency and inconsistency - Gauss elimination method – Eigen values, eigen vectors for real matrices – Cayley- Hamilton theorem – Inverse and powers of a matrix. Linear transformations – Orthogonal transformations.

**Unit II:** Solution of algebraic and transcendental equations – Bisection method - False - position method - Newton - Raphson method. Solution of System of equations: Crout's method- Gauss Seidel iteration method.

**Unit III:** Interpolation – Finite differences - Forward differences - Backward differences - Newton's forward and backward difference formulae for interpolation - Lagrange's formula for unequal intervals- Inverse interpolation. Curve fitting: Method of least squares- Fitting of a straight line, second degree and exponential curves.

**Unit IV:** Numerical differentiation: Finding first and second order derivatives using Newton's formulae. Numerical integration: Newton - Cote's quadrature formulae - Trapezoidal rule – Simpson's 1/3 rule – Simpson's 3/8 rule.

**Unit V:** Numerical solution of ordinary differential equations - Solution by Taylor's series –Picard's method of successive approximations –Euler's modified method - Runge - Kutta methods of second and fourth order – Milne's predictor - corrector method.

**Textbooks:**

1. Higher Engineering Mathematics, Dr. B.S.Grewal, Khanna Publishers-42 edition.
2. Introductory methods of Numerical Analysis, S.SSastry, 5<sup>th</sup> edition.

**References:**

1. Engineering Mathematics – III B, Dr. M.KVenkata Raman, 13<sup>th</sup> edition.
2. Higher Engineering Mathematics, B.VRamana, Mc. Graw Hill Education(India) Pvt. Limited.
3. Numerical Methods, S. Arumugam, A.Thangapandi Isaac, A. Soma Sundaram, Second edition, Scitech Publications (India) Pvt. Limited.
4. Advanced Engineering Mathematics, Erwin Kreyszig, Willey Publications, 9<sup>th</sup> edition- 2013.

**Outcomes:**

- Students are able to understand and Applied Matrix theory in solving Engineering Problems.
- Students are able to understand and applied numerical methods in solving simultaneous equations and transcendental equations

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1523203	BS	Engineering Chemistry	3	1	0	30	70	3

#### Objectives:

- Knowledge in Chemistry serves as basic nutrient for the understanding and thereby design of materials of importance in life. Thus the advancement in Engineering depend on the outcome of basic sciences.
- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial Engineering applications.
- The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry principles (or) applications in the field of engineering.
- An attempt has been made to logically correlate the topic with its application.

#### UNIT-I:

Water: Sources of water, types of impurities in water. Hardness of water: Causes, expression of hardness - units - Types of hardness-Temporary & permanent hardness of water. Disadvantages of hard water, Methods of treatment of water for domestic purpose Analysis of water : Hardness of water by EDTA method, Estimation of Dissolved oxygen by Winkler's method Numerical problems.

Boiler troubles - Scale & Sludge formation, caustic embrittlement, Boiler corrosion, priming & foaming. Softening of water -Internal Treatment: phosphate,colloidal,calgon,carbonate and sodium aluminate treatment, External treatment : Zeolite, Ion exchange process. Reverse osmosis, electro dialysis.

#### UNIT -II:

Polymers: Introduction, Types of Polymerization, Mechanism (chain growth & Step growth). Plastics: Thermoplastic resins & Thermo set resins. Compounding of plastics, Preparation, properties, engineering applications of polyethylene, Bakelite, Nylon, Teflon. Elastomers-Natural rubber, vulcanization, Compounding of rubber,

Synthetic Rubbers :Buna-S, Butyl rubber and Thiokol Rubbers.

Inorganic Polymers : Basic introduction, Preparation, properties and engineering applications of Silicones, Polyphosphazins(-(R)<sub>2</sub>-P=N-)

#### UNIT-III:

Electrochemistry: Basic concepts for construction of Electrochemical cells, Types of cells: Concentration cells, Galvanic cells. Electrochemical Series. Batteries- Primary (Laclanche cell) and Secondary Batteries (Lead acid cell) .Fuel cells-H<sub>2</sub>-O<sub>2</sub>,fuel cell and methanol- oxygen fuel cells.

Corrosion- Introduction, Types and Mechanism of Corrosion(Wet and Dry corrosion), factors influence corrosion, Control of Corrosion- Cathodic Protection(Sacrificial anodic protection & impressed current cathodic protection). Basic principles of Electroplating, Electroless plating.

#### UNIT-IV:

Fuel technology:

Fuels: Classification, Characteristics of good fuel. Solid fuels: Manufacture of Metallurgical coke by Otto Hoffmann's by product oven process. Liquid fuels – petroleum crude - refining of petroleum. Synthetic petrol: Bergius and Fischer Tropsech's process, Calorific value of fuels: HCV, LCV, determination of Calorific value of solid fuels(Bomb calorimetry).

Lubricants: Functions of lubricant, mechanism of lubrication(thick film, thin film& extreme pressure lubrication). Properties of lubricants: Viscosity, Flash & fire point,Cloud and pour point, Aniline point.

#### UNIT- V:

Advanced Chemistry:

Green Chemistry: Introduction , Significance of green chemistry, 12 principles of Green chemistry. .

Photo Chemistry: Introduction, Fluorescence, Phosphorescence, Luminiscent compounds, Solar cells  
 Catalysis: Introduction, Types of Catalysis(Homogenous& Heterogenous catalysis) Action of catalyst  
 (Catalytic promoters, Catalytic inhibitor and catalytic poisons) and applications of catalyst.

#### TEXTBOOKS

- 1 Text Book of Engineering Chemistry, Jain and Jain, DhanapathRai Publishing Company, New Delhi, 15th Edition, 2010.
- 2 Engineering Chemistry by Jayaveera, G.V. Subba Reddy, Tata McGraHill Publications, Edition 2013.
- 3 Text Book of Engineering Chemistry, Shashichawla, DhanapathRai Publications, New Delhi, 4th Edition, 2011.
- 4 Text Book of Engineering Chemistry by S.S. Dara&Mukkati S. Chand & Co Publishers, New Delhi, 2006.

#### REFERENCES

1. Text Book of Engineering Chemistry - C. Parameswara Murthy, C.V. Agarwal and Andra Naidu, BS Publications, Hyderabad, 3rd Edition, 2008.
2. Engineering Chemistry by K.B. Chandra Sekhar, UN. Das and Sujatha Mishra, SCITECH, Publications India Pvt. Limited, Chennai, 2nd Edition, 2012.
3. Chemistry of Engineering Materials by C.V. Agarwal, A. Naidu, BS publications.

EXPECTED OUTCOMES(EO) : The Student is expected to :

- Differentiate between hard and soft water.Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially.
- Understand the electrochemical sources of energy
- Understand industrially based polymers,various engineering materials.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1524204	HS	English-2	4	0	0	30	70	3

Objectives:

- To improve the language, proficiency of the students in English with an emphasis on LSRW Skills.
- To develop an awareness in the students about the significance of silent reading and comprehension.
- To equip the students to study academic subjects with greater facility through theoretical and practical components of the syllabus.
- To develop study skills as well as communication in formal and informal situations.
- To enable students to express themselves fluently and appropriately in social and professional contexts.
- To develop an awareness in the students about writing as an exact and formal skill.

UNIT – I

Phonetics & Transcription  
 Resume & Emails

UNIT – II

Dialogue Writing  
 Speech Making

UNIT – III

Paragraph Writing

## Precis Writing

### UNIT – IV

Group Discussion  
Interviews

### UNIT – V

Letter Writing  
Technical Report Writing

### Reference Books

1. Effective Technical Communication – M. Ashraf Rizvi, Tata McGraw-Hill
2. Speaking English Effectively – Krishna Mohan & N.P. Sing, Macmillan Publication
3. A Text Book of English Phonetics for Indian Students – T. Bala Subramanian, Trinity Press.
4. Communication with Confidence – Puspalatha, Oxford Publication
5. An approach to Communication Skills – Dhan Rajan
6. Business Correspondence and Report Writing – R.C. Sharma & Krishnamohan

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
11502205	PJ	Electrical Circuits (Common for EEE & ECE)	3	1	0	30	70	3

### Objectives

This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes single phase circuits, magnetic circuits, theorems, transient analysis and network topology.

#### UNIT – I

**Introduction to Electrical Circuits:** circuit concepts, classification of network elements, voltage & current sources; independent & dependent sources, source transformation techniques, R-L-C Parameters, Voltage - Current relationship for passive elements. Kirchhoff's laws, network reduction techniques – series, parallel, series parallel, Y/ $\Delta$ - Transformations, Mesh and Nodal analysis for D.C excitation.

#### UNIT – II

**Single Phase AC Circuits:** RMS, Average values, form factor, peak factor for different periodic waveforms, phase, phase difference, phasor notation, J-notation. Concept of Reactance, Impedance, Susceptance, and Admittance, Active & Reactive power, Power factor, power triangle. Response of R, L & C elements for Sinusoidal excitation, steady state analysis of RL, RC and R-L-C (Series, parallel, series parallel) Circuits for sinusoidal excitations, phasor diagram. Steady state analysis of A.C Circuits using mesh and nodal analysis.

#### UNIT – III

**Series and Parallel resonance:** Resonant frequency, Half Power frequency, Band width, Q- Factor, Relation between them, problems.

**Locus Diagrams:** Impedance & admittance locus diagrams of RL & RC Series circuits and two branch parallel circuits.

#### UNIT – IV

**Magnetic Circuits:** Concept of self & mutual inductances, Dot Convention, Problems, Coefficient of coupling, Composite Magnetic circuit, analysis of Series and Parallel Magnetic Circuits, Duality and dual Circuits, problems.

#### Unit – V

**Network Topology:** Definition – Graph, tree, Co-tree, Incidence Matrix, Tie-Set & Cut – Set Matrices for Planar networks, Formulation of equilibrium equations based on graph theory, problems.

### Text Books

1. Network Analysis – Van Valkenburg - 3<sup>rd</sup> edition, PHI.
2. Engineering Circuit Analysis – William H. Hayt –Jack E. Kimmerly – TMH

3. Fundamentals of Electric Circuits – Charles’s, Alexander & Mathew N.O. Sadiku, TMH 3<sup>rd</sup> Edition.
4. Electrical Circuits – N. Sreenivasulu – Reem Publications

#### References

1. Circuits & Networks – A. Sudhakar , Shayammohan.S. Pillai, 4<sup>th</sup> Edition – TMH.
2. Theory and Problems of Electrical Circuits – Joseph A. Edminister – Schaum Series, 1<sup>st</sup> Edition – TMH.
3. Network Analysis – N C Jagan & C. Lakshmi Narayana, BSP.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1525206	HS	Human Values and Professional Ethics	4	0	0	30	70	3

Course Objective:

- This course deals with professional ethics which includes moral issues and virtues, social responsibilities of an engineer, right qualities of moral leadership

#### UNIT - I : ENGINEERING ETHICS

Senses of Engineering Ethics – Variety of Moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg’s Theory – Consensus and Controversy – Professions and Professionalism – Professional ideals and virtues

#### UNIT – II : ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation – Engineers as Responsible Experimenters – Research Ethics – Codes of Ethics – Industrial Standards – A Balanced Outlook on Law – The Challenger Case Study

#### UNIT – III : ENGINEER’S RESPONSIBILITY FOR SAFETY

Safety and Risk – Assessment of Safety and Risk – Risk benefit Analysis – Reducing Risk – The Government Regulator’s Approach to Risk – Chernobyl Case and Bhopal Case studies.

#### UNIT – IV : RESPONSIBILITIES AND RIGHTS

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property (IPR) – Discrimination.

#### UNIT – V : GLOBAL ISSUES

Multinational Corporations – Business Ethics – Environmental Ethics – Computer Ethics – Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Leadership – Sample Code of conduct.

#### TEXT BOOKS :

1. Mike martin and Roland Schinzinger. “ Ethics in Engineering ”, McGrow Hill, New York 2005
2. Charles E Harris. Michael S Pritchard and Michael J Rabins. “ Engineering Ethics – Concepts and Cases ”, Thompson Learning 2000.

#### REFERENCE BOOKS :

1. Charles D Fleddermann, “ Engineering Ethics”, Prentice Hall, New Mexico, 1999.
2. John R Baatright. “Ethics and the Conduct of Business”, Pearson Education 2003.
3. Edmund G Seeabauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University press 2001.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “ Business Ethics – An Indian Perspective”, Biztantra, New Delhi, 2004.
5. David Ermann and Michele S Shauf, “ Computers, Ethics and Society”, Oxford University Press, 2003

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1524207	HS	English Language and Communication Skills Lab	0	0	3	50	50	2

**Objectives:**

- To improve the language, proficiency of the students in English with an emphasis on LSRW Skills.
- To develop an awareness in the students about the significance of silent reading and comprehension.
- To equip the students to study academic subjects with greater facility through theoretical and practical components of the syllabus.
- To develop study skills as well as communication in formal and informal situations.
- To enable students to express themselves fluently and appropriately in social and professional contexts.
- To develop an awareness in the students about writing as an exact and formal skill.

**LANGUAGE LAB**

1. Phonetics
2. Situational Dialogues
3. Telephonic Skills
4. Describing Objects / Situation / People and Places
5. Information Transfer
6. Idioms

**COMMUNICATION LAB**

1. Introducing oneself
2. JAM Session
3. Extempore / Elocution
4. Role-play
5. Debate
6. Group Discussion

**Suggested Software:** Walden & K-Van Solutions

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1599208	BS	Physics and Chemistry Lab	0	0	3	50	50	2

**PART A – ENGINEERING PHYSICS LAB**

Objectives:-

- To explore the application of interference and diffraction by doing concerned experiments.
- To understand the role of laser in various applications.
- To know the significance of fiber parameters in communication application.
- To understand the concept of energy gap, Hall effect, B-H curve, X-ray diffraction and synthesis of nano material by performing the experiments.

**LIST OF EXPERIMENTS**

Any 7 of the following experiments has to be performed in a semester:

1. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method.
2. Determination of dispersive power of the prism.
3. Determination of thickness of thin object by wedge method.
4. Determination of radius of curvature of lens by Newton's Rings.
5. Laser : Determination of wavelength using diffraction grating.
6. Determination of Numerical aperture and acceptance angle of an optical fiber.
7. Energy gap of a semiconductor using p-n junction diode.
8. Hall effect: Determination of mobility of charge carriers in semiconductor
9. Hysteresis: B-H curve
10. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method.
11. Determination of crystallite size using X-ray pattern (powder) by using Debye-Scherrer method.
12. Synthesis of nanomaterials by any convenient method.

Outcomes:-

- Students can aware of the application of interference, diffraction phenomena along with laser.

The basic concept of fiber parameters, energy gap, Hall effect, B-H curve, X ray diffraction technique, along with synthesis of nano-materials can be elucidated by the students

## **PART B – ENGINEERING CHEMISTRY LAB**

### OBJECTIVES

- The objective of the course is that the student will have exposure to various experimental skills which is very essential for an Engineering student.
- The experiments are selected from various areas of Chemistry like Conductometry, Polymers, Energy sources and water.
- Also the student is exposed to various tools like Analytical Balance, pH meter, Viscometer, Bomb calorimeter, etc.

### LIST OF EXPERIMENTS

Introduction to Lab - Analytical Balance, Molarity, Normality, Calculations, Glass wares.

1. Determination of total hardness of water by EDTA method.
2. Estimation of Dissolved Oxygen present in given water sample by Winkler's method
3. Determination of viscosity of oils by Redwood viscometer I.
4. Determination of viscosity of oils by Redwood viscometer II.
5. Determination of calorific value of fuel sample using Bomb Calorimetry.
6. Estimation of Iron by Diphenyl amine indicator.
7. Determination of Copper by EDTA method.
8. Conductometric titrations of Strong acid Vs Strong base (NaOH).
9. Colorimetric estimation of Manganese.
10. pHmeter calibration and measurement of pH of water and various other samples.

### REFERENCES

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et.al., Pearson Education, Sixth Edition, 2012.

2. Laboratory manual on Engineering Chemistry, Anupama Rajput, Dhanpat Rai & Co Publications.
3. Essentials of Experimental Engineering Chemistry, Shashichawla, Dhanpat Rai & Co Publications.

#### OUTCOME

The student is expected to learn from this laboratory course the concept of error and its analysis. It also allows the student to develop experimental skills to design new experiments in Engineering. With the exposure to these experiments the student can compare the theory and correlate with experiment



Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1521301	PN	Mathematics - IV	3	1	0	30	70	3

**Objectives:**

- To train the students in getting a thorough understanding of the fundamentals of special functions.
- To prepare students for lifelong learning and successful careers using analytic function, conformal mapping, complex integration and residues.

**UNIT I**

**Special Functions:** Beta function - Gamma function - Relation between Beta and Gamma functions and their properties. – Evaluation of improper integrals – Power series method.

**UNIT II**

Bessel functions – Solution of Bessel equation - Recurrence formulae for  $J_n(x)$  - Generating function for  $J_n(x)$  - Jacobi series – Orthogonality of Bessel functions - Legendre polynomials – Solution of Legendre’s equation – Legendre Polynomials - Rodrigue’s formula -Generating function for  $P_n(x)$  - Recurrence formulae for  $P_n(x)$  - Orthogonality of Legendre polynomials.

**UNIT III**

Functions of a complex variable – Limit – Continuity -Differentiability - Analytic function – Properties – Cauchy – Riemann equations in cartesian and polar coordinates - Harmonic and Conjugate harmonic functions. - Construction of analytic function using Milne - Thomson method. Applications to flow problems.

**UNIT IV**

Conformal Mapping: Some standard transforms – translation, rotation, magnification, inversion and reflection. Bilinear transformation –invariant points. Special conformal transformations  $w = e^z$ ,  $z^2$ ,  $\sin z$  and  $\cos z$ . Complex integration: Line integral - Evaluation along a path and by indefinite integration - Cauchy’s theorem - Cauchy’s integral formula - Generalized integral formula.

**UNIT V**

Singular point – Isolated singular point – Simple pole, Pole of order  $m$  - Essential singularity.

Residues: Evaluation of residues by formula. Cauchy’s residue theorem - Evaluation of the real definite integrals of the type (i) Integration around the unit circle  $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$  (ii) integration around a small semi circle  $\int_{-\infty}^{\infty} f(x)dx$

**Text Books:**

3. Higher Engineering Mathematics by Dr. B.S Grewal, Khanna Publishers-43 edition.
4. Advanced Engineering Mathematics by Erwin Kreyszig, Willey Publications, 9<sup>th</sup> edition.
5. Higher Engineering Mathematics by B.V.Ramana, Mc.Graw Hill Education(India) Private Limited.

**Reference Books:**

10. Advanced Mathematics for Engineers and Scientists by B. Rama Bhupal Reddy and K.V. Nageswara Reddy, Research India Publications.
11. Advanced Engineering Mathematics by N. Bali, M Goyal, Firewall Media 7<sup>th</sup> edition.

12. Engineering Mathematics, Volume – III , E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.

**Out comes:**

- The students become familiar with the application of special functions and complex variables to engineering and Industrial problems.
- The students will be able to use Complex Analysis to analyze, formulate and solve the problems in engineering applications.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1511302	PN	Fluid Mechanics & Hydraulic Machinery	3	1	0	30	70	3

**UNIT-I**

**Introduction :**Dimensions and units – physical properties of fluids, specific gravity, viscosity, surface and capillarity, vapor pressure and their influence on fluid motion. Newtonian and Non-Newtonian fluids. Fluid Pressure at a Point; Pascal’s law, Hydrostatic law, Atmospheric, Absolute and gauge pressure; Hydrostatic paradox, Pressure measurement manometers; Simple, differential and Micro Manometers

**Kinematics Of fluid Motion:** Methods of describing fluid motion; Classification of flow; Steady, unsteady, uniform and non – uniform flows: Laminar and turbulent flows: Three, two and one dimensional flows; Irrotational and rotational flows; Streamline; Pathline; Streakline; Equation for acceleration; Convective acceleration; Local acceleration; Continuity equation; Velocity potential and stream function; Flownet.

**UNIT-II**

**Dynamics Of Fluid Flow:** Forces acting on a Fluid in Motion; Euler’s equation of motion; Bernoulli’s equation; energy correction factor; Momentum Principle; force exerted on a pipe bend. Discharge through Venturi Meter; Discharge through Orifice Meter; Discharge through flow nozzle; Measurement of velocity by Pitot tube, pitot – static tube.

**Closed Conduit Flow:** Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length; Hydraulic power transmission through a pipe; Siphon; Pipes in series, parallel & branched pipes.

**UNIT-III**

**Basics of turbo Machinery:** Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency – Angular momentum principle, Torque and head transferred in roto dynamic machines.

**Hydraulic Turbines – I:** Introduction, head and efficiencies of hydraulic turbines, Classification of turbines; pelton wheel: parts, Velocity triangles, work done and efficiency, working proportions, design of pelton wheel. Radial flow reaction turbines:

velocity triangles and work done for inward radial flow turbine, degree of reaction, discharge, speed ratio, flow ratio.

#### **UNIT- IV**

**Hydraulic Turbines –II:** Francis turbine: main components and working, work done and efficiencies, design proportions; design of Francis turbine runner. Kaplan turbine: main components and working, working proportions. Draft tube: theory and efficiency; specific speed, unit quantities, characteristic curves of hydraulic turbines. Cavitation: causes, effects.

**Centrifugal Pumps:** Introduction, component parts and working of a centrifugal pump, work done by the impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; limitation of suction lift, net positive suction head (NPSH); Performance and characteristic curves; Cavitation effects; Multistage centrifugal pumps; troubles and remedies.

#### **UNIT- V**

**Hydro Electric Power Station:** Development of hydro power in Andhra Pradesh and India; Classification of hydel plants – runoff river plants, storage plants and pumped storage plants; low, medium and high head schemes; Investigation and planning; components of hydel schemes – fore bay, intake structure, surge tanks, penstocks, power house, turbines – selection of suitable type of turbine, Scroll casing, draft tube and tail race; assessment of available power; definition of gross head, operating head, effective head; hydrographs, Flow duration curve; Power; installed capacity, dependable capacity; firm power, secondary power; power factor; load factor, capacity factor, utilization factor and Diversity factor.

#### **Text Books**

1. Hydraulics & Fluid Mechanics by P. N. Modi & S. N. Seth; Standard Book house, New Delhi
2. Fluid Mechanics & Hydraulic Machines by Dr. R. K. Bansal; Laxmi Publications, New Delhi.

#### **Reference Books:**

1. Hydraulic Machines by Jagadish Lal, Metropolitan.
2. Fluid Mechanics by A. K. Jain; Khanna Publishers, Delhi.
3. Fluid Mechanics & Fluid Machines by Rajput, S.Chand &Co.
4. Fluid Mechanics & Fluid Power Engineering by D.S. Kumar Kataria & Sons.
5. Fluid Mechanics, Hydraulics and Hydraulic Machines by K R Arora, Standard Publishers.
6. Engineering Fluid Mechanics by Kumar K.L., Eurasia Publishing House (P) Ltd., New Delhi.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504303	PJ	Electronic Devices & Circuits (Common to EEE & ECE)	3	1	0	30	70	3

#### Course Objectives:

- To understand electronic devices, including diodes, bipolar junction transistors and FET.
- To understand basic circuits of the electronic devices.

#### Learning Outcomes:

- Gain practical knowledge of the principles of operation and characteristics of pn Junction diodes, Zener diodes, Photodiode and Phototransistor.
- Able to analyze and design pn Junction diode Rectifier circuits.
- Able to design BJT & FET Amplifiers and analyze their frequency response
- Demonstrate the knowledge in LED, SCR and UJT in future applications

#### UNIT-I

**Semiconductors:** Intrinsic and extrinsic semiconductors, mobility and conductivity, Fermi level and carrier concentration of semi conductors, Drift and diffusion currents, continuity equation, Hall effect.

**PN junction diode:** Construction and operation of PN Junction diode, V-I Characteristics, Temperature Dependence, Static and dynamic resistance, Transition and Diffusion Capacitance, Zener diode and photo diode.

#### UNIT-II

**Rectifiers:** Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics.

#### UNIT-III

**Bipolar Junction Transistors:** NPN and PNP junction Transistors, Current components, CB, CE and CC Configurations and their Input and Output Characteristics, Comparison of CE, CC and CB, Saturation, Cutoff and Active Region,  $\alpha$ ,  $\beta$  and  $\gamma$  Parameters and the relation between them.

#### UNIT-IV

**Field Effect Transistor (FET):** JFET and its characteristics, Pinch off Voltage, Drain Saturation Current, MOSFET-Enhancement and Depletion Modes, Small signal models of FET, Biasing of FETs.

#### UNIT-V

**Transistor Biasing Circuits:** Various Biasing Circuits, Thermal Runaway, Stabilization and compensation, Thermal Stability, Transistor as an Amplifier.

**Special Semiconductor Devices:** Tunnel Diode, LED, Schottky Barrier Diode, Varactor Diode, Photo transistor, Uni- Junction transistor (UJT), SCR, LDR, .

**Text Books:**

1. Jacob Millman and C. Halkias, "Electronic devices and circuits", McGraw Hill.
2. Jacob Millman and C. Halkias, "Integrated Electronics Analog Digital Circuits", McGraw Hill.
3. R.L. Boylestad, "Electronic Devices and Circuit Theory", Prentice Hall Publications.
4. N.Salivahanan, and N.Suresh Kumar, "Electronic Devices and Circuits", TMH ,3rd Edition, 2012.

**Reference Books:**

1. David A. Bell, "Electronic Devices and Circuits", Oxford University press , 5<sup>th</sup> Edition, 2008.
2. K. Lal Kishore, "Electronic Devices and Circuits", BSP. 2<sup>nd</sup> Edition, 2005
3. S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press, 5<sup>th</sup> Edition.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502304	PJ	Electromagnetic Fields	3	1	0	30	70	3

**Prerequisite(S):** Engineering Mathematics and Physics

**Objective:**

The objective of this course is to introduce the concepts of electric fields and magnetic fields and their applications which will be utilized in the development of the theory of power transmission lines and electrical machines.

**Course Outcomes:** on successful completion of the course, student will be able to

1. demonstrate knowledge on:
  - Electro Static and Magnetic Fields due to electric charges and Steady Currents
  - Time varying electric and magnetic fields
2. Analyze the Maxwell's equations for both time variant and invariant electric and magnetic fields.
3. Evaluate
  - Electric field by Coulomb's Law and Electric field and Capacitance by applying Gauss's law.
  - Magnetic field and inductance by applying Ampere's circuital law.
4. Apply various laws of electromagnetic to study the performance of electric machines.

**UNIT - I**

**Electrostatic Fields:** Coulomb's law, Electric Field Intensity (EFI), EFI due to a line charge, surface charge and volume charge. Work done in moving a point charge in an

electric field. Gauss's Law, Gauss law using Infinite line charge and co-axial cable, Gauss Law in point form (Maxwell First Law,  $\text{div}(\mathbf{D}) = \rho_v$ ), Electric potential, potential gradient Electric Dipole, Dipole Moment – Potential & EFI due to an electric dipole.

#### **UNIT- II**

**Conductors & Dielectrics:** Current and current density, Conduction and Convection Current Densities, Continuity Equation, Behavior of conductors in electric fields, Ohm's Law in point form, Dielectric, Polarization, Boundary Conditions – Dielectric -conductor, Dielectric - Dielectric. Capacitance – Capacitance of parallel plate, Spherical and Co-axial Capacitors.

#### **UNIT - III**

**Magneto static Fields:** Biot-Savart's law, MFI due to a straight current carrying filament, circular, square and solenoid current carrying wire. Maxwell's second equation ( $\nabla \cdot \mathbf{B} = 0$ ), Ampere's circuital law and its applications, Ampere's circuital law in point form, Maxwell third equation  $\nabla \times \mathbf{H} = \mathbf{J}$ , Scalar and Vector magnetic potential.

#### **UNIT - IV**

**Magnetic Field in Materials:** Lorentz force equation, Force on a current element in a magnetic field, Force on a straight and long current carrying conductor in magnetic fields, Force between two straight parallel current carrying conductors, Torque on a current loop placed in a magnetic field. Concept of Self inductance – Determination of self inductance of Solenoid and Toroid.

#### **UNIT - V**

**Time varying Fields:** Faraday's laws of Electromagnetic Induction, its integral and point forms, Maxwell's fourth equation ( $\text{Curl}(\mathbf{E}) = -\frac{\partial \mathbf{B}}{\partial t}$ ). Statically and dynamically induced EMFs, Modification of Maxwell's equation for time varying fields, displacement current, and Maxwell's equation in differential and integral form.

#### **Text Books**

1. "Engineering Electromagnetics" by William H. Hayt and John A. Buck, TMH, 7<sup>th</sup> edition 2006.
2. "Principles of Electromagnetics" by Mathew N. O. Sadiku, Oxford International student edition (4<sup>th</sup>)
3. "Electromagnetic Fields" by Dr. S. Kamakshaiah, Right Publishers, 2007.

#### **References**

1. "Electromagnetics" by J. D. Kraus, TMH, 4<sup>th</sup> edition 1992.
2. "Electromagnetic Fields" by TVS Arun Murthy, S. Chand & Company Ltd., 1<sup>st</sup> edition 2008.
3. "Field Theory" by K. A. Gangadhar, P. M. Ramanathan, Khanna Publishers, 15<sup>th</sup> edition, 2003.
4. "Electromagnetic Waves & Radiating Systems" by Edward C. Jordan and Keith G. Balmain, Prentice Hall of India Pvt. Ltd.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502305	PJ	Network Theory	3	1	0	30	70	3

**Prerequisite(S):** Electrical Circuits - I and Mathematics - I

**Objective:**

This course introduces the concepts of circuit analysis which includes three phase circuits, transient analysis of D.C. and A.C excitations, various Network functions and synthesis.

**Course Outcomes:** On successful completion of this course, the students will be able to

1. demonstrate knowledge on
  - star/delta connections with balanced/unbalanced conditions
  - transient analysis of DC and AC excitations.
  - Two-port network parameters
  - Fourier analysis of AC circuits and Fourier transforms
2. analyze
  - RL, RC and RLC circuits for DC and AC excitations
  - Electrical circuits for non-sinusoidal periodic waveforms
3. Design the network elements using two-port parameters.
4. Evaluate
  - Voltage, Current and Power for balanced and unbalanced 3 phase systems
  - Transient behaviour using differential equations and Laplace transforms.
  - Two port parameters namely Z, Y, ABCD, h and g.

**UNIT – I**

**Network Theorems:** Superposition Theorem, Thevinin’s Theorem, Norton’s Theorem, Compensation Theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millmen’s theorem, Tellegen’s theorems for D.C and Sinusoidal Excitations.

**UNIT – II**

**Three Phase Circuits:** Advantages of Three phase system, Phase sequence, balanced and unbalanced systems – magnitude & phasor relationship between line and phase voltages and currents in balanced Y and  $\Delta$  circuits. Analysis of balanced Three phase circuits with Y and  $\Delta$  connected loads –Analysis of unbalanced loads- Neutral displacement method, Y- $\Delta$  conversion and loop current method.

Measurement of Three phase power by two wattmeter method, Measurement of Three phase reactive power by single wattmeter method.

**UNIT – III**

**DC Transient Analysis:** Determination of Initial Conditions – Transient response of R-L, R-C and R-L-C circuits for DC–Solution method using differential equation and Laplace transforms.

**UNIT – IV**

**AC Transient Analysis:** Transient response of R-L, R-C and R-L-C series circuits for sinusoidal excitations – Solution method using differential equation and Laplace transforms. Analysis of Electrical Circuits non-sinusoidal periodic waveforms.

**UNIT – V**

**Two Port Parameters:** One port and two port networks, driving point and transfer functions of Networks. Open circuit impedance & short circuit admittance parameters, hybrid & inverse hybrid parameters, transmission & inverse transmission parameters, Inter-relationships between parameter sets – Series, parallel & cascade connection of two ports – condition for symmetry & reciprocity of two port Networks in terms of different parameters – Terminated two port Networks.

**Text Books**

1. Theory and Problems of Electrical Circuits – Joseph A. Edminister – Schaum Series, 1<sup>st</sup> Edition – TMH.
2. Circuit Theory -A.Chakrabarti, DhanapatRai & Co publications.
3. Electrical Circuits - N.Sreenivasulu, Reem publications.
4. Network Analysis – Van Valkenburg - 3<sup>rd</sup> edition, PHI.

**References**

1. Circuits & Networks – A. Sudhakar, Shayammohan. S. Pillai, 4<sup>th</sup> Edition – TMH.
2. Networks and Systems – D. Roy Chowdari – New Age International
3. Network Analysis with applications – Stanely - Pearson education 4<sup>th</sup> edition.
4. Network Analysis by G.K.Mittal, Khanna Publishers.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502306	PJ	Electrical Machines - I	3	1	0	30	70	3

**Prerequisite(S):** Engineering Physics

**Objective:**

Electrical machines course is one of the important course of the Electrical discipline. In these course different types of DC generators, motors which are widely used in industries are covered and their performance aspects will be studied.

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

1. demonstrate knowledge on
  - different types of singly- and multi- excited magnetic field systems.
  - construction, operation and characteristics of DC machines.
  - armature reaction and commutation.
  - Starting methods and speed control of DC motors.
  - testing of DC machines.
2. analyze the operation of DC machine under various operating conditions.



3. design armature windings for DC machines and starters for DC motors.
4. evaluate the performance of DC machines by different testing methods
5. choose suitable DC machine for domestic and industrial applications.

#### **UNIT - I**

**DC Generators:** Introduction- Construction – Principle of Operation, Armature windings – Lap and Wave windings - Simplex & Multiplex windings – EMF equation – Problems.

**Armature Reaction** – Cross Magnetizing & demagnetizing AT/Pole – Compensating winding - commutation – reactance voltage – Methods of improving Commutation – Problems.

#### **UNIT - II**

**Types of DC Generators:** Methods of Excitation – Open Circuit Characteristics - build up of EMF- Critical Field Resistance & Critical Speed – Causes for Failure to self excitation & Remedial Measures – Problems.

#### **UNIT - III**

**Load Characteristics of DC Generators:** Load Characteristics of shunt, series & compound generators – parallel operation of DC Generators – use of equalizer bar and cross connection of field windings – load sharing - problems.

#### **UNIT - IV**

**D.C Motor:** DC Motors – Principle of operation – Back EMF – Torque Equation – Characteristics & application of shunt, Series & Compound Motors – Armature reaction & Commutation.

**Speed Control of D.C Motors:** Speed control of DC Shunt & Series Motors – Armature, Flux and Voltage control methods –problems. Starters - types-design of starters – problems.

#### **Unit - V**

**Testing of D.C Machines:** Losses and Efficiency, Condition for maximum efficiency. Methods of Testing – Direct, Indirect & Regenerative testing - Brake test – Swinburne's test – Hopkinson's test – Field's test – Retardation test – Separation of stray losses in a DC Motor.

#### **Text Books**

1. Electrical Machines P.S. Bimbira, Khanna Publishers
2. Electric Machines – by I.J Nagrath & D.P. Kothari , Tata Mc Graw – Hill Companies Publishers.
3. Electrical machines-1: DC machines- by J. B. Gupta, Kataria Publications

#### **Reference Books:**

1. Electrical Machinery – A. E. Fitzgerald, C. Kingsley and S. Umlauts, Mc Graw – Hill Companies, 5<sup>th</sup> Edition.
2. Performance and design of DC machines – by Clayton and Hancock-BPB Publishers-2004.
3. Direct Current Machines - by R.K. Rajput -Laxmi Publications.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1511307	PN	Fluid Mechanics & Hydraulic Machinery Lab	0	0	3	50	50	2

**Course Objective:** The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

**LIST OF EXPERIMENTS:**

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and / or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli's equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502308	PJ	Electrical Circuits and Simulation Lab	0	0	3	50	50	2

**Prerequisite(S):** Electrical Circuits and Network Theory

**Objective:** The objective is to verify theoretically and practically Network Theorems and Parameters, measure the power for balance and unbalance 3 phase loads, self and mutual inductance of transformer, resonant parameters for series circuit, mesh and nodal analysis using simulation.

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

1. demonstrate skills in
  - Network Theorems for DC and AC
  - Two - port network parameters
  - Measurement of active and reactive power
  - Resonance and Locus Diagrams
  - Coupling coefficient
2. Obtain two-port network parameters
3. Design the electrical circuits using PSPICE
4. Analyze RL, RC and RLC circuits
5. function effectively as individual and as member in a team.
6. communicate effectively both oral and written.

**PART-A: ELECTRICAL CIRCUITS**

1. Verification of Thevenin's and Norton's Theorem
2. Verification of Superposition theorem and Maximum power Transfer theorem
3. Verification of Compensation Theorem
4. Verification of Reciprocity, Millman's Theorems
5. Locus Diagrams of RL RC series circuits
6. Series Resonance
7. Determination of Self, Mutual Inductances and Coefficient of coupling
8. Z and Y parameters
9. Transmission and hybrid parameters
10. Measurement of Active Power for Star and Delta connected balanced loads
11. Measurement of Reactive Power for Star and Delta connected balanced loads
12. Measurement of 3-Phase Power by two Wattmeter Method for Unbalanced loads

**PART-B: SIMULATION USING P SPICE/SCI LAB/MATLAB/MULTISIM**

1. Simulation of DC circuits
2. DC transient response
3. Mesh Analysis
4. Nodal Analysis

**Note:** Eight Experiments are to be conducted from Part –A and any two from Part –B.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1514401	PJ	Analog Electronic Circuits	3	1	0	30	70	3

#### UNIT I

**SMALL SIGNAL ANALYSIS OF AMPLIFIERS (BJT & FET):** BJT Modeling using h-parameters, Determination of h-Parameters from Transistor Characteristics, Measurement of h-Parameters, Analysis of CE, CB and CC configurations using h-Parameters, Comparison of CB, CE and CC configurations, Simplified Hybrid Model, Millers Theorem, Dual of Millers Theorem. Small Signal Model of JFET & MOSFET, Small signal analysis of Common Source, and Common Drain Amplifiers using FET, Illustrative problems.

#### UNIT II

**MULTISTAGE AMPLIFIERS:** BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

#### UNIT III

**FEEDBACK AMPLIFIERS:** Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies.

**SINUSOIDAL OSCILLATORS:** Condition for oscillations – LC Oscillators – Hartley, Colpitts, – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators -- RC Phase Shift and Weinbridge Oscillators.

#### UNIT IV

**LARGE SIGNAL AMPLIFIERS:** Class A power Amplifier, Maximum Value of Efficiency of Class A Amplifier, Transformer coupled amplifier – Push-Pull Amplifier – Complimentary Symmetry Circuits (Transformer Less Class B Power Amplifier) – Phase Inverters, Transistor Power Dissipation, Thermal Runaway, Heat Sinks.

#### UNIT V

**LINEAR WAVE SHAPING:** High pass, Low pass RC circuits-response for sinusoidal, Step, Pulse, Square and Ramp inputs, Clippers and Clampers

**MULTI-VIBRATORS:** Analysis of Diode and transistor switching times, Analysis and Design of Bistable, Monosatable and Astable Multi-vibrators, Schmitt trigger Using Transistors.

#### Text Books:

1. Jacob Millman and C. Halkias, "Integrated Electronics Analog Digital Circuits", McGraw Hill.
2. Jacob Millman, Harbert Taub and Mothiki S Prakash Rao, "Pulse, Digital & Switching Waveforms" 2nd edition 2008, Tata McGraw Hill Companies.

#### Reference Books:

1. K. Lal Kishore, "Electronic Circuit Analysis", Second Edition, BSP
2. G.S.N. Raju, "Electronic Devices and Circuits", IK International Publications, New Delhi, 2006
3. Allen Mottershead, "Electronic Devices and Circuits", Prentice –Hall of India.
4. A. Anand Kumar, "Pulse and Digital Circuits", PHI, 2005.
5. David A. Bell, "Solid State Pulse Circuits", 4th edition, PHI, 2002.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504402	PJ	<b>Switching Theory &amp; Logic Design (Common to EEE &amp; ECE Branches)</b>	3	1	0	30	70	3

#### Course Objectives:

- To provide the students with an introduction to the fundamentals of Number systems, logic gates, Combinational and sequential circuits

#### Learning Outcomes:

- Learn the concepts of number systems, Boolean Algebra and K-Maps that are essential to minimize the logical functions in the design and development of digital systems
- Design and develop various combinational and sequential circuits
- Demonstrate the ability to realize Switching functions using Programmable Logic Devices
- Solve engineering problems pertaining to Digital Electronics and arrive at solutions

#### UNIT I

**Number Systems & Codes:** Overview of number systems –complement representation of negative numbers-binary arithmetic, binary codes-error detecting & error correcting codes –Hamming codes.

#### UNIT II

**Boolean Algebra and Minimization of Switching Functions:** Fundamental postulates of Boolean Algebra - Basic theorems and properties –Canonical and Standard forms-Minimal SOP and POS forms ,Algebraic simplification digital logic gates –universal gates-Multilevel NAND/NOR realizations. The map method, tabulation method.

#### UNIT III

**Combinational Logic Design:** Design using conventional logic gates, Encoder, Decoder, Multiplexer, De-Multiplexer, Realization of switching functions using multiplexer, Parity bit generator, Code-converters, Hazards and hazard free realizations.

#### UNIT IV

**Programmable Logic Devices:** Basic PLD's-ROM, PROM, PLA, and PLD, Realization of Switching functions using PLD's.

## UNIT V

**Sequential Circuits:** Synchronous and Asynchronous sequential circuits, Flip-flops-Triggering and excitation tables, Flip flop conversions, shift registers, Design of Synchronous and Asynchronous counters, Ring and Johnson counters. Serial Binary adder, Sequence detector.

### Text Books:

1. ZVI Kohavi, Switching & Finite Automata theory -, TMH, 2<sup>nd</sup> Edition.
2. Morris Mano, "Digital Design", PHI, 3<sup>rd</sup> Edition, 2006.
3. A. Anand Kumar, "Switching Theory & Logic Design", 2008, PHI.

### Reference Books:

1. William I. Fletcher, "An Engineering Approach to Digital Design", PHI.
2. Charles H. Roth, "Fundamentals of Logic Design", Thomson Publications, 5<sup>th</sup> Edition, 2004.
3. John M. Yarbrough, "Digital Logic Applications and Design", Thomson Publications, 2006.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502403	PJ	Generation of Electrical Power	3	1	0	30	70	3

**Prerequisite(S):** Fluid Mechanics and Hydraulic Machinery, DC Machines

**Objective:** The objective of this course is to learn various power plants in brief such as Thermal, Hydro and Nuclear Power Plants. With respect to the environmental aspects the Distributed Generations such as Solar, Wind, Bio-Gas, Geo- Thermal and Ocean Energy are also discussed in this subject.

**Course Outcomes:** On completion of the course, student will be able to

1. demonstrate knowledge on
  - layout of various power plants and their operation.
  - combined operation of power stations.
  - concept of different types of turbines and their usage in different types of power generation stations.
  - Nonconventional energy sources.
2. analyze
  - the water power equation.
  - load sharing between power stations.

### 3. Evaluate

- reserve capacity of Hydel power plant using mass curve.

#### **UNIT - I**

##### **Thermal Power Station:**

Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash, and flue gases – brief description of TPS components: Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney, and cooling towers.

#### **UNIT - II**

##### **Hydro and Nuclear Power Stations**

**Hydro Power Stations (HPS):** Selection of site, Classification, Layout, Description of main components.

**Nuclear Power Stations (NPS):** Nuclear fission and chain reaction – Nuclear fuels, Principle of operation of Nuclear reactor, Reactor components: Moderators, Control rods, reflectors and Coolants. Radiation hazards: Shielding and safety precautions. Types of Nuclear Reactors and brief description of PWR, BWR and FBR.

#### **UNIT - III**

##### **Basics of Solar Energy & Geo-Thermal Energy Generation:**

Role and Potential of solar energy options, Principles of Solar radiation, Flat plate and concentrating solar energy collectors, different methods of solar energy storage – Solar applications: heating energy, cooling, distillation and drying - Principles of Geo thermal energy – Methods of Harnessing.

#### **UNIT - IV**

##### **Basics of Wind energy Generation**

Role and potential of wind energy option, horizontal and vertical axis wind mills, performance characteristics – Betz criterion – application – Economic aspects.

#### **UNIT - V**

##### **Basics of Bio gas Energy Generation & Basics of Ocean Energy Systems**

Principles of Bioconversion, types of Biogas digesters – Characteristics of Bio-gas, Utilization – Economic and environmental aspects.

Principle of Ocean Energy – Tidal and Wave energy – Economic aspects.

##### **Text Books:**

1. A Text Book of Power Plant Engineering by R. K. Rajput, 4<sup>th</sup> edition, Laxmi Publications, 2007.
2. Power Plant Engineering by P. C. Sharma, S. K. Kataria Publications
3. Non-conventional energy sources by G. D. Rai, Khanna Publishers.

##### **Reference Books:**

1. Power Plant Engineering by P. K. Nag, 2<sup>th</sup> edition, TMH.
2. Power Plant Engineering by Ramalingam, Scitech Publications.
3. A Course in Power Plant Engineering by Arora and S. Domkundwar.
4. Generation, Distribution and Utilization of Electrical Energy - by C.L.Wadhwa. New Age publishers

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502404	PJ	Electrical and Electronics Measurements	3	1	0	30	70	3

**Objective:**

Electrical measurements course introduces the basic principles of all measuring instruments. It also deals with the measurement of RLC parameters voltage, current Power factor, power, energy and magnetic measurements and Digital Meters.

**Prerequisite(S):** Engineering physics, Engineering Mathematics, Electric circuits

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

1. demonstrate knowledge on
  - various errors and compensation
  - construction, working and testing of various measuring instruments.
  - measurement of various electrical parameters and quantities
2. analyze
  - different types of errors and compensations
  - DC and AC bridges.
3. design extension of meter ranges of various measuring instruments.
4. evaluate various electrical circuit parameters/elements using bridges.
5. apply various measuring instruments in domestic and industrial applications.

**UNIT - I**

**Measuring Instruments:** Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron, dynamometer type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunt and multipliers- problems.

**UNIT - II**

**Measurement of Power and Energy:** Single phase dynamometer wattmeter, expression for deflecting and control torques, Single phase induction type energy meter – driving and braking torques – errors and compensations. Three phase energy meter. Types of P.F. Meters – dynamometer and moving iron type – 1-phase and 3-phase meters.

**UNIT - III**

**D.C. & A.C Bridges:** Method of measuring low, medium and high resistance – sensitivity of Wheatstone’s bridge – Kelvin’s double bridge for measuring low resistance, measurement of high resistance – loss of charge method. Measurement of inductance – Maxwell’s bridge, Anderson’s bridge. Measurement of capacitance and loss angle – Desauty’s Bridge, Schering Bridge- Frequency measurement- Wien’s bridge.

**UNIT - IV**

**Instrument Transformers and Potentiometers:** CT and PT – Ratio and phase angle errors–design considerations. Principle and operation of D.C. Crompton’s



potentiometer–standardization – Measurement of unknown resistance, current and voltage. A.C. potentiometers: polar and coordinate type's - standardization – applications.

#### **UNIT – V**

**Electronic Measurements:** Cathode Ray Oscilloscope – Cathode Ray tube – Time base generator – Horizontal and Vertical amplifiers – application of CRO – Measurement of phase, frequency, current & voltage – Lissajous pattern.

Digital meters - Digital Voltmeter – Successive approximation, ramp and integrating type.

#### **Text Books**

1. Electrical measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5<sup>th</sup> Edition, Reem Publications.
2. Electrical & Electronic Measurement & Instruments by A. K. Sawhney, Dhanpat Rai & Co. Publications.
3. Electronic Instrumentation and measurement techniques by William D Cooper- Prentice Hall Publishers

#### **Reference Books**

1. Electrical Measurements – by Buckungham and Price, Prentice – Hall
2. Electrical Measurements: Fundamentals, Concepts, Appliations – by Resslerand, M.U, New Age International (P) Limited, Publish.
3. Electronic Instrumentation by H. S. Kalsi, Tata Grawhill Mc, 3<sup>rd</sup> Edition.

<b>Subject Code</b>	<b>Subject Category</b>	<b>Subject Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>IM</b>	<b>EM</b>	<b>CR</b>
<b>1502405</b>	<b>PJ</b>	<b>Electrical Machines - II</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>30</b>	<b>70</b>	<b>3</b>

**Prerequisite(S):** Electric Circuits, DC Machines.

#### **Objective:**

This subject facilitates to study the performance of Transformers which play a major role in transmission and distribution of electrical power and induction motors which are the major part of industrial drives and agricultural pump sets.

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

1. demonstrate knowledge on
  - construction and working of transformers, auto transformers and induction machines.
  - testing of transformers and induction machines.
  - parallel operation of transformers
  - Speed control of induction motors
2. analyze the behaviour of transformers and induction machines for various operating conditions.
3. design suitable accessories/techniques for the starting and speed control of induction motors.

4. Evaluate the performance of transformers and three phase induction machines.
5. categorize the suitable transformer and induction machine for domestic, agriculture and industrial applications.

#### **UNIT - I**

**Single phase transformer:** Construction & principle of operation- types- EMF equation -operation on no-load & on-load- Phasor diagrams. Equivalent Circuit - losses, effect of variations of frequency & supply voltage on iron losses, efficiency and regulation. All - day efficiency.

#### **UNIT - II**

**Testing of Transformers:** O.C and S.C Tests, Sumpner's test - pre-determination of efficiency & regulation, Separation of Losses Test.

Parallel Operation with Equal & Unequal voltage ratio's, Auto-transformers- Equivalent circuit - comparison with two winding transformers.

#### **UNIT-III**

**Poly phase Transformers:** Types of connections - Y-Y, Y- $\Delta$ ,  $\Delta$ -Y,  $\Delta$ - $\Delta$ , Open Delta, Scott connection, 3-winding transformers, tertiary windings, operation of three phase transformer on unbalanced input supply.

**3- $\phi$  Induction Motors:** Constructional Details - types- production of Rotating Magnetic Field - Principle of operation - slip, rotor parameters at standstill and running condition, Phasor Diagram - Equivalent Circuit.

#### **UNIT IV**

**Characteristics of Induction Motor** - Rotor Power input, Rotor copper loss and mechanical power developed and their internal relations. Torque Equation - Maximum Torque and Starting Torque - Maximum Output - Slip for Maximum Output - Torque-Slip characteristics and efficiency.

**Testing of 3- $\phi$  Induction Motors:** Brake Test - Predetermination of performance from no-load and blocked rotor tests, Determination of Equivalent Circuit Parameters, Circle Diagram.

#### **UNIT- V**

**Methods of Starting** - DOL starter, Auto Transformer starter, Y/ $\Delta$  starter and Rotor Resistance method.

**Speed control of 3- $\phi$  Induction Motor:** Stator side control: Pole changing - voltage control, frequency control of 3- $\phi$  Induction Motor. Rotor side control: cascade connection, injection of emf into rotor circuit -Double cage Induction Motor, Induction generator & applications, crawling & cogging.

#### **Text Books:**

1. Electrical Machines - I. J. Nagrath, D. P. Kothari, TMH, 7<sup>th</sup> Edition 2005.
2. Electric Machines - P. S. Bimbra, Khanna Publications.
3. Electric machinery - A.E. Fitzgerald, C. Kingsley and S. Umans, McGraw Hill company 5<sup>th</sup> Edition.

#### **Reference books:**

1. Electrical machines -II (AC machines) J. B. Gupta.
2. Theory of alternating machinery by Langsdorf, TMH 2<sup>nd</sup> Edition.

### 3. Alternating Current Machines by R.K.Rajput, Laxmi Publications

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502406	PJ	Power Systems - I	3	1	0	30	70	3

**Prerequisite(S):** Electromagnetic Fields, Signals and Networks

**Objective:**

This course is an extension of Generation of Electric Power course. It deals with economic aspects of generation, mechanical design of transmission lines, cables and insulators, electrical design of transmission lines and distribution system.

**Course Outcomes:** On successful of the course, student will be able to

1. demonstrate knowledge on
  - transmission line parameters and their performance.
  - transients in transmission lines.
  - Overhead line insulators, Sag and Tension calculations for transmission system.
  - corona, classification of cables and their performance.
2. analyze
  - the electrical and mechanical aspects of transmission lines.
  - the capacitance of cable for different configurations.
3. design
  - electrical and mechanical systems to improve the overall performance of transmission lines and cables.
  - Overhead Line Insulators.
4. exhibit skills in
  - evaluating the parameters and performance of transmission lines and cables.
  - evaluating the electrical and mechanical aspects of transmission lines, cables and insulators.

**UNIT - I**

**Economic Aspects of Power Generation:** Load Curve, Load Duration Curve, Integral Load Duration Curves, Load Factor, Demand Factor, Diversity Factor, Capacity Factor, Utilization Factor and Plant Use Factors-Numerical Problems.

Choice of Size and Number of Generating Units, Cost of Electrical Energy, Problems, Types of Tariff Charges on Consumers – Numerical Problems.

**UNIT - II**

**Mechanical Design of Transmission Lines:** Insulators, Types of Insulators, String Efficiency, Methods of Improving String Efficiency, problems.

Line Supports, Sag and Tension Calculations for Equal and Unequal Heights of Towers, Effect of Wind and Ice on Weight of Conductors – Numerical Problems, Stringing Chart and Sag Template.

### UNIT – III

**Transmission Line Parameters:** Types of Conductors, Calculation of resistance for solid conductor, concept of GMR and GMD, Calculation of inductance and Capacitance for 1- $\phi$  and 3- $\phi$  single and double circuit lines, , symmetrical and asymmetrical conductor configuration with and without transportation –Effect of Earth on Capacitance - Numerical Problems.

### UNIT – IV

**AC Distribution:** Comparison of AC single phase, Three Phase, Three wire and Three Phase Four wire systems, types of primary distribution systems, types of secondary distribution systems, AC distribution fed at one end and at both ends. Kelvin's law, limitation of Kelvin's law, selection of voltage of primary distribution, choice of scheme and size of feeders.

### UNIT – V

**Underground Cables:** Construction, Types of Cables, Insulation in Cables, Calculation of Insulation Resistance and Stress in Insulation. Capacitance of Single and 3 Core Belted Cables. Grading of Cables, Capacitance Grading, Description of Intersheath Grading, numerical problems.

**Corona:** Description of Corona Phenomenon, Factors Affecting Corona, Critical Disruptive Voltage, Visual Disruptive Voltage and Power Loss, Radio Interference.

### Text Books

1. Electrical power systems - by C. L. Wadhwa, New Age International (P) Limited, Publishers, 4<sup>th</sup> Edition, 2005.
2. Power system Engineering-by I. J. Nagrath and D. P. Kothari, Tata McGraw Hill
3. A Text Book on Power System Engineering by M. L. Soni, P. V. Gupta, U. S. Bhatnagar, A. Chakrabarti, Dhanpat Rai & Co Pvt. Ltd., 2003.

### Reference Books

1. Power System Analysis and Design by B. R. Gupta, S. Chand & Co, 6th Revised Edition, 2010.
2. Principles of power systems by V.K.Mehta, S Chand publishers.
3. Electric Power Systems by S. A. Nasar, Schaum Outline Series, TMH, 3rd Edition, 2008.

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1514407	PJ	Electronic Devices & Circuits Lab(Common to EEE & ECE)	0	0	3	50	50	2

### Course Objectives:

- To know the different devices- their characteristics and applications
- To study the design and analysis of amplifier circuits

### Learning Outcomes:

- Gain practical knowledge of the principles of operation and characteristics of

pn-diodes, Zener diodes, Photodiode and Phototransistor

- Able to analyze and design pn-diode Rectifier circuits
- Able to design BJT & FET Amplifiers and analyze their frequency response
- Demonstrate the knowledge in LED, SCR and UJT in future applications

**Electronic Workshop Practice (in 3 lab sessions):**

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB s
2. Identification, Specifications and Testing of Active Devices, Diodes, BJTs, Low power JFETs, MOSFETs, Power Transistors, LEDs, LCDs, SCR, UJT.
3. Study and operation of Millimetres (Analog and Digital), Function Generator, Regulated Power Supplies
4. Study and Operation of CRO

**List of Experiments: (Any ten from the following)**

1. Forward and Reverse bias characteristics of PN Junction diode
2. Zener diode characteristics and Zener diode as Voltage Regulator.
3. Input and Output characteristics of Transistor in CB Configuration.
4. Input and Output characteristics of Transistor in CE Configuration.
5. Half Wave Rectifier With and without filter.
6. Full wave Rectifier With and without filter.
7. Bridge rectifier with and without filter.
8. FET characteristics
9. VI characteristics of LED
10. Characteristics of Photo diode
11. Characteristics of Photo transistor
12. SCR Characteristics.
13. UJT Characteristics.
14. LDR Characteristics.

**Note: Change at least two experiments every year.**

**Equipment required for Laboratories:**

1. Regulated Power supplies (RPS) - 0-30v.
2. CROs - 0-20M Hz.
3. Function Generators - 0-1 M Hz.
4. Multimeters
5. Decade Resistance Boxes/Rheostats -
6. Decade Capacitance Boxes
7. Micro Ammeters (Analog or Digital)- 0-20  $\mu$ A, 0-50 $\mu$ A, 0-100 $\mu$ A, 0-200 $\mu$ A.
8. Voltmeters (Analog or Digital) - 0-50V, 0-100V, 0-250V.

Electronic Components - Resistors, Capacitors, BJTs, LCDs, SCRs, UJTs, FETs, LEDs, LDRs, MOSFETs, Diodes (Ge & Si type), Germanium and Silicon transistors (NPN & PNP type)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1502408	PJ	Electrical Machines - I Lab	0	0	3	50	50	2

**Prerequisite(S):** Electrical Machines - I

**Objective:** The objective is to know the performance characteristics of various DC Machines under different load conditions, speed control of DC shunt motor, separation of losses.

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

1. demonstrate skills in
  - identify various parts of DC machine and different types of starters
  - obtaining various characteristics of DC machines.
  - determining the performance of DC machines.
  - separating losses in DC machines.
2. analyze the performance of various DC machines and decide suitability for a given application
3. function effectively as individual and as member in a team.
4. communicate effectively both oral and written.

**The following experiments are required to be conducted as compulsory experiments.**

1. Magnetization characteristics of DC shunt generator.
2. Load test on DC shunt generator.
3. Brake test on DC shunt motor.
4. Load test on DC compound generator.
5. Hopkinson's test on DC shunt machines.
6. Fields test on DC series machines.
7. Swinburne's test and speed control of DC shunt motor.
8. Brake test on DC compound motor.

**In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted.**

9. Load test on DC series generator.
10. Retardation test on DC shunt motor.
11. Separation of losses in DC shunt motor.