मौलाना आज़ाद नेशनल उर्दू यूनिवर्सिटी   مولانا آزاد نیشنل اُردو یونیورسٹی

MAULANA AZAD NATIONAL URDU UNIVERSITY

(A Central University Established by an Act of Parliament in 1998)

(Accredited "A" Grade by NAAC)

Gachibowli, Hyderabad – 500032, Telangana, INDIA

AICTE Model Curriculum with effect from 2020-21 for MANUU Polytechnics

General Course Structure & Credit Distribution

Diploma in

Electrical and Electronics Engineering

MANUU POLYTECHNICS

Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hours Practical (P) per week	1 credit

A. **Program Credits:**
   The total number of credits proposed for the three-year Diploma program in Engineering & Technology is 120.

B. **Structure of Diploma Engineering Program:**
   The structure of Diploma Engineering program shall have essentially the following categories of courses with the breakup of credits as given:

Sr. No.	Category	Suggested Breakup of Credits
1.	Humanities & Social Sciences courses	7
2.	Basic Science courses	18
3.	Engineering Science courses	16
4.	Program Core courses (Branch specific)	46
5.	Program Elective courses (Branch specific)	12
6.	Open Elective courses (from other technical and/or emerging subjects)	9
7.	Project work, seminar and internship in industry or elsewhere	12
8.	Audit Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge etc.]	(non-credit)
	Total	**120**

C. **Course code and definition:**

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
HS	Humanities & Social Sciences Courses
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
AU	Audit Courses
SI	Summer Internship
PR	Project
SE	Seminar

D. **Course level coding scheme:**

As per the CBCS Rules and Regulations of Examination Branch of MANUU.

E. **Category-wise Courses**

HUMANITIES & SOCIAL SCIENCES COURSES [HS]

Note:
(i) Number of Humanities & Social Sciences Courses:4
(ii) Credits:7

Sl. No	Code No.	Course Title	Hours per week			Semes-ter	Credits
			L	T	P		
1.		Communication Skills in English	2	0	0	I	2
2.		Sports and Yoga	0	0	2	I	1
3.		Communication Skills in English Lab	0	0	2	I	1
4.		Entrepreneurship and Start-ups	3	0	0	VI	3
Total Credits							**7**

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BASIC SCIENCES COURSE [BS]

Note:
(i) Number of Basic Sciences Courses:8
(ii) Credits:18

Sl. No	Code No.	Course Title	Hours per week			Semester	Credits
			L	T	P		
1.		Mathematics-I	2	1	0	I	3
2.		Applied Physics-I	2	1	0	I	3
3.		Applied Chemistry	2	1	0	I	3
4.		Applied Physics-I Lab	0	0	2	I	1
5.		Applied Chemistry Lab	0	0	2	I	1
6.		Mathematics-II	3	0	0	II	3
7.		Applied Physics-II	2	1	0	II	3
8.		Applied Physics-II Lab	0	0	2	II	1
Total Credits							**18**

ENGINEERING SCIENCE COURSES [ES]

Note:

(i) Number of Engineering Sciences Courses:8

(ii) Credits:16

Sl. No	Code No.	Course Title	Hours per week			Semes-ter	Credits
			L	T	P		
1.		Engineering Graphics	0	0	3	I	1.5
2.		Engineering Workshop Practice	0	0	3	I	1.5
3.		Introduction to IT Systems	2	1	0	II	3
4.		Fundamentals of Electrical &Electronics Engineering	2	1	0	II	3
5.		Engineering Mechanics	2	1	0	II	3
6.		Introduction to IT Systems Lab	0	0	4	II	2
7.		Fundamentals of Electrical &Electronics Engineering Lab	0	0	2	II	1
8.		Engineering Mechanics Lab	0	0	2	II	1
Total Credits							**16**

PROGRAM CORE COURSES [PC]

Note:

(i) Number of Program Core Courses: 20 to 30 (including lab courses)

(ii) Credits:**46**

(iii) Number of contact hours per week of a subject may vary as per subject contents without affecting the subject credits.

Sl. No	Code No.	Course Title	Hours per week			Semester	Credits
			L	T	P		
1							
.							
.							
n							
Total Credits							**46**

PROGRAM ELECTIVE COURSES [PE]

Note:

(i) Number of Program Elective Courses: 4 to 6
(Minimum ten Branch Specific courses to be specified for the students to choose from)

(ii) Credits:**12**

Sl. No	Code No.	Course Title	Hours per week			Semester	Credits
			L	T	P		
1							
.							
.							
n							
Total Credits							**12**

OPEN ELECTIVE COURSES [OE]

Note:

(i) Number of Open Elective Courses: 3 to 4 (minimum ten courses to be specified out of the suggestive list of open elective courses given as Appendix III)

(ii) Credits:**9**

(iii) The Open Elective Courses to be offered preferably in III year (one course may be offered in V Semester and two courses in VI Semester)

(iv) The students can opt only for those open elective courses that are offered by other than their respective departments

Sl. No	Code No.	Course Title	Hours per week			Semester	Credits
			L	T	P		
1							
.							
.							
n							
Total Credits							**9**

PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSEWHERE

Sl. No	Code No.	Course Title	Hours per week			Semes-ter	Credits
			L	T	P		
1.		Summer Internship – I (3-4 weeks) after IInd Sem					2
2.		Summer Internship – II (4-6 weeks) after IVth Sem					3
3.		Minor Project	0	0	4	IV	2
4.		Major Project	0	0	2	V	4
5.			0	0	6	VI	
6.		Seminar	1	0	0	VI	1
Total Credits							**12**

Note:
- Summer Internship–I should be undertaken in an industry/ Govt .or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres /Institutes/Schemes.

- Summer Internship–II should be undertaken in an industry only

- Seminar should be based on real/ live problems of the Industry/Govt./NGO/MSME/Rural Sector or an innovative idea having the potential of a Startup

AUDIT COURSES [AU]
Note: These are mandatory non-credit courses.

Sl. No	Code No.	Course Title	Hours per week			Semes-ter	Credits
			L	T	P		
1.		Environmental Science	2	0	0	II	0
2.		Essence of Indian Knowledge and Tradition	2	0	0	IV	0
3.		Indian Constitution	2	0	0	VI	0
Total Credits							**0**

DESCRIPTION OF BRANCH CODES

Sr. No.	Branch	Code
1.	Civil Engineering	CE
2.	Computer Engineering	CO
3.	Electronics and Communication Engineering	EC
4.	Electrical Engineering	EE
5.	Mechanical Engineering	ME
6.	Production Engineering	PE
7.	Information Technology	IT
8.	Chemical Engineering	CH

INDUCTION PROGRAM

Please refer Appendix IV for guidelines.

The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program ',as available on AICTE Portal, although that is for UG students of Engineering & Technology (Link:https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf).

Induction program (mandatory)	Two-week duration
Induction program for students to be offered right at the start of the first year.	- Physical activity - Creative Arts - Universal Human Values - Literary - Proficiency Modules - Lectures by Eminent People - Visits to local Areas - Familiarization to Dept./Branch & Innovations

F. Mandatory Visits/Workshop/Expert Lectures:

a. It is mandatory to arrange one industrial visit every semester for the students of each branch.

b. It is mandatory to conduct a One-week workshop during the winter break after fifth semester on professional/industry/entrepreneurial orientation.

c. It is mandatory to organize atleast one expert lecture per semester for each branch by inviting resource persons from domain specific industry

G. Evaluation Scheme:

a. For Theory Courses:
(The weightage of Internal assessment is 40% and for End Semester Exam is 60%)
The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

b. For Practical Courses:
(The weightage of Internal assessment is 60% and for End Semester Exam is 40%)
The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

c. For Summer Internship / Projects / Seminar etc.
Evaluation is based on work done, quality of report, performance in viva-voce, presentation by the student in front of Internship & project review committees consist of HoD, Principal Nominated Member and Concerned Faculty.

Note: The internal assessment is based on the student's performance in mid semester tests (two best out of three), quizzes, assignments, class performance, attendance, viva-voce in practical, lab record etc.

FR (Fail due to shortage of attendance and therefore, to repeat the course)

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Semester I–Pool: 1
(Common to CIVIL, MECH, ECE Branches)
Curriculum Structure

Sl. No	Category of Course	Code No.	Course Title	Hours per week			Total contact hrs/week	Scheme of Evaluation		Credits
				L	T	P		CIE	SEE	
1	Basic Science	DPCC113BST	Mathematics-I	2	1	0	3	40	60	3
2	Basic Science	DPCC111BST	Applied Physics-I	2	1	0	3	40	60	3
3	Basic Science	DPCC112BST	Applied Chemistry	2	1	0	3	40	60	3
4	Engineering Science	DPCE111PCP	Engineering Graphics	0	0	2	2	60	40	1
5	Basic Science	DPCC112BSP	Applied Chemistry Lab	0	0	2	2	60	40	1
6	Engineering Science	DPIT111PCT	Introduction to IT Systems	2	1	0	3	40	60	3
7	Engineering Science	DPIT111PCP	Introduction to IT Systems Lab	0	0	4	4	60	40	2
8	Basic Science	DPCC111BSP	Applied Physics-I Lab	0	0	2	2	60	40	1
9	Humanities& Social Science	CCPE055NCP	Sports and Yoga	0	0	2	2	50	--	1
Total Credits										**18**

Semester I- Pool: 2
(Common to CSE, IT, EEE Branches)
Curriculum Structure

Sl. No	Category of Course	Code No.	Course Title	Hours Per week			Total contact hrs/ week	Scheme of Evaluation		Credits
				L	T	P		CIE	SEE	
1	Basic Science	DPCC113BST	Mathematics-I	2	1	0	3	40	60	**3**
2	Basic Science	DPCC111BST	Applied Physics-I	2	1	0	3	40	60	**3**
3	Engineering Science	DPCE101EST	Engineering Mechanics	2	1	0	3	40	60	**3**
4	Humanities & Social Science	DPCC111HST	Communication Skills In English	2	0	0	2	20	30	**2**
5	Engineering Science	DPEE111PCT	Fundamentals of Electrical & Electronics Engineering	2	1	0	3	40	60	**3**
6	Humanities &Social Science	DPCC111HSP	Communication Skills in English Lab	0	0	2	2	60	40	**1**
7	Engineering Science	DPCE112PCP	Engineering Workshop Practice	0	0	4	4	60	40	**2**
8	Basic Science	DPCC111BSP	Applied Physics-I Lab	0	0	2	2	60	40	**1**
9	Engineering Science	DPCE111ESP	Engineering Mechanics Lab	0	0	2	2	60	40	**1**
10	Engine ring Science	DPEE111PCP	Fundamentals of Electrical& Electronics Engineering Lab	0	0	4	4	60	40	**2**
11	Audit	DPCC116NCT	Environmental Science	2	0	0	2	20	30	**0**
			Total Credits							**21**

Semester II–Pool: 1
(Common to CIVIL, MECH, ECE Branches)
Curriculum Structure

Sl. No	Category of Course	Code No.	Course Title	Hours per week			Total contact hrs/week	Scheme of Evaluation		Credits
				L	T	P		CIE	SEE	
1	Basic Science	DPCC213BST	Mathematics-II	2	1	0	3	40	60	**3**
2	Basic Science	DPCC211BST	Applied Physics-II	2	1	0	3	40	60	**3**
3	Humanities & Social Science	DPCC111HST	Communication Skills in English	2	0	0	2	20	30	**2**
4	Engineering Science	DPEE111PCT	Fundamentals of Electrical & Electronics Engineering	2	1	0	3	40	60	**3**
5	Engineering Science	DPCE101EST	Engineering Mechanics	2	1	0	3	40	60	**3**
6	Basic Science	DPCC211BSP	Applied Physics-II Lab	0	0	2	2	60	40	**1**
7	Engineering Science	DPCE112PCP	Engineering Workshop Practice	0	0	4	4	60	40	**2**
8	Engineering Science	DPEE111PCP	Fundamentals of Electrical & Electronics Engineering Lab	0	0	4	4	60	40	**2**
9	Engineering Science	DPCE111ESP	Engineering Mechanics Lab	0	0	2	2	60	40	**1**
10	Humanities& Social Science	DPCC111HSP	Communication Skills In English Lab	0	0	2	2	60	40	**1**
11	Audit	DPCC116NCT	Environmental Science	2	0	0	2	20	30	**0**
Total Credits										**21**

Semester II – Pool: 2
(Common to CSE, IT, EEE Branches)
Curriculum Structure

Sl. No	Category of Course	Code No.	Course Title	L	T	P	Total contact hrs/week	CIE	SEE	Credits
				Hours per week				**Scheme of Evaluation**		
1	Basic Science	DPCC213BST	Mathematics-II	2	1	0	3	40	60	**3**
2	Basic Science	DPCC211BST	Applied Physics-II	2	1	0	3	40	60	**3**
3	Engineering Science	DPIT111PCT	Introduction to IT Systems	2	1	0	3	40	60	**3**
4	Engineering Science	DPCE111PCP	Engineering Graphics	0	0	2	2	60	40	**1**
5	Basic Science	DPCC112BST	Applied Chemistry	2	1	0	3	40	60	**3**
6	Basic Science	DPCC211BSP	Applied Physics-II Lab	0	0	2	2	60	40	**1**
7	Engineering Science	DPIT111PCP	Introduction to IT Systems Lab	0	0	4	4	60	40	**2**
8	Basic Science	DPCC112BSP	Applied Chemistry Lab	0	0	2	2	60	40	**1**
9	Humanities &Social Science	CCPE055NCP	Sports and Yoga	0	0	2	2	50	--	**1**
Total Credits										**18**

Mathematics-I

Course Objectives:
This course is designed to give a comprehensive coverage at an introductory level to the subject of Trigonometry, Differential Calculus and Basic elements of algebra.

Course Content:

UNIT - I: Trigonometry
Concept of angles, measurement of angles in degrees, grades and radians and their conversions, T-Ratios of Allied angles (without proof), Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios of multiple angles, sub-multiple angles (2A, 3A, A/2). Graphs of sin x, cos x, tan x and e^x.

Differential Calculus

Definition of function; Concept of limits. Four standard limits $\lim\limits_{x \to a} \dfrac{x^n - a^n}{x - a}$, $\lim\limits_{x \to 0} \dfrac{\sin x}{x}$, $\lim\limits_{x \to a}\left(\dfrac{a^x - 1}{x}\right)$ and $\lim\limits_{x \to a}(1+x)^{1/x}$.

Differentiation by definition of x^n, $\sin x, \cos x, \tan x, e^x \text{ and } \log_a x$. Differentiation of sum, product and quotient of functions. Differentiation of function of a function. Differentiation of trigonometric and inverse trigonometric functions, Logarithmic differentiation, Exponential functions.

UNIT - III: Algebra
Complex Numbers: Definition, real and imaginary parts of a Complex number, polar and Cartesian, representation of a complex number and its conversion from one form to other, conjugate of a complex number, modulus and amplitude of a complex number Addition, Subtraction, Multiplication and Division of a complex number. De-movier's theorem, its application.
Partial fractions: Definition of polynomial fraction proper & improper fractions and definition of partial fractions. To resolve proper fraction into partial fraction with denominator containing non-repeated linear factors, repeated linear factors and irreducible non-repeated quadratic factors. To resolve improper fraction into partial fraction.

Permutations and Combinations: Value of $n\mathrm{P_r} \text{ and } nC_\mathrm{r}$.
Binomial theorem: Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof) first and second binomial approximation with applications to engineering problems

References:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. A Text book of Engineering Mathematics for I,II semester by Dr. M.V.S.S N. Prasad by Radiant Publishing House.
4. A Text Book of Intermediate, Mathematics I , II year by Telugu Akademi , Telangana
5. Reena Garg, Engineering Mathematics, Khanna Publishing House, New Delhi (Revised Ed. 2018)
6. V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, Engineering Mathematics, 6/e., Vi-kas Publishing House.
7. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

<u>**APPLIED PHYSICS-I**</u>

Course Objectives:
Applied Physics includes the study of a large number of diverse topics all related to materials/things that exist in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which such objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content. The course will help the diploma engineers to apply the basic concepts and principles to solve broad- based engineering problems and to understand different technology based applications.

Learning Outcome:
 After undergoing this subject, the student will be able to:
- Identify physical quantities, select their units for use in engineering solutions, and make measurements with accuracy by minimizing different types of errors.
- Represent physical quantities as scalar and vectors and solve real life relevant problems.
- Analyse type of motions and apply the formulation to understand banking of roads/railway tracks and conservation of momentum principle to describe rocket propulsion, recoil of gun etc.
- Define scientific work, energy and power and their units. Drive relationships for work, energy and power and solve related problems.
- Describe forms of friction and methods to minimize friction between different surfaces.

Course Content:
Unit 1: Physical world, Units, Dimensions and Vectors
Physics – scope and nature– physics in relation to technology, Physical quantities, Fundamental physical quantities, Derived physical quantities with units, examples. S.I. Units of various physical quantities with symbols, Rules for writing SI units. Dimensions of physical quantity, dimensional formulae, principle of Homogeneity of Dimensions, applications of Dimensional Analysis. Scalar and Vector quantities – examples, representation of vector, types of vectors. Addition and Subtraction of Vectors, Resolution of a Vector, Triangle and Parallelogram law of vectors, Scalar and Vector Product, properties with examples, problems solving

Unit 2: Dynamics
Recapitulation of equations of motion in a straight line, acceleration due to gravity, expressions for Maximum Height, Time of ascent, Time of descent and time of flight. Work, energy, power and their SI units, potential Energy and Kinetic Energy examples and their expression. The law of conservation of Energy, verify in the case of freely falling body. simple harmonic motion with examples, conditions of S.H.M, Explanation of simple Harmonic Motion by Reference circle, Expressions for Displacement, Velocity, Acceleration, Time Period and Frequency in S.H.M, simple pendulum and expression for time period of a simple pendulum, second's pendulum, problems solving

Unit 3: Properties of Matter
 Introduction to Elasticity, stress and strain, types of stress and strain, Hooke's law moduli of elasticity, young's modulus, Bulk Modulus, Rigidity Modulus. Surface tension: concept, units, cohesive and adhesive forces, angle of contact, applications of surface tension, effect of temperature and impurity on surface tension. Capillarity and its applications in daily life, Experimental determination of surface tension based on capillary rise method. Viscosity and coefficient of viscosity and effect of temperature on viscosity, problems solving

Unit 4: Heat and Thermodynamics
Concept of heat and temperature, modes of heat transfer (conduction, convection and radiation with

examples), scales of temperature and their relationship, Expansion of solids, coefficient of linear, Areal and cubical expansions and relation amongst them. Expansion of gases, volume coefficient of a gas and pressure coefficient of a gas, Boyles law, Charles laws, ideal gas Equation, laws of thermodynamics, specific heats and molar specific heats, $C_P-C_V=R$, problems solving.

Text Books and References

1. Concepts of physics by HC VERMA, Surya publication, Ghaziabad, india
2. Physics- Resnik and Halliday- Wiley Toppan Publishers- England
3. Physics- intermediate-I &II year- Telugu Academy, Telangana
4. P.k palaniswamy: Atext book of Engineering Physics
5. C.Kittel(Wiley Eastern) : introduction to solid state physics.

Applied Physics-I Lab

Course Objectives

Study of Applied Physics aims to give an understanding of physical world by observations and predictions. Concrete use of physical principles and analysis in various fields of engineering and technology is very prominence. The course aims to supplement the factual knowledge gained in the lecture by first hand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students get necessary confidence in handling equipment and thus learn various skills in measurement.

Learning Outcome:

After undergoing this lab work, the student will be able to:

- Select right kind of measuring tools (Meter scale, Vernier caliper, Screw gauge, Spherometer etc.) for determining dimensions of physical quantities and make measurements with accuracy and precision.
- Differentiate various shapes and determine dimensions of plane, curved and regular surfaces/bodies.
- Apply and Verify laws of forces and determine resultant force acting on a body.
- Appreciate role of friction and measure co-efficient of friction between different surfaces.
- Describe and verify Hook"s law and determine force constant of spring body.
- Identify various forms of energy, energy transformations and verify law of conservation of energy.
- Understand viscosity of liquids and determine viscosity of a given liquid.
- Understand use of thermometers to measure temperature under different conditions and different scales of temperature measurements.

List of Practical's

1. Determination of volume of solid cylinder and sphere, using a Vernier caliper
2. Determination of diameter of a wire, thickness of thin glass plate using a screw gauge.
3. Determination of radius of curvature of a convex and a concave mirror/surface using a spherometer.
4. To verify triangle and parallelogram law of forces.(Concurrent forces)
6. Determination of the acceleration due to gravity at a place using simple pendulum.
7. Determination of force constant of a spring using Hooke's Law.
8. Determination of the surface Tension of a given liquid by capillary Rise Method.
9. Determination of the viscosity of a given liquid by Stoke"s law
10. Determination of atmospheric pressure at a place using Quill Tube Method
11. To measure room temperature and temperature of a hot bath using mercury thermometer and convert it into different scales.

Applied Chemistry

Course Objectives:

There are numerous number materials are used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. On successful completion of this course content will enable technicians to understand, ascertain and analyse and properties of natural raw materials require for producing economical and eco-friendly finished products.

- Solve various engineering problems applying the basic knowledge of atomic structure and chemical bonding.
- Use relevant water treatment method to solve domestic and industrial problems.
- Solve the engineering problems using knowledge of engineering materials and properties.
- Use relevant fuel and lubricants for domestic and industrial applications
- Solve the engineering problems using concept of Electrochemistry and corrosion.

Learning Outcomes

At the end of the course student will be able to

1. Understand the classification and general properties of engineering materials such as metal, alloys, glasses, cement, refractory and composite materials using knowledge of chemical bonding.
2. Understand and assess the suitability of water source for domestic and industrial application, effluents and minimize water pollution.
3. Qualitatively analyze the engineering materials and understand their properties and applications.
4. Choose fuel and lubricants suitable for economical industrial processing to obtain eco- friendly finished products.
5. a) Ascertain construction, mechanism efficiency of electrochemical cells, solar cell fuel cells
   b) Understand corrosion and develop economical prevention techniques.

Course Content:

Unit 1: Atomic Structure, Chemical Bonding and Solutions

Bohr‟s theory (expression of energy and radius to be omitted), Quantum numbers orbital concept. Shapes of s, p and d orbitals, Pauli‟s exclusion principle, Hund‟s rule of maximum multiplicity Aufbau rule, electronic configuration.
Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example), covalent bond, co-ordination bond in NH_4^+.
Solution–idea of solute, solvent and solution, methods to express the concentration of solution-molarity (M=mole per liter), ppm.

Unit 2: Water, Chemistry of Fuels and Lubricants

Graphical presentation of water distribution on Earth(pie or bar diagram).Classification of soft and hard water based on soap test, salts causing water hardness, unit of hardness and simple numerical on water hardness.
Cause of poor lathering of soap in hard water, problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc). Water softening techniques – soda lime process, zeolite process and ion exchange process.

Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilization.

Chemistry of Fuels and Lubricants:

Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), calculation of HCV and LCV using Dulong"s formula.

Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas and biogas.

Lubrication – function and characteristic properties of good lubricant, classification with ex- amples. Physical properties (viscosity and viscosity index, oiliness, flash and fire point, could and pour point only) and chemical properties (coke number, total acid number saponification value)of lubricants.

Unit 3: Engineering Materials

Natural occurrence of metals – minerals, ores of iron, aluminium and copper, gangue (ma-
trix), flux, slag, metallurgy – brief account of general principles of metallurgy. Extraction of iron from haematite ore using blast furnace. Alloys –
definition, purposes of alloying, ferrous alloys and non-ferrous with
suitable examples, properties and applications.

Portland cement and hardening, Glasses Refractory and Composite materials.

Polymers – monomer, homo and co polymers, simple reactions involved in preparation and their application of thermoplastics and thermosetting plastics(using PVC, PS, PTFE, nylon – 6, nylon – 66, Bakelite only), rubber and vulcanization of rubber.

Unit 4: Electro Chemistry

Electronic concept of oxidation, reduction and redox reactions.

Definition of terms: electrolytes, non-electrolytes with suitable examples, Faradays laws of electrolysis and simple numerical problems. Industrial Application of Electrolysis –
- Electrometallurgy
- Electroplating
- Electrolytic refining.

Application of redox reactions in electrochemical cells –
- Primary cells – dry cell,
- Secondary cell-commercially used lead storage battery, fuel and Solar cells. Introduction to Corrosion of metals–
- definition, types of corrosion (chemical and electrochemical), H_2 liberation and O_2 absorption mechanism of electrochemical corrosion, factors affecting rate of corrosion.

Internal corrosion preventive measures –
- Purification, alloying and heat treatment and

External corrosion preventive measures: a) metal (anodic, cathodic) coatings, b) organic inhibitors.

Suggested Learning Resources:
1) Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
2) Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi,2015.

Applied Chemistry Lab

Course Objectives:

There are numerous number of materials used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. The course aims to supplement the factual knowledge gained in the lectures by first hand manipulation of processes and apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering problems.

Learning Outcomes:

At the end of the course student will be able to

- To express quantitative measurements accurately.
- To practice and adapt good measuring techniques.
- To use various apparatus for precise measurements.
- To understand and differentiate different methods of quantitative analysis.
- To know and understand principles of quantitative analysis using instruments.

LIST OF PRACTICALS:

Perform any 12 (twelve) Laboratory Practicals.

Volumetric and Gravimetric analysis:

1 Preparation of standard solution of oxalic acid or potassium permanganate.
2 To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
3 Standardization of $KmnO_4$ solution using standard oxalic acid and Determine the percentage of Iron present in given Hematite ore by $KmnO_4$ solution.
4 Iodometric estimation of copper in the copper pyrite ore.
5 Volumetric estimation of total acid number (TAN) of given oil.
6 Volumetric estimation of
     a) Total hardness of given water sample using standard EDTA solution.
     b) Alkalinity of given water sample using 0.01M sulphuric acid
7   Proximate analysis of coal
     a) Gravimetric estimation moisture in given coal sample
     b) Gravimetric estimation ash in given coal sample

Instrumental analysis

8. Determine the conductivity of given water sample.
9. Determination of the Iron content in given cement sample using colorimeter.
10. Determination of calorific value of solid or liquid fuel using bomb calorimeter.
11. Determination of viscosity of lubricating oil using Redwood viscometer.
12. DeterminationofflashandfirepointoflubricatingoilusingAble"sflash point apparatus.
13. To verify the first law of electrolysis of copper sulfate using copper electrode.
14. Construction and measurement of emf of elector chemical cell (Daniel cell).
15. To study the effect of dissimilar metal combination.

Text Book:

1. Text Book of Chemistry for Class XI & XII (Part-I, Part-II); N.C.E.R.T., Delhi,2017- 18.

Communication Skills in English

Course Objectives:

Communication skills play an important role in career development. This course aims at introducing basic concepts of communication skills with an emphasis on developing personality of the students. Thus, the main objectives of this course

To develop confidence in speaking English with correct pronunciation.

To develop communication skills of the students i.e. listening, speaking, reading and writing skills. To introduce the need for personality development- Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc.

Course Outcomes:

At the end of this course, the participants will:

- Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.

- Be informed of the latest trends in basic verbal activities such as presentations, facing interviews and other forms of oral communication.

- Also develop skills of group presentation and communication in team. Develop non-verbal communication such as proper use of body language and gestures.

Course Content

Unit-1 Communication: Theory and Practice

- Basics of communication: Introduction, meaning and definition, process of communication etc.

- Types of communication: formal and informal, verbal, non-verbal and written Barriers to effective communication.

- **7** Cs for effective communication (considerate, concrete, concise, clear, complete, correct courteous).

- Art of Effective communication,

    o   Choosing words
    o   Voice
    o   Modulation
    o   Clarity
    o   Time
    o   Simplification of words
- Technical Communication.

Unit-2 Soft Skills for Professional Excellence
- Introduction: Soft Skills and Hard Skills.
- Importance of soft skills.
- Life skills: Self-awareness and Self-analysis, adaptability, resilience, emotional intelligence and empathy etc.
- Applying soft skills across cultures.
- Case Studies.

Unit-3: Reading Comprehension

Comprehension, vocabulary enhancement and grammar exercises based on reading of the following texts:

Section-1

Malgudi Days: R.K. Narayan

The Room on Roof: Ruskin Bond "The Gift of the Magi" by O. Henry

"Uncle Podger Hangs a Picture" Jerome K. Jerome

Section-2

Night of the Scorpion by Nissim Ezekiel,
Stopping by Woods on a Snowy,
Evening by Robert Frost, Where the
Mind is Without Fear by Rabindranath
Tagore, Ode to Tomatoes by Pablo
Neruda,

Unit-4: Professional Writing

The art of précis writing, Letters: business and personnel, Drafting e-mail, notices, minutes of a meeting etc   Filling-up different forms such as banks and on-line forms for placement etc. Vocabulary and Grammar Vocabulary of commonly used words Glossary of administrative terms (English and Hindi) One-word substitution, Idioms and phrases etc. Parts of speech, active and passive voice, tenses etc., Punctuation

References:

1. M. Ashraf Rizvi. *Effective Technical Communication*. Mc-Graw Hill: Delhi,2002.

Communication Skills in English – Lab

Course Objectives:

Communication skills play an important role in career development. This lab course aims at actively involving students in various activities to improve their communication skills with an emphasis on developing personality of the students. Thus, the objectives of this course are:

1. To develop listening skills for enhancing communication.

2. To develop speaking skills with a focus on correct pronunciation and fluency.

3. To introduce the need for Personality development- Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc. for that purpose group discussion, extempore and other activities should be conducted during lab classes.

Learning Outcome:

- Attheendofthiscoursethestudentswillbeabletocommunicateeffectively with an increase in their confidence to read, write and speak English fluently.

- They will also demonstrate a significant increase in word power.

- The variety of exercises and activities that will be conducted in the Language Lab will develop their skills needed to participate in a conversation like listening carefully and respectfully to others" viewpoints; articulating their own ideas and questions clearly and overall students will be able to prepare, organize, and deliver an engaging oral presentation.

- They will also develop non-verbal communication such as proper use of body language and gestures.

Course Content:

Unit 1 Listening Skills

Listening Process and Practice: Introduction to recorded lectures, poems, interviews and speeches, listening tests.

Unit II Introduction to Phonetics

Sounds: consonant, vowel, diphthongs, etc. transcription of words (IPA), weak forms, syllable division, word stress, intonation, voice etc.

Unit III Speaking Skills

Standard and formal speech: Group discussion, oral presentations, public speaking, business presentations etc. Conversation practice and role playing, mock interviews etc.

Unit IV Building vocabulary

Etymological study of words and construction of words, phrasal verbs, foreign phrases, idioms and phrases. Jargon/ Register related to organizational set up, word exercises and word games to enhance self-expression and vocabulary of participants.

Recommended Readings:

1. Daniel Jones. *The Pronunciation of English.* Cambridge: Cambridge University Press, 1956.

Engineering Graphics

Course Objectives:

Following are the objectives of this course:
- To understand the language of graphics which is used to express ideas, convey instructions while carrying out engineering jobs.
- To develop drafting and sketching skills, to know the applications of drawing equipments, and get familiarize with Indian Standards related to engineering drawings.
- To develop skills to visualize actual object or a part of it, on the basis of drawings.
- To develop skills to translate ideas into sketches and to draw and read various engineering curves, projections and dimensioning styles.
- To understand the basic commands and develop basic skills related to computer aided drafting, of how to draw, modify, and edit basic shapes (2D), using AUTOCAD.

Course Outcomes

Following outcomes will be achieved:
- Select and construct appropriate drawing scales, use drawing equipments, and understand Indian Standards of engineering drawing
- Draw views of given object and components 3) Sketch orthographic projections into isometric projections and vice-versa.
- Apply computer aided drafting tools to create 2D engineering drawings

Course Content

Unit – I Basic elements of Drawing
- Drawing Instruments and supporting materials: method to use them with applications. Convention of lines and their applications.
- Representative Fractions – reduced, enlarged and   full-size scales; Engineering Scales such as plain and diagonal scale.
- Dimensioning techniques as per SP-46:2003 – types and applications of chain, parallel and coordinate dimensioning.
- Geometrical and Tangency constructions. (Redraw the figure)

Unit – II Orthographic projections
- Introduction of projections-orthographic, perspective, isometric and oblique: concept and applications (No question to be asked in examination).
- Introduction to orthographic projection, First angle and Third angle method, their symbols.
- Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces. (use First Angle Projection method only)
- Isometric Projections
- Introduction to isometric projections. Isometric scale and Natural scale. Isometric view and isometric projection.
- Illustrative problems related to objects containing lines, circles and arcs shape only. Conversion of orthographic views into isometric view/projection.

Unit – III Free Hand Sketches of engineering elements
- Free hand sketches of machine elements: Thread profiles, nuts, bolts, studs, set screws, washer, locking arrangements. (For branches other than mechanical Engineering, the teacher should select branch specific elements for free hand sketching)
- Free hand sketches of orthographic view (on squared graph paper) and isometric view (on isometric grid paper)

Unit – IV Computer Aided Drafting Interface & Drafting: concept.

- Hardware and various CAD software available. System requirements and Understanding the interface.
- Components of AutoCAD software window: Title bar, standard tool bar, menu bar, object properties tool bar, draw tool bar, modify tool bar, cursor cross hair. Command window, status bar, drawing area, UCS icon.
- File features: New file, Saving the file, opening an existing drawing file, creating templates, Quit.
- Setting up new drawing: Units, Limits, Grid, Snap. Undoing and redoing action.

Computer aided drafting

- Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, PolyLine. Method of Specifying points: Absolute coordinates, Relative Cartesian and Polar coordinates. Modify and edit commands like trim, extend, delete, copy, offset, array, block, layers.
- Dimensioning: Linear, Horizontal Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius, Angular Dimensions.
- Dim scale variable. Editing dimensions.
- Text: Single line Text, Multiline text.
- Standard sizes of sheet. Selecting Various plotting parameters such as Paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview.

Suggested Learning Resources:

1. Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS. Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2.
2. Bhatt, N. D. Engineering Drawing. Charotar Publishing House, Anand, Gujrat 2010; ISBN: 978-93- 80358-17-8.
3. Jain & Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi (ISBN: 978- 93-86173-478)
4. Jolhe, D. A. Engineering Drawing. Tata McGraw Hill Edu. New Delhi, 2010; ISBN: 978-0-07-064837-1
5. Dhawan, R. K. Engineering Drawing. S. Chand and Company, New Delhi; ISBN: 81-219-1431-0.
6. Shah, P. J. Engineering Drawing. S. Chand and Company, New Delhi, 2008, ISBN:81-219-2964-4.
7. Kulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. Engineering Graphics with AutoCAD. PHI Learning Private Limited-New Delhi (2010); ISBN: 978-8120337831.
8. Jeyapoovan, T. Essentials of Engineering Drawing and Graphics using AutoCAD. Vikas Publishing House Pvt. Ltd, Noida, 2011; ISBN: 978-8125953005.
9. Autodesk. AutoCAD User Guide. Autodesk Press, USA, 2015.
10. Sham, Tickoo. AutoCAD 2016 for Engineers and Designers. Dream tech Press; Galgotia Publication, New Delhi, 2015; ISBN 978-9351199113.

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Course Objectives:

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

- Solve various engineering problems applying ecosystem to produce eco – friendly products.
- Use relevant air and noise control method to solve domestic and industrial problems.
- Use relevant water and soil control method to solve domestic and industrial problems.
- To recognize relevant energy sources required for domestic and industrial applications.
- Solve local solid and e-waste problems.

Course Outcomes:
At the end of the course student will be able to

- Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
- Understand the suitable air, extent of noise pollution, and control measures and acts.
- Understand the water and soil pollution, and control measures and acts.
- Understand different renewable energy resources and efficient process of harvesting.
- Understand solid Waste Management, ISO 14000 & Environmental Management.

Course Content:
Pre requisite: - High School Chemistry

Unit-1 Ecosystem
- Structure of ecosystem, Biotic & Abiotic components
- Food chain and food web
- Global warming -Causes, effects, process, Green House Effect, Ozone depletion

Unit– 2 Air and Noise Pollution
- Definition of pollution and pollutant, Natural and manmade sources of air pollution
- Air Pollutants: Types, Particulate Pollutants: Effects and control of air pollution
- Noise pollution: sources of pollution, Effects and control of Noise pollution

Unit- 3 Water and Soil Pollution
- Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition
- Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.
- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste.

Unit– 4 Renewable sources of Energy
- Solar Energy: Basics of Solar energy. Solar pond. Solar water heater, solar dryer.

- Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas.
- Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy.
- New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy
- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste.

References:

Suggested Learning Resources:

1. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi

2. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.

Introduction to IT Systems

Course Objectives:

This course is intended to make new students comfortable with computing environment – Learning basic computer skills, Learning basic application software tools, Understanding Computer Hard- ware, Cyber security awareness

Course Outcomes:

At the end of the course student will be able to comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/ attacks.

Course Content:

UNIT 1:

Basic Internet skills: Understanding browser, efficient use of search engines, awareness about Digital India portals (state and national portals) and college portals.

General understanding of various computer hardware components – CPU, Memory, Display, Key- board, Mouse, HDD and other Peripheral Devices.

UNIT 2:

OS Installation (Linux and MS Windows), Unix Shell and Commands, vi editor.

UNIT 3: HTML4, CSS, making basic personal webpage.

UNIT 4: Office Tools: OpenOffice Writer, OpenOffice Spreadsheet (Calc), OpenOffice Impress.

Information security best practices.

Class lectures will only introduce the topic or demonstrate the tool, actual learning will take place in the Lab by practicing regularly.

Suggested Lab Work:

This is a skill course. Topics/concepts taught in the class should be practiced in the Lab same week and practiced regularly during the semester till student becomes confident about it. This course is all about some theory and a lot of practice.

References:

1. R.S. Salaria, Computer Fundamentals, Khanna Publishing House
2. Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House
3. Online Resources, Linux man pages, Wikipedia
4. Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and Shell programming, by Mokhtar Ebrahim, Andrew Mallett

Introduction to IT Systems Lab

Course Objectives:

This Lab course is intended to practice whatever is taught in theory class of „Introduction of IT Systems" and become proficient in using computing environment – basic computer skills, basic application software tools, Computer Hardware, cyber security features, etc.

Course Outcomes:

At the end of the course student will be able to comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basicabuses/attacks.

Course Content:

S.No.	Topics for Practice
1	Browser features, browsing, using various search engines, writing search queries
2	Visit various e-governance/Digital India portals, understand their features, services offered
3	Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, 27hosal27ze various ports/interfaces and related cables, etc.
4	Install Linux and Windows operating system on identified lab machines, explore various options, do it multiple times
5	Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.
6	Practice HTML commands, try them with various values, make your own Webpage
7	Explore features of Open Office tools, create documents using these features, do it multiple times
8	Explore security features of Operating Systems and Tools, try using them and see what happens.

This is a skill course. More you practice, better it will be.

References:

1. Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing House.
2. IT Essentials PC Hardware and Software Companion Guide, Davis Anfinson and Ken Quamme, CISC Press, Pearson Education.

<u>**Applied Physics –II**</u>

Course Objectives

Applied Physics aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content. The course will help the diploma engineers to apply the basic concepts and principles to solve broad-based engineering problems and to understand different technology-based applications.

Learning Outcome:

After undergoing this subject, the student will be able to;

a) Describe waves and wave motion, periodic and simple harmonic motions and solve simple problems. Establish wave parameters: frequency, amplitude, wavelength, and velocity and able to explain diffraction, interference, polarization of waves.

b) Explain ultrasonic waves and engineering, medical and industrial applications of Ultrasonics. Apply acoustics principles to various types of buildings for best sound effect.

c) State basic optical laws, establish the location of the images formed by mirrors and thin converging lens, design and assemble microscope using lenses combination.

d) Describe refractive index of a liquid or a solid and will be able to explain conditions for total internal reflection.

e) Define capacitance and its unit, explain the function of capacitors in simple circuits, and solve simple problems.

f) Differentiate between insulators, conductors and semiconductors, and define the terms: potential, potential difference, electromotive force.

Course Content
UNIT – 1: Wave motion and Optics

Wave motion, transverse and longitudinal waves with examples, progressive and it's characteristics, Sound waves and their properties, principle of superposition of waves and beat formation. Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications. Light waves and their properties, reflection and refraction, refractive index (snell's law), Critical angle, Total internal reflection and conditions for total internal reflection, applications of total internal reflection in optical fiber,. Image formation by thin lenses, lens formula, power of lens, magnification, problems solving

UNIT -2: Electrostatics and Current Electricity

Charges, Coulombs inverse square law, Electric field, Electric lines of force and their properties, Electric potential and potential difference. Capacitance and its units Capacitor and its principle, Capacitance of a parallel plate capacitor, Series and parallel combination of capacitors.

Electric Current and its units, Ohm's law, Resistance and its units, Conductance, Specific resistance, conductivity, Series and parallel combination of resistances. Kirchhoff's laws, Wheatstone bridge and its applications, Meter Bridge Experiment for determination of specific resistance with neat circuit diagram, problems solving.

UNIT – 3: Electromagnetism

Introduction to magnetism, coulomb inverse square law in magnetism, Magnetic field and its units, , magnetic lines of force, Magnetic induction, magnetic moment and units,

Force on moving charge in magnetic field. Force on current carrying conductor, force on rectangular coil placed in magnetic field. Moving coil galvanometer; principle, construction and working,

Conversion of a galvanometer into ammeter and voltmeter, problems solving.

UNIT – 4: Modern Physics

Energy bands in solids, Types of materials (insulator, semi-conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction diode and V-I characteristics Photo- Electric effect, Einstein's photoelectric equation, laws of photoelectric effect, working of photo cell

Nanoscience and Nanotechnology Introduction, nanoparticles and nanomaterials, properties at nanoscale, nanotechnology and applications, problems solving.

Text Books and References

1. Concepts of physics by HC VERMA, Surya publication, Ghaziabad, India
2. Physics- Resnik and Halliday- Wiley Toppan Publishers- England
3. Physics- intermediate-I &II year- Telugu Academy, Telangana
4. P. K Palani swamy: A text book of Engineering Physics
5. C. Kittel (Wiley Eastern): Introduction to solid state physics.

Course Objectives:

Concrete use of physical principles and analysis in various fields of engineering and technology is very prominence. The course aims to supplement the factual knowledge gained in the lecture by first hand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students get necessary confidence in handling equipment and thus learn various skills in measurement.

Learning Outcome:
After undergoing this subject, the student will be able to;
  a) Apply concept of vibrations and determine the time period of vibrating objects.
  b) Use of equipment for determining velocity of ultrasonics in different liquids.
  c) Verify optical laws; reflection, refraction from plane interfaces and surfaces.
  d) Apply knowledge of optics to determine focal length and magnifying power of optical lenses.
  e) Understand uses of electrical components and meters and verify Ohm's law for flow of current.
  f) Quantify resistances and verify laws of series and parallel combination of resistances.
  g) Measure resistance of a galvanometer and how it is converted into an ammeter and volt- meter.
  h) Handle optical fibers and determine numerical aperture of given optical fiber.

List of Practicals/Activities:
  1. Determine the Velocity of sound in air using resonance column Apparatus at room temperature and at 0o C.
  2. Determine focal length and magnifying power of a convex lens.
  3. Determine focal length and magnifying power of a concave lens
  4. To verify Ohm''s law by plotting graph between current and potential difference
  5. Determine the resistance and specific resistance of the wire using Meter Bridge
  6. To verify laws of resistances in series and parallel combination using meter bridge.
  7. Draw the lines of force of combined magnetic field due to bar magnet in earth''s magnetic field by locating the null points when North pole of the bar magnet pointing towards Geographical North of the Earth.
  8. Draw the lines of force of combined magnetic field due to bar magnet in earth''s magnetic field by locating the null points when North pole of the bar magnet pointing towards Geographical North of the Earth
  9. To draw V-I characteristics of a semiconductor diode (Ge, Si) and determine its knee voltage.
  10. To measure numerical aperture (NA) of an optical fiber.

Engineering Mechanics

Course Objectives:

Following are the objectives of this course:

- To obtain resultant of various forces
- To calculate support reactions through conditions of equilibrium for various structures
- To understand role of friction in equilibrium problems

Course Outcomes:

After completing this course, student will be able to:

- Identify the force systems for given conditions by applying the basics of mechanics.
- Determine unknown force(s) of different engineering systems.
- Apply the principles of friction in various conditions for useful purposes.
- Find the centroid and centre of gravity of various components in engineering systems.

Course Contents:

Unit – I Basics of mechanics and force system

- Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body.
- Scalar and vector quantity, Units of measurement (SI units) – Fundamental units and derived units.
- Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification.
- Resolution of a force – Orthogonal components of a force, moment of a force, Varignon's Theorem.
- Composition of forces – Resultant, analytical method for determination of resultant for concur- rent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.

Unit– II Equilibrium

- Equilibrium and Equilibrant, Free body diagram, Analytical method of analysing equilibrium.
- Lamis Theorem – statement and explanation, Application for various engineering problems.
- Types of beams, supports (hinge, roller and fixed) and loads (vertical, inclined point load & uniformly distributed load) acting on the beam.
- Beam reaction for cantilever, simply supported beam with or without overhang – subjected to Point load, uniformly distributed load and combination of loads.

Unit– III Friction

- Introduction – Theory of Friction – Angle of friction – Laws of Friction – Static and Dynamic Frictions- Wedge Friction, Screw-jack and Differential Screw- jack
- Equilibrium of bodies on level surface subjected to force parallel and inclined to plane.

Unit– IV Centroid

- Introduction to Centroid, Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle). Centroid of T, L, I, Channel section, Z section, Unsymmetrical I section and Built-up sections.

Text Book:

1. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.

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Engineering Mechanics Lab

Course Objectives:

 Following are the objectives of this course:
1) To obtain resultant of various forces
2) To calculate support reactions through conditions of equilibrium for various structures
3) To understand role of friction in equilibrium problems
4) To know fundamental laws of machines and their applications to various engineering problems

Course Outcomes:

After completing this course, student will be able to
1. Identify the force systems for given conditions by applying the basics of mechanics.
2. Determine unknown force(s) of different engineering systems.
3. Apply the principles of friction in various conditions for useful purposes.
4. Find the centroid and centre of gravity of various components in engineering systems.
5. Select the relevant simple lifting machine(s) for given purposes.

List of Practical to be performed:

1. To study various equipments related to Engineering Mechanics.
2. To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
3. Determine resultant of concurrent force system applying Law of Polygon of forces using force table.
4. Determine resultant of concurrent force system graphically.
5. Determine resultant of parallel force system graphically.
6. Verify Lami's theorem.
7. Study forces in various members of Jib crane.
8. Determine support reactions for simply supported beam.
9. Obtain support reactions of beam using graphical method.
10. Determine coefficient of friction for motion on horizontal and inclined plane.
11. Determine centroid of geometrical plane figures.

Text Book:

1.   Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.

Fundamentals of Electrical and Electronics Engineering

Course Objectives:

To provide basic knowledge of the different elements and concepts of electrical engineering field and to learn basic concepts of various active and passive electronic components, Signals, Op-Amp and their applications, Digital Electronics and their applications to help students deal with electrical and electronics engineering principles and applications in industrial processes of different fields.

Outcomes:

1. Understand the basics of analog and digital electronics
2. Analyze eclectic and magnetic circuits
3. Understand the working of transformers and machines.

Course Contents:

UNIT I Overview of Electronic Components & Signals:
Passive Components: Resistors, Capacitors, Inductors. Ohm's Law.
Active Components: Diodes and BJT--Construction, Working, Characteristics and Applications.
Signals: DC/AC, voltage/current, periodic/non- periodic signals.

UNIT II Overview of Analog and Digital Circuits:
Operational Amplifiers-Ideal Op-Amp, Practical op- amp, Application of Op-Amp as amplifier, adder, differentiator and integrator.

Introduction to Boolean Algebra, Simplification of Expressions using Boolean Algebra, Introduction to Logic Gates.

Unit III Electric and Magnetic Circuits
EMF, Current, Potential Difference, Power and Energy; M.M.F, magnetic force, Electromagnetic induction, Faraday's laws of Electromagnetic induction, Lenz's law, Dynamically induced emf, Statically induced emf, Equations of self and mutual inductance; Analogy between electric and magnetic circuits.

Unit IV A.C. Circuits, Transformers and Machines
Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, and power factor; General Construction and Principle of Transformer; Emf equation and transformation ratio of transformers; Construction and Working principle of DC Motor; Basic equations and characteristic of DC motors.

Text Book:

1. Basic Electrical Engineering, Ritu Sahdev, Khanna Publishing House

2. Electronics Devices& Circuits ,Jacob Millman McGraw Hill Education; 4 edition (2015) ISBN: 978-9339219543

Fundamentals of Electrical and Electronics Engineering Lab

Course Objectives:

To provide basic knowledge of the different elements and concepts of electrical engineering field and to learn basic concepts of various active and passive electronic components, Signals, Op-Amp and their applications, Digital Electronics and their applications to help students deal with electrical and electronics engineering principles and applications in industrial processes of different fields.

Course Outcomes:

At the end of the course student will be able to:

1. Understand basic principle and operation of electric circuits and machines.
2. Solve basic problems related to electrical circuits and machines. Explain the operation of different electrical technologies.
3. Demonstrate an understanding of the control systems.
4. Understand the basic circuit elements
5. Understand different types of signal waveforms.
6. Understand logic gates and apply them in various electronic circuits.
7. Understand the basic concepts of op-amps, and their applications.
8. Use relevant electric/electronic protective devices safely.

S. No.	List of Experiments	Approx. Hrs.
1.	Determine the value of given resistor using digital multimeter to confirm with colour code.	02
2	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.	02
3	Use LCR-Q tester to measure the value of given capacitor and inductor.	02
4	Connect capacitors in series and parallel combination on bread board and measure its value using multimeter.	02
5	Measure voltage, current and power in 1-phase circuit with resistive load.	02
6	Measure voltage, current and power in R-L series circuit.	02
7	Test the performance of PN-junction diode.	02
8	Test the performance of Zener diode.	02
9	Determine the current gain of CE transistor configuration.	03
10	Determine the transformation ratio (K) of 1-phase transformer.	03

Text Book:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House,2018

Mathematics-II

Course Objectives:

- This course is designed to give a comprehensive coverage at an introductory level to the subject of matrices, Integral Calculus coordinate geometry, Basic elements of vector algebra and First Order Differential Equations.

Course Content:

UNIT – I: Determinants and Matrices

Elementary properties of determinants up to 3rd order, consistency of equations, Crammer's rule. Algebra of matrices, Inverse of a matrix, matrix inverse method to solve a system of linear equations in 3 variables.

UNIT – II: Integral Calculus

Integration as inverse operation of differentiation. Simple integration by substitution, by parts and by partial fractions (for linear factors only). Use of formulas $\int_0^{\pi/2} \sin^n x \, dx$, $\int_0^{\pi/2} \cos^n x \, dx$ and $\int_0^{\pi/2} \sin^m x \cos^n x \, dx$ for solving problems Where m and n are positive integers.

Applications of integration for (i). Simple problem on evaluation of area bounded by a curve and axes. (ii). Calculation of Volume of a solid formed by revolution of an area about axes. (Simple problems).

UNIT – III: Co-Ordinate Geometry

Equation of straight line in various standard forms (without proof), inter section of two straight lines, angle between two lines. Parallel and perpendicular lines, perpendicular distance formula. General equation of a circle and its characteristics. To find the equation of a circle, given:

i. Centre and radius,
ii. Three points lying on it and
iii. Coordinates of end points of a diameter;

Definition of conics (Parabola, Ellipse, Hyperbola) their standard equations without proof. Problems on conics when their foci, directories or vertices are given.

UNIT – IV: Vector Algebra

Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector products of 2 vectors. Simple problems related to work, moment and angular velocity.

UNIT-V: Differential Equations

Solution of first order and first-degree differential equation by variable separation method (simple problems). MATLAB – Simple Introduction.

References:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. A Text book of Engineering Mathematics for I, II, III semester by Dr. M.V.S.S N. Prasad by Radiant Publishing House.
4. A Text Book of Intermediate Mathematics I, II year by Telugu Akademi, Telangana
5. S.S. Sabharwal, Sunita Jain, Eagle Parkashan, Applied Mathematics, Vol. I & II, Jalandhar.
6. Comprehensive Mathematics, Vol. I & II by Laxmi Publications, Delhi.
7. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

Course Code	:	
Course Title	:	**Engineering Workshop Practice**
Number of Credits	:	2 (L: 0, T: 0, P:4)
Prerequisites	:	Nil
Course Category	:	PC

Course Objectives:

Following are the objectives of this course:
- Tounderstandbasicengineeringprocessesformanufacturingandassembly.
- To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipment's
- To understand and interpret job drawings, produce jobs, and inspect the job for specified Dimensions
- Tounderstandthevarioustypesofwiringsystemsandacquireskillsinhouse wiring
- To understand, operate, control different machines and equipment's adopting safety practice

Course Outcomes:

After competing this course, student will be able to:
- Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools &equipment's and machines
- Understandjobdrawingandcompletejobsasperspecificationsinallottedtime
- Inspect the job for the desired dimensions and shape
- Operate, control different machines and equipments adopting safety practices

List of Practicals to be performed (Minimum 8 practicals should be conducted):

S.No.	Details of Practical Content
I	**Carpentry:** i) Demonstration of different wood working processes, like plaining, marking, chiseling, turning of wood etc. ii) One simple job involving any one joint like mortise and tendon dovetail, bridle, half lap etc. **Fitting:** i) Demonstration of different operations like chipping, filing, drilling, tapping, sawing, cutting etc. ii) One simple fitting job involving practice of chipping, filing, drilling, tapping, cutting etc.
II	**Welding:** i) Demonstration of different welding tool. Ii) Demonstration on Arc Welding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding. iii) One simple job involving butt and lap joint **Sheet Metal Working:** i) Demonstration of different sheet metal operations like sheet cutting, bending, edging, lancing, soldering, and riveting. Ii) One simple job involving sheet metal operations and soldering and riveting
III	**Electrical House Wiring:** Practice on simple lamp circuits (i) one lamp controlled by one switch by surface conduit wiring, (ii) Lamp circuits- connection of lamp and socket by separate switches
IV	**Demonstration:** i) Demonstration of measurement of Current, Voltage, Power and Energy. ii) Demonstration of advance power tools, pneumatic tools, electrical wiring tools and accessories. Iii) Tools for Cutting and drilling

Suggested Learning Resources:

1. S.K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi,2015

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MAULANA AZAD NATIONAL URDU UNIVERSITY

(A Central University established by an Act of Parliament in 1998)

Accredited 'A' Grade by NAAC

Gachibowli, Hyderabad - 500 032, T.S.

AICTE Model Curriculum with effect from 2021-22 for MANUU Polytechnics

General Course Structure
&
Credit Distribution

Diploma in
Electrical and Electronics Engineering

Electrical and Electronics Engineering

Curriculum Structure

(III to VI Semester)

Electrical and Electronics Engineering

Curriculum Structure

(III to VI Semester)

Implementation of AICTE Model Curriculum 2019 for Diploma in **Engineering Courses in MANUU Polytechnics**
(Hyderabad, Bangalore, Darbhanga, Kadapa, Cuttack)
Semester III

Curriculum in Electrical and Electronics Engineering

Course Code	Description	Course Title	Hours/Week			Credits	Total Contact Hours/ Week
			L	T	P		
DPEE305PCT	Professional Core Courses	Introduction to Electric Generation Systems	3	0	0	3	3
DPEE305PCP	Professional Core Courses	Introduction to Electric Generation Systems Laboratory	0	0	2	1	2
DPEE306PCT	Professional Core Courses	Electrical Circuits	2	1	0	3	3
DPEE306PCP	Professional Core Courses	Electrical Circuits Laboratory	0	0	2	1	2
DPEE307PCT	Professional Core Courses	Electrical and Electronic Measurements	2	1	0	3	3
DPEE307PCP	Professional Core Courses	Electrical and Electronic Measurements Laboratory	0	0	2	1	2
DPEE308PCT	Professional Core Courses	Electric Motors and Transformers	2	1	0	3	3
DPEE308PCP	Professional Core Courses	Electric Motors and Transformers Laboratory	0	0	2	1	2
DPEE309PCT	Professional Core Courses	Analog and Digital Electronics	3	0	0	3	3
DPCC301SEP		Summer Internship-I	0	0	0	2	0
		Total				**21**	**23**

Implementation of AICTE Model Curriculum 2019 for Diploma in**Engineering Courses in MANUU Polytechnics**
(Hyderabad, Bangalore, Darbhanga, Kadapa, Cuttack)
Semester IV

Curriculum in Electrical and Electronics Engineering

Course Code	Description	Course Title	Hours/Week			Credits	Total Contact Hours/ Week
			L	T	P		
DPEE405PCT	Professional Core Courses	Fundamentals of Power Electronics	3	0	0	3	3
DPEE405PCP	Professional Core Courses	Fundamentals of Power Electronics Laboratory	0	0	2	1	2
DPEE406PCT	Professional Core Courses	Electric Power Transmission and Distribution	3	0	0	3	3
DPEE406PCP	Professional Core Courses	Electric Power Transmission and Distribution Laboratory	0	0	2	1	2
DPEE407PCT	Professional Core Courses	Induction, Synchronous and Special Electrical Machines	3	0	0	3	3
DPEE407PCP	Professional Core Courses	Induction, Synchronous and Special Electrical Machines laboratory	0	0	4	2	4
	Programme Elective I	Programme Elective I	3	0	0	3	3
	Programme Elective II	Programme Elective II	3	0	0	3	3
DPCC402SEP	PR	Minor Project	0	0	4	2	4
DPCC401PET	AU	Essence of Indian Knowledge and Tradition	2	0	0	0	2
		Total				**21**	**29**

List of Program Elective I

Course Code	Course Title
	Industrial Instrumentation and Condition Monitoring
	Communication Technologies
	Industrial Drives

List of Program Elective II

Course Code	Course Title
	Industrial Automation & Control
	Electrical Testing and Commissioning
	Electrical Estimation and Contracting

Implementation of AICTE Model Curriculum 2019 for Diploma in**Engineering Courses in MANUU Polytechnics**

(Hyderabad, Bangalore, Darbhanga, Kadapa, Cuttack)
Semester V

Curriculum in Electrical and Electronics Engineering

CourseCode	Description	Course Title	Hours/Week			Credits	Total Contact Hours/ Week
			L	T	P		
	ProfessionalCore Courses	Microcontroller Applications	3	0	0	3	3
	ProfessionalCore Courses	Microcontroller Applications Laboratory	0	0	2	1	2
	Professional Core Courses	Control Systems	3	0	0	3	3
	Professional Core Courses	Control Systems Laboratory	0	0	4	2	4
	Programme Elective III	Programme Elective III	3	0	0	3	3
	Programme Elective IV	Programme Elective IV	3	0	0	3	3
	Open Elective	Open Elective I	3	0	0	3	3
	Internship	Summer Internship - II	0	0	0	3	0
	Project	Major Project	0	0	2		2
Total						**21**	**23**

List of Program Elective III

Course Code	Course Title
	Illumination Practices
	Building Electrification
	Solar Power Technologies

List of Program Elective IV

Course Code	Course Title
	Wind Power Technologies
	Biomass and Micro-hydro Power Plants
	Electric Vehicles

List of Open Elective I

Course Code	Course Title
	Renewable Energy Technologies
	Soft Computing Techniques
	Energy Efficiency and Audit

Implementation of AICTE Model Curriculum 2019 for Diploma inEngineering Courses in

MANUU Polytechnics

(Hyderabad, Bangalore, Darbhanga, Kadapa, Cuttack)

Semester VI

Curriculum in Electrical and Electronics Engineering

Course Code	Description	Course Title	Hours/Week			Credits	Total Contact Hours/ Week
			L	T	P		
	Professional Core Courses	Switchgear and Protection	3	0	0	3	3
	Professional Core Courses	Switchgearand Protection Laboratory	0	0	4	2	4
	Humanities	Entrepreneur ship and Start-ups	3	0	0	3	3
	Open Elective	Open Elective II	3	0	0	3	3
	Open Elective	Open Elective III	3	0	0	3	3
	Mandatory Audit courses	Indian Constitution	2	0	0	0	2
	Project 2	Major Project	0	0	6	4	6
	Seminar	Seminar	1	0	0	1	1
		Total				**19**	**25**

List of Open Elective II

Course Code	Course Title
	Internet of Things
	Artificial Intelligence
	Mechatronics

List of Open Elective III

Course Code	Course Title
	Energy Conservation & Audit
	Product Design
	Project Management

Implementation of AICTE Model Curriculum 2019 for Diploma in**Engineering Courses in MANUU Polytechnics**
(Hyderabad, Bangalore, Darbhanga, Kadapa, Cuttack)
Semester III

Curriculum in Electrical and Electronics Engineering

Course Code	Description	Course Title	Hours/Week			Credits	Total Contact Hours/ Week
			L	T	P		
	Professional Core Courses	Introduction to Electric Generation Systems	3	0	0	3	3
	Professional Core Courses	Introduction to Electric Generation Systems Laboratory	0	0	2	1	2
	Professional Core Courses	Electrical Circuits	2	1	0	3	3
	Professional Core Courses	Electrical Circuits Laboratory	0	0	2	1	2
	Professional Core Courses	Electrical and Electronic Measurements	2	1	0	3	3
	Professional Core Courses	Electrical and Electronic Measurements Laboratory	0	0	2	1	2
	Professional Core Courses	Electric Motors and Transformers	2	1	0	3	3
	Professional Core Courses	Electric Motors and Transformers Laboratory	0	0	2	1	2
	Professional Core Courses	Analog and Digital Electronics	3	0	0	3	3
		Summer Internship-I	0	0	0	2	0
		Total				**21**	**23**

Introduction to Electric Generation Systems

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the efficient operation of various electric power generating plants.

Outcomes:

After completing this course, students will be able to

- Maintain the optimized working of the thermal power plant.
- Maintain the optimized working of large and micro hydro power plants.
- Maintain the optimized working of solar, biomass-based and wind power plants.
- Select the adequate mix of power generation based on economic operation.

Course Contents:

Unit-I Thermal Power Plants: Coal, Gas/ Diesel and Nuclear-based

Layout and working of a typical thermal power plant with steam turbines and electric generators. Important components such as economizer, air preheater, super heater, steam prime movers, condensers, draft fans etc. Practices and working of various thermal power plants: coal-based, gas-based, diesel- based, nuclear-based. Coal fired boilers:fire tube and water tube. Gas/diesel based combustion engines, Types of nuclear reactors: Disposal of nuclear waste and nuclear shielding.

Unit-II Large and Micro-Hydro Power Plants:

Energy conversion process of hydro power plant. Classification of hydro power plant: High, medium and low head. Construction and working of hydro turbines used in different types of hydro power plant: (a)High head – Pelton turbine (b)Medium head – Francis turbine (c)Low head – Kaplan turbine. Different types of micro- hydro turbines for different heads: Pelton, Francis and Kaplan turbines.

Unit-III Solar, Wind and Biomass based Power Plants:

Solar Map of India: Global solar power radiation. Solar Power Technology (a) Concentrated Solar Power (CSP) plants, construction and working of Power Tower, Parabolic Trough, Parabolic Dish, Fresnel Reflectors (b) Solar Photovoltaic (PV) power plant: layout, construction, working. Biomass-based Power Plants: (a)Layout of a Bio-chemical based (e.g., biogas) power plant: (b) Layout of a Thermo-chemical based (e.g., Municipal waste) power plant (c) Layout of an Argo- chemical based (e.g., bio-diesel) power plant. Features of the solid, liquid and gas biomasses as fuel for biomass power plant. Wind Power Plants: Wind Map of India**:** Wind power density in watts per square meter. Layout of Horizontal axis large wind power plant: Geared wind power plant. Direct-drive wind power plant.

Unit-IV Economics of Power Generation and Interconnected Power System:

Related terms: connected load, firm power, cold reserve, hot reserve, spinning reserve. Base load and peak load plants; Load curve, load duration curve, integrated duration curve. Cost of generation: Average demand, maximum demand, demand factor, plant capacity factor, plant use factor, diversity factor, load factor and plant load factor. Choice of size and number of generator units, combined operation of power station. Causes and Impact and reasons of Grid system fault: State grid, national grid, brownout and black out; sample blackouts at national and international level.

References:

1. Nag. P. K.Power Plant Engineering, McGraw Hill, New Delhi, ISBN: 978 9339204044

2. Tanmoy Deb, Electrical Power Generation, Khanna Publishing House, Delhi (Ed.2018)

3. Gupta, B.R., Generation of Electrical Energy, S. Chand& Co. New Delhi,

4. Rachel, Sthuthi; Earnest, Joshua – Wind Power Technologies, PHI Learning, NewDelhi, ISBN: 978-93-88028-49- 3; E-book 978-93-88028-50-9

5. Solanki, Chetan Singh, – Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning, New Delhi, ISBN: 9788120351110

6. Hau**,** Erich, Wind Turbines, Springer-Verlag, Berlin Heidelberg, Germany,ISBN:978-3-642-27150-2

7. Gipe, Paul, Wind Energy Basics, Chelsea Green Publishing Co; ISBN: 978-1603580304

8. Wizelius, Tore; Earnest, Joshua – Wind Power Plants and Project Development,PHI

9. Gupta, J.B. A Course in Electrical Power– S. K Kataria and Sons, New Delhi.2014,

10. Soni, Gupta, Bhatnagar, A Course in Electrical Power. – Dhanpatrai and Sons

11. System, S.Chand & Co. New Delhi, 2005, ISBN: 9788121924962

Introduction to Electric Generation Systems Laboratory

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the efficient operation of various electric power generating plants.

Outcomes:

After completing these courses, students will be able to

- Maintain the optimised working of the thermal power plant.
- Maintain the optimised working of large and micro hydro power plants.
- Maintain the optimised working of solar and solar power plants.
- Maintain the optimised working of wind power plants.

List of Practicals:

1. Identify the routine maintenance parts of the coal fired thermal power plant after watching a video programme

2. Identify the routine maintenance parts of the gas fired thermal power plant after watching a video programme

3. Identify the routine maintenance parts of the nuclear fired thermal power plant after watching a video programme.

4. Identify the routine maintenance parts of the large hydro power plant after watching a video programme

5. Identify the routine maintenance parts of the micro hydro power plant after watching a video programme

6. Identify the routine maintenance parts of the large wind power plant after watching a video programme.

7. Identify the routine maintenance parts of the horizontal axis small wind turbine after watching a video programme.

8. Identify the routine maintenance parts of the vertical axis small wind turbine after watching a video programme.

9. Assemble the parabolic trough or parabolic dish Concentrated Solar Power (CSP) plant.

10. Assemble the solar PV plant to produce electric power and then dismantle it.

Electric Circuits

Course Objectives:

- Maintain electrical systems applying AC and DC circuit fundamentals.
- To acquire knowledge in circuits and understand the fundamentals of derived circuit laws.
- To understand the Fundamental theorems, steady state and transient analysis of single phase and 3-phase circuits.
- Acquire the knowledge about Circuits elements, equations, Power, energy and Circuit analysis methods.

Course Outcomes:

After completing this course, students will be able to

- Troubleshoot problems related to single phase A.C series and parallel circuits.
- Troubleshoot problems related to three phase circuits.
- Use principles of circuit analysis to troubleshoot electric circuits.
- Apply network theorems to troubleshoot electric circuits.

Course Contents:

Unit-I Current, Voltage, Power, Energy and Ohm's law, Series and parallel connections of resistors- current and voltage division rule, Ideal and Practical voltage and current source, Source transformation: voltage source to current source and vice versa, temperature coefficient of resistance.

Unit-II Kirchhoff's Laws- Mesh Analysis, Node Analysis Star/delta and delta/star transformation, Star-Delta Transformation, Network Theorems: Super position theorem, Thevenin's Theorem-Norton's, Theorem Maximum power transfer theorem and Reciprocity theorem.

Unit-III Single Phase A.C Series and parallel Circuits

Generation of alternating voltage, Phasor representation of sinusoidal quantities R, L and C circuit elements its voltage and current response. R-L, R-C, R-L-C, combination of A.C series and R-L, R-C, R-L-C, combination of A.C parallel circuit. Impedance, reactance, impedance triangle, Power factor, active power, reactive power, apparent power, power triangle and vector diagram Resonance, Bandwidth, Quality factor and voltage magnification in series and parallel R-L, R-C, R-L-C circuit

Unit-IV Three Phase Circuits

Phasor and complex representation of three phase supply Phase sequence and polarity Types of three -phase connections, Phase and line quantities in three phase star   and   delta system, Balanced and unbalanced load, Three phase power, active, reactive and apparent power in star and delta system

References:

1. Ashfaq Husain, Networks & Systems, Khanna Book Publishing, New Delhi.

2. Gupta, B.R; Singhal, Vandana;, Fundamentals of Electrical Network, S. Chand andCo., New Delhi, ISBN : 978-81-219-2318-7

3. Saxena, S.B Lal; Dasgupta, K; Fundamentals of Electrical Engineering,Cambridge University Press Pvt. Ltd., New Delhi, ISBN : 978-11-0746-435-3

4. Theraja, B. L. : Theraja, A. K;, A Text Book of Electrical Technology Vol-I, S. Chand & Co. Ramnagar, New Delhi, ISBN : 9788121924405

5. Sudhakar, A. ; Shyammohan, S. Palli; Circuit and network, McGraw HillEducation, New Delhi, ISBN : 978-93-3921-960-4

6. Bell, David A., Electric Circuits, Oxford University Press New Delhi, ISBN : 978-01-954-2524-6

7. Boylested, R.L., Introductory circuit Analysis, Wheeler, New Delhi,ISBN: 978-00-231-3161-5

8. Mittle, V.N. ;Mittle, Arvind; Basic Electrical Engineering, McGraw HillEducation, Noida, ISBN: 978-00-705-9357-2

9. Sivanandam, S.N, Electric Circuit Analysis, Vikas Publishing House Pvt. Ltd, Noida, ISBN:978- 81259-1364-1

10. Salivahanan, S.; Pravinkumar, S; Circuit theory, Vikas Publishing House Pvt. Ltd, Noida; ISBN:978-93259-7418-0

Electric Circuits Laboratory

Course Objectives:

- Fundamentals of Kirchhoff's current and voltage laws and its practical implementation.
- Practical implementation of network theorems.
- Measurement of voltage, current, power and impedance of any circuit.
- Frequency resonance analysis of a given circuit.

Course Outcomes:

After completing this course, students will be able to

- Practical implications of the fundamentals of Network theorem, Kirchhoff's current and voltage laws
- Accurate measurement of voltage, current, power and impedance of any circuit
- DC analysis, Transient analysis and Frequency analysis of a given circuit.

List of Practicals:

1. Use voltmeter, ammeter to determine current through the given branch of an electric network by applying mesh analysis.
2. Use voltmeter, ammeter to determine current through the given branch of a electric network by applying node analysis.
3. Use voltmeter, ammeter to determine current through the given branch and voltage across the given element of circuit by applying superposition theorem.
4. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Thevenin's theorem.
5. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Norton's theorem
6. Use voltmeter, ammeter to determine load resistance for maximum power transfer for a given circuit by applying maximum power transfer theorem.
7. Use variable frequency supply to create resonance in given series R-L-C circuit or by using variable inductor or variable capacitor.
8. Use variable frequency supply create resonance in given parallel R-L-C circuit or by using variable inductor or capacitor.
9. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent

power consumed in given R-L-C series circuit. Draw phasor diagram.

10. Use voltmeter, ammeter, wattmeter, p.f meter to determine current, p.f., active, reactive and apparent power for given R-L-C parallel circuit. Draw phasor diagram.

11. Use voltmeter, ammeter, wattmeter, p.f meter to determine line and phase quantities of voltage and current for balanced three phase star and delta connected load and calculate active, reactive, and apparent power. Draw phasor diagram.

References:

1. Ashfaq Husain, Networks & Systems, Khanna Book Publishing, New Delhi.

2. Gupta, B.R; Singhal, Vandana;, Fundamentals of Electrical Network, S.Chand andCo., New Delhi, ISBN : 978-81-219-2318-7

3. Saxena, S.B Lal; Dasgupta, K; Fundamentals of Electrical Engineering,Cambridge University Press Pvt. Ltd., New Delhi, ISBN : 978-11-0746-435-3

4. Theraja, B. L. : Theraja, A. K;, A Text Book of Electrical Technology Vol-I, S. Chand & Co. Ramnagar, New Delhi, ISBN : 9788121924405

5. Sudhakar, A. ; Shyammohan, S. Palli; Circuit and network, McGraw HillEducation, New Delhi, ISBN : 978-93-3921-960-4

6. Bell, David A., Electric Circuits, Oxford University Press New Delhi, ISBN : 978-01-954-2524-6

7. Boylested, R.L., Introductory circuit Analysis, Wheeler, New Delhi,ISBN: 978-00-231-3161-5

8. Mittle, V.N. ;Mittle, Arvind; Basic Electrical Engineering, McGraw HillEducation, Noida, ISBN: 978-00-705-9357-2

9. Sivanandam, S.N, Electric Circuit Analysis, Vikas Publishing House Pvt. Ltd, Noida, ISBN:978- 81259-1364-1

10. Salivahanan, S.; Pravinkumar, S; Circuit theory, Vikas Publishing House Pvt. Ltd, Noida; ISBN:978-93259-7418-0

Electrical and Electronic Measurements

Course Objectives:

- Use relevant measuring instrument in different electrical applications.
- Acquire hand on experience about different measurement devices and its working principles.
- Acquire hand on experience and knowledge on measurement of current, voltage, power, energy and resistance.

Course Outcomes:

After completing this course, students will be able to

- Check the working of the electrical measuring instrument.
- Use different types of measuring instruments for measuring voltage and current.
- Use different types of measuring instruments for measuring electric power
- Use different types of measuring instruments for measuring electric energy.
- Use different types of electrical instruments for measuring various ranges of electrical parameters.

Course Contents:

Unit-I Fundamentals of Measurements:

Classification of Instrument Systems: Null and deflection type instruments, Absolute and secondary instruments, Analog and digital instruments, indicating, recording and integrating instruments. Operating forces: Deflecting, Controlling and Damping Torque, types of errors, Calibration: need and procedure. DC Ammeter: Basic, Multi range, Universal shunt. DC Voltmeter: Basic, Multi-range, concept of loading effect and sensitivity AC voltmeter: Rectifier type (half wave and full-wave) Clamp-on meter.

Unit-II Measurement of Electric Power:

Analog meters: Permanent magnet moving coil (PMMC) and Permanent magnet moving iron (PMMI) meter, their construction, working, salient features, merits and demerits, Dynamometer type wattmeter: Construction and working, Range: Multiplying factor andextension of range using CT and PT, Errors and compensations. Active and reactive power measurement: One, two and three wattmeter method. Effect of Power factor on wattmeter reading in two wattmeter method.

Unit-III Measurement of Resistance and Energy:

Measurement of resistance: Low resistance- Kelvin's double bridge, Medium Resistance- Voltmeter and ammeter, High resistance- Megger and Ohm meter- Series and shunt. Measurement of Electric Energy: Single and three phase electric energy meter, Constructional features and working principle, Errors and their compensations. Calibration of single-phase electric energy meter using direct loading. Bridges: Measurement of inductance and capacitance using bridge (Maxwell's Inductance Bridge, Maxwell's Inductance Capacitance Bridge, Hay's bridge, Anderson Bridge, Owen's bridge, Schering Bridge).

Unit-IV CRO and Other Meters:

Cathode Ray Oscilloscope: Basic block diagram, working, Cathode ray tube, electrostatic deflection, vertical amplifier, time base generator, horizontal amplifier, measurement of voltage/ amplitude/ time period/ frequency/ phase angle delay line.

Other meters: Earth tester, Digital Multimeter; L-C-R meter, Frequency meter (ferromagnetic and Weston type), Phase sequence indicator, power factor meter (single phase and three phase dynamometer type), Synchro scope, Tri- vector meter. Signal generator: need, working and basic block diagram. Function generator**:** need, working and basic block diagram.

References:

1. Theraja B. L., Theraja A. K., A Text Book of Electrical Technology Vol-I(Basic Electrical Engg.), S.Chand and Co. New Delhi, ISBN: 9788121924405

2. Mittle V. N., Basic Electrical Engineering, McGraw-Hill New Delhi, ISBN : 978-0-07-0088572-5

3. Edward Hughes, Electrical Technology, Pearson Education, New Delhi, ISBN-13:978-0582405196

4. Rajput R.K., Electrical and Electronic Measurement and Instrumentation, S.Chandand Co. New Delhi, ISBN : 9789385676017

5. Sawhney A.K., Electrical and Electronics Measurements and Instrumentation.,Dhanpai Rai and Sons,New Delhi, ISBN : 9780000279744

6. Suryanarayna N.V., Electrical Measurements and Measuring Instruments,S.Chand and Co. New Delhi , ISBN :8121920116

Electrical and Electronic Measurements Laboratory

Course Objectives:

- Use relevant measuring instrument in different electrical applications.
- Acquire hand on experience about different measurement devices and its working principles.
- Acquire hand on experience and knowledge on measurement of current, voltage, power, energy and resistance.

Course Outcomes:

After completing this course, students will be able to

- Check the working of the electrical measuring instrument.
- Use different types of measuring instruments for measuring voltage and current.
- Use different types of measuring instruments for measuring electric power
- Use different types of measuring instruments for measuring electric energy.
- Use different types of electrical instruments for measuring various ranges of electrical parameters.

List of Practicals:

1. Identify measuring instruments on the basis of symbols on dial, type, accuracy, classposition and scale
2. Measure AC and DC quantities in a working circuit.
3. Extend range of ammeter and voltmeter by using (i) shunt and multiplier (ii) CT andPT.
4. Use Clamp-on meter for measurement of AC/DC current, AC/DC voltage.
5. Use electro-dynamic watt-meter for measurement of power in a single-phase circuit.
6. Use two watt-meters for measuring active power of three-phase balanced load.
7. Calibrate single phase electronic energy meter by direct loading.
8. Use Kelvin's double bridge for measurement of low resistance.
9. Use voltmeter and ammeter method for measurement of medium resistance
10. Use CRO for the Measurement of supply frequency in single-phase circuit.

Electric Motors and Transformers

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electric motors and transformers.

Course Outcomes:

After completing this course, students will be able to

- Maintain different types of DC generators.
- Maintain different types of DC motors.
- Maintain single phase transformer.
- Maintain three phase transformers.
- Maintain different types of special purpose transformers used in different applications.

Course Contents:

Unit-I DC Generators

DC generator: construction, parts, materials and their functions. Principle of operation of DC generator: Fleming's right hand rule, schematic diagrams, e.m.f. equation of generator, armature reaction, commutation, Different types of DC generators, Applications of DC generators.

Unit-II D.C. Motors

DC motor: Types of DC motors. Fleming's left-hand rule, Principle of operation, Back e. m.f. and its significance, Voltage equation of DC motor. Torque and Speed; Armature torque, Shaft torque, BHP, Brake test, losses, efficiency. DC motor starters: Necessity, two point and three-point starters. Speed control of DC shunt and series motor: Flux and Armature control.

Unit-III Single Phase Transformers

Types of transformers: Shell type and core type; Construction: Parts and functions. Transformer: Principle of operation, EMF equation of transformer: Derivation, Voltage transformation ratio, Transformer No-load and on-load phasor diagram, Leakage reactance, Equivalent circuit of transformer: Equivalent resistance and reactance. Transformerlosses, Voltage regulation and Efficiency: Direct loading, OC/SC method, All day efficiency

Unit-IV Three Phase and Special purpose Transformers

Bank of three single phase transformers, Single unit of three phase transformer Distribution and Power transformers: Construction, cooling. Three phase transformers connections, three phase to two phase conversion (Scott Connection) Need of parallel operation of three phase transformer, Conditions for parallel operation. Single phase and three phase auto transformers: Construction, working and applications. Instrument Transformers: Construction, working and applications of Current transformer and Potential transformer. Isolation transformer: Constructional Features and applications.

References:

1. G.C. Garg & P.S. Bimbhra, Electrical Machines, Vol-I, II, Khanna Book Publishing House (ISBN: 978-9386173-447, 978-93-86173-607), New Delhi.

2. Mittle, V.N. and Mittle, Arvind., Basic Electrical Engineering, McGraw Hill Education, New Delhi, ISBN: 9780070593572.

3. Bhattacharya, S. K., Electrical Machines, McGraw Hill Education, New Delhi, ISBN: 9789332902855.

4. Mehta, V. K. and Mehta, Rohit, Principles of Electrical Machines, S. Chand and Co. Ltd., New Delhi, ISBN: 9788121930888.

5. Theraja, B.L., Electrical Technology Vol-II (AC and DC machines), S. Chand and Co. Ltd., New-Delhi, ISBN: 9788121924375.

6. Bandyopadhyay, M. N., Electrical Machines Theory and Practice, PHI Learning Pvt. Ltd., New Delhi, ISBN: 9788120329973 Vi.

7. Murugesh Kumar, K., DC Machines and Transformers, ISBN: 9788125916055.

8. Kothari, D. P. and Nagrath, I. J., Electrical Machines, McGraw Hill Education. New Delhi, ISBN: 9780070699670

Electric Motors and Transformers Laboratory

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use electric motors and transformers.

Course outcomes:

After completing this course, students will be able to

- Maintain different types of DC generators.
- Maintain different types of DC motors.
- Maintain single phase transformer.
- Maintain three phase transformers.
- Maintain different types of special purpose transformers used in different applications.

List of Practical's:

1. Reverse the direction of rotation of the DC shunt motor.
2. Perform brake test on DC shunt motor.
3. Control the speed of DC shunt motor by different methods.
4. Control the speed of DC series motor by different methods.
5. Perform the brake test on DC series motor.
6. Control the speed of DC compound motor by different methods
7. Obtain Internal and External characteristics of DC Shunt Generator.
8. Perform open circuit and short circuit test on single phase transformer to determineequivalent circuit constants, voltage regulation and efficiency.
9. Perform parallel operation of two single phase transformers to determine the load current sharing.
10. Perform polarity test on a single-phase transformer whose polarity markings aremasked. Check the functioning of the CT, PT and Isolation transformer.

Analog and Digital Electronics

Course Objectives:

- To give the idea about fundamental properties of semiconductors.

- To prepare students to perform the analysis of any Analog electronics circuit.

- To empower students to understand the design and working of transistor amplifiers andoscillators.

- . To acquire the basic knowledge of digital logic levels and application of knowledge tounderstand digital electronics circuits.

- To prepare students to perform the analysis and design of various digital electronic circuits.

Course Outcomes:

After completing this course, students will be able to

- Acquire basic knowledge of physical and electrical conducting properties of semiconductors.

- Develop the Ability to understand the design and working of BJT amplifiers.

- Able to design amplifier circuits using BJT s and FET"s. and observe the
  amplitude andfrequency responses of common amplifier circuits.

- Observe the effect of negative and positive feedback on different parameters of an
  Amplifierand different types of negative and positive feedback topologies.

- Have a thorough understanding of the fundamental concepts and techniques used
  in digitalelectronics.

- To understand and examine the structure of various number systems and its
  application indigital design.

- The ability to understand, analyze and design various combinational and sequential circuits.

Course Contents:

Unit-I Semiconductor Diodes and Transistors:

Intrinsic semiconductor, doping, and Extrinsic semiconductor, P-type and N-type semiconductor, PN Junction, depletion layer, barrier potential, PN Junction biasing, Zener Diode, Single phase-Half Wave, Full Wave Rectifiers (Centre tapped & Bridge), Filters: C and LC Filters. Bipolar Junction Transistors: construction, type and operation, BJT Configuration: common base, common emitter, common collector, input and output characteristics, current amplification factor for different configurations, UJT**:** Equivalentcircuit and operation.

Unit-II Transistor Amplifier and Oscillator:

General classification of amplifiers, RC coupled and Transformer coupled amplifiers: Circuit diagram and operation, frequency response, advantages and disadvantages. Power amplifiers: Class-A, Class-B & Class-C amplifier. Feedback in amplifier: positive and negative feedback, Effect of negative feedback, types of negative feedback circuits.

Oscillators: types of oscillators- AF Oscillator, RC phase shift Oscillator, RF Oscillator- Hartley oscillator, Colpitts oscillator, UJT relaxation oscillator. Applications of oscillators.

Unit-III Number Systems:

Decimal, binary, octal and hexadecimal number system, inter conversion of decimal, binary and hexadecimal numbers. BCD code, Addition, Subtraction, 1"s 2"s Complement, Logic Gates, Boolean Algebra De-Morgan's Theorem, standard POS and SOP forms, min-terms and max-terms representation of Boolean functions, Karnaugh Maps

Unit-IV Combinational and Sequential Logic Circuits:

Combinational Logic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Multiplexer, Demultiplexer. Sequential Logic Circuits: Flip Flops – R-S, J-K, edge triggered J-K, T, D. Counters: Ring Counter, Ripple Counter, synchronous counter, Modulo-N counter, Decade Counter, Shift Register.

References:

1. Analog Circuits by A.K. Maini, "Khanna Publishing House Ed. 2018 (ISBN: 978-93-86173-584)"

2. Electronics Devices and circuit theory by Boyestad & Nashelsky "Pearson Education India; 11 edition (2015) ISBN: 978-9332542600"

3. Electronics Devices & Circuits by Jacob Millman "McGraw Hill Education; 4edition (2015) ISBN: 978-9339219543"

4. Digital Electronics by Roger L. Tokheim Macmillian "McGraw-Hill Education(ISE Editions); International 2 Revised ed edition ISBN: 978-0071167963"

5. Digital Electronics – an introduction to theory and practice by William H. Gothmann "Prentice Hall I++69*ndia Learning Private Limited; 2 edition ISBN:978-8120303485"

6. Fundamentals of Logic Design by Charles H. Roth Jr. "Jaico Publishing House; First edition ISBN: 978-8172247744"

7. Digital Electronics by R. Anand "Khanna Publications, New Delhi (Edition 2018)ISBN: 978-93-82609445"

Implementation of AICTE Model Curriculum 2019 for Diploma in**Engineering Courses in MANUU Polytechnics**
(Hyderabad, Bangalore, Darbhanga, Kadapa, Cuttack)
Semester IV

Curriculum in Electrical and Electronics Engineering

Course Code	Description	Course Title	Hours/Week			Credits	Total Contact Hours/ Week
			L	T	P		
	Professional Core Courses	Fundamentals of Power Electronics	3	0	0	3	3
	Professional Core Courses	Fundamentals of Power Electronics Laboratory	0	0	2	1	2
	Professional Core Courses	Electric Power Transmission and Distribution	3	0	0	3	3
	Professional Core Courses	Electric Power Transmission and Distribution Laboratory	0	0	2	1	2
	Professional Core Courses	Induction, Synchronous and Special Electrical Machines	3	0	0	3	3
	Professional Core Courses	Induction, Synchronous and Special Electrical Machines laboratory	0	0	4	2	4
	Programme Elective I	Programme Elective I	3	0	0	3	3
	Programme Elective II	Programme Elective II	3	0	0	3	3
	PR	Minor Project	0	0	4	2	4
	AU	Essence of Indian Knowledge and Tradition	2	0	0	0	2
		Total				**21**	**29**

List of Program Elective I

Course Code	Course Title
	Industrial Instrumentation and Condition Monitoring
	Communication Technologies
	Industrial Drives

List of Program Elective II

Course Code	Course Title
	Industrial Automation & Control
	Electrical Testing and Commissioning
	Electrical Estimation and Contracting

Fundamentals of Power Electronics

Course Objectives:

- To understand and acquire knowledge about various power semiconductor devices.

- To prepare the students to analyze and design different power converter circuits.

Course Outcomes:

After completing this course, students will be able to

- Select power electronic devices for specific applications.

- Maintain the performance of Thyristors.

- Troubleshoot turn-on and turn-off circuits of Thyristors.

- Maintain phase-controlled rectifiers.

- Maintain industrial control circuits.

Course Contents:

Unit – I Power Electronic Devices:

Construction, working principle, V-I characteristics and uses of Power Transistor, MosFET and IGBT. SCR: construction, Working and V-I characteristics of SCR, Two transistor analogy for SCR. Symbol and characteristics of Thyristor family devices like GTO, RCT, Triac and Diac, Series and parallel operation of SCRs, String efficiency

Unit – II Turn-on and Turn-off Methods and Protection of Thyristor:

SCR Turn-On methods: High voltage triggering, Thermal triggering, Illumination triggering, dv/dt triggering, Gate triggering. Gate triggering circuits: Resistance firing circuit, Resistance-Capacitance circuit and UJT firing circuit. SCR Turn-Off methods: Forced Commutation techniques of SCR (Class A, B, C, D and E). Protection circuits: over-voltage, over-current, Snubber, Crowbar.

Unit– III Phase Controlled Rectifiers:

Phase control: firing angle, conduction angle. Single phase half controlled full controlled and midpoint-controlled rectifier with R, RL load: Circuit diagram, working, input- output waveforms, equations for DC output and effect of freewheeling diode. Different configurations of bridge-controlled rectifiers: Full bridge, half bridge with common anode, common cathode, SCRs in one arm and diodes in another arm

Unit– IV Industrial Control Circuits:

Analysis of Single-Phase AC Regulators for R and RL loads. Triac applications in regulators like Illumination/Fan speed control. Applications of SCR: Battery charger, Temperature Controller, Emergency light system, etc. Details of SMPS and UPS.

References:

1. Ramamoorty M., An Introduction to Thyristors and their applications, East-West Press Pvt. Ltd., New Delhi, ISBN: 8185336679.

2. Sugandhi, Rajendra Kumar and Sugandhi, Krishna Kumar, Thyristors: Theory and Applications, New Age International (P) ltd. Publishers, New Delhi, ISBN: 978-0-85226-852-0.

3. Bhattacharya, S.K., Fundamentals of Power Electronics, Vikas Publishing House Pvt. Ltd. Noida, ISBN: 978-8125918530.

4. Jain & Alok , Power Electronics and its Applications, Penram International Publishing (India) Pvt. Ltd, Mumbai, ISBN: 978-8187972228.

5. Rashid , Muhammad, Power Electronics Circuits Devices and Applications, Pearson Education India, Noida, ISBN: 978-0133125900.

6. Singh, M. D. and Khanchandani, K.B., Power Electronics, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2008 ISBN: 9780070583894.

7. Zbar, Paul B., Industrial Electronics: A Text –Lab Manual, McGraw Hill Publishing Co. Ltd., New Delhi, ISBN: 978-0070728226.

8. Grafham D.R., SCR Manual, General Electric Co., ISBN: 978-0137967

Fundamentals of Power Electronics Laboratory

Course Objectives:

- To understand and acquire knowledge about various power semiconductor devices.

- To prepare the students to analyze and design different power converter circuits.

Course Outcomes

After completing this course, students will be able to

- Select power electronic devices for specific applications.
- Maintain the performance of Thyristors.
- Troubleshoot turn-on and turn-off circuits of Thyristors.
- Maintain phase-controlled rectifiers.
- Maintain industrial control circuits.

List of Practicals:

1. Test the proper functioning of power transistor.

2. Test the proper functioning of IGBT.

3. Test the proper functioning of DIAC to determine the break over voltage.

4. Determine the latching current and holding current using V-I characteristics of SCR.

5. Test the variation of R, C in R and RC triggering circuits on firing angle of SCR.

6. Test the effect of variation of R, C in UJT triggering technique.

7. Perform the operation of Class – A, B, C, turn off circuits.

8. Perform the operation of Class –D, E, F turn off circuits.

9. Use CRO to observe the output waveform of half wave-controlled rectifier withresistive load and determine the load voltage.

10. Draw the output waveform of Full wave controlled rectifier with R load,RL load, free-wheeling diode and determine the load voltage.

Electric Power Transmission and Distribution

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of the electrical transmission and distribution systems.

Course Outcomes:

After completing this course, students will be able to

- Interpret the normal operation of the electric transmission and distribution systems.

- Maintain the functioning of the medium and high voltage transmission system.

- Interpret the parameters of the extra high voltage transmission system.

- Maintain the functioning of the low voltage AC distribution system.

- Maintain the components of the transmission and distribution lines.

Course Contents:

Unit – I Basics of Transmission and Distribution:

Single line diagrams with components of the electric supply transmission and distribution systems. Classification of transmission lines: Primary and secondary transmission; standard voltage level used in India, based on type of voltage, voltage level, length. Transmission Line Parameters and Performance: Concepts of R, L and C of line parameters and types of lines. Performance of short line and medium line: Efficiency, regulation and its derivation, vector diagram and effect of power factor. Transposition of conductors, Skin effect and proximity effect.

Basics of Transmission and Distribution: Single line diagrams with components of the electric supply transmission and distribution systems. Classification of transmission lines: Primary and secondary transmission; standard voltage level used in India, based on type of voltage, voltage level, length. Transmission Line Parameters and Performance: Concepts of R, L and C of line parameters and types of lines. Performance of short line and medium line: Efficiency, regulation and its derivation, vector diagram and effect of power factor. Transposition of conductors, Skin effect and proximity effect.

Unit – II A.C Distribution System: AC Distribution: Component's classification, primary and secondary distribution system. Feeder and distributor: Factors to be considered in design of feeder and distributor. Types of different distribution schemes: radial, ring, and grid,layout, advantages, disadvantages. Distribution Sub-Station**:** Classification, site selection, advantages, disadvantages and applications. Single Line diagram (layout) of 33/11KV Sub- Station and 11KV/400Vsub-station.

Unit – III Components of Transmission and Distribution line:

Overhead Conductors**:** Properties of material, types of conductors with trade names, significance of sag.

Line supports: Requirements, types of line structures.

Line Insulators: Properties of insulating material, types of insulators and their applications,causes of insulator failure, string efficiency with methods of improving string efficiency.

Underground cables: Classifications of cables, cable conductor, cable construction, comparison with overhead lines.

Unit – IV Extra High Voltage Transmission: Extra High Voltage AC (EHVAC)

Transmission line: Necessity, high voltage substation components such as transformers and other switchgears, advantages, limitations and applications. Ferranti and Corona effect.

High Voltage DC (HVDC) Transmission Line**:** Necessity, components, advantages, limitations and applications. Layout of monopolar, bi-Polar and homo-polar transmissionlines. Features of EHVAC and HVDC transmission line.

Text Books and References:

1) G.C. Garg, Utilization of Electric Power & Electric Traction, Khanna Book Publishing Co., New Delhi (ISBN: 978-93-86173-355)

2) Mehta, V.K., Principles of Power System, S. Chand and Co. New Delhi, ISBN: 9788121924962

3) Soni;Gupta; Bhatnagar, A Course in Electrical Power, Dhanpat Rai and Sons New Delhi, ISBN:9788177000207

4) Gupta,J.B., A Course in Power Systems, S.K. Kataria and sons, New Delhi, ISBN: 9788188458523

5) Theraja, B.L.; Theraja, A.K., A Textbook of Electrical Technology Vol. III, S.Chand and Co. New Delhi, ISBN : 9788121924900

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7) Sivanagaraju S.; Satyanarayana S., Electrical Power Transmission and Distribution, Pearson Education, New Delhi, , ISBN:9788131707913

8) Ned Mohan, Electrical Power System: A First Course, Wiley India Pvt. Ltd. New Delhi, ISBN:9788126541959

9) Gupta, B.R., Power System Analysis and Design, S. Chand and Co. New Delhi, ISBN: 9788121922388

10) Kamraju, V., Electrical Power Distribution System, Tata McGraw-Hill, New Delhi, ISBN:9780070151413.

Electric Power Transmission and Distribution Laboratory

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of the electrical transmission and distribution systems.

Course outcomes:

After completing this course, students will be able to

- Interpret the normal operation of the electric transmission and distribution systems.
- Maintain the functioning of the medium and high voltage transmission system.
- Interpret the parameters of the extra high voltage transmission system.
- Maintain the functioning of the low voltage AC distribution system.
- Maintain the components of the transmission and distribution lines.

Laboratory work is not applicable for this course.

Following are the suggested student-related *co- curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare a report based on transmission line network in Maharashtra.

b. Collect the information on components of transmission line.

c. Evaluate transmission line performance parameters of a given line.

d. Library/ Internet survey of electrical high voltage line and HVDC lines.

e. Visit to 33/11 KV and 11KV/400V Distribution Substation and write a report.

Also, one micro-project can be assigned to the student. A suggestive list of micro-projectsis given here.

Similar micro-projects could be added by the concerned faculty.

a. Prepare a model showing:

i.Single line diagram of electric supply system.

    ii. Single line diagram of a given distribution system.

    iii. Short line and medium transmission line.

    iv. Write a report on the same by giving the details of lines in Maharashtra State.

b. Collect different samples of Overhead Conductors, Underground Cables, Line supports and Line Insulators.

c. Prepare a power point presentation:

    i. Extra High Voltage AC Transmission line.

    ii. High Voltage DC Transmission line.

    iii. Flexible AC Transmission line.

    iv. New trends in wireless transmission of electrical power.

d. Collect information on:

    i. A.C Distribution System adjacent to your institute.

    ii. Draw a layout diagram of 11KV/400 V substation in your campus/ adjacent substation

Induction, Synchronous and Special Electric Machines

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

• Maintain Induction, Synchronous and FHP Machines used in different applications.

Course outcomes:

After completing this course, students will be able to

- Maintain three phase induction motor used in different applications.
- Maintain single phase induction motor used in different applications.
- Maintain three phase alternators used in different applications.
- Maintain synchronous motors used in different applications.
- Maintain FHP motors used in different applications.

Course contents:

Unit – I Three Phase Induction Motor

Working principle: production of rotating magnetic field, Synchronous speed, rotor speed and slip. Constructional details of phase induction motors: Squirrel cage induction motor and Slip ring induction motor. Rotor quantities: frequency, induced emf, power factor at starting and running condition. Characteristics of torque versus slip (speed), Torques: starting, full load and maximum with relations among them. Losses and efficiency. Testing-no load and blocked rotor tests-determination of equivalent circuit parameters, Methods of starting-auto transformer, star delta and rotor resistance starters, Double cage induction motor- construction, theory, equivalent circuit, Characteristics and applications. Speed control methods: stator voltage, pole changing, rotor resistance and VVVF.

Unit – II Single phase induction motors and Fractional horse power (FHP) Motors:

Construction, principle, double revolving field theory, equivalent circuit, Resistance start induction run, capacitor start induction run, capacitor start capacitor run, shaded pole, repulsion type, series motor, universal motor, and hysteresis motor, Synchronous Reluctance Motor, Switched Reluctance Motor, BLDC, Permanent Magnet Synchronous Motors,stepper motors.

Unit –III Three phase Alternators:

Construction, E.M.F. equation of an Alternator with numerical by considering short pitch factor and distribution factor. Armature resistance and leakage reactance drops. Armature reaction at various power factors and synchronous impedance, phasor diagram, open circuit and short circuit tests. Voltage regulation: direct loading and synchronous impedance methods. Slip test, power angle characteristics, Parallel operation and load sharing, operation on infinite bus-bar.

Unit-IV Synchronous motors:

Theory of operation–phasor diagrams, variation of current and power factor with excitation. Hunting and its suppression, determination and pre-determination of V and inverted Vcurves. Synchronous motor on load with constant excitation (numerical), effect of excitation at constant load (numerical), method of starting.

Text Books and References:

1. P.S. Bimbhra, Electric Machines, Khanna Book Publishing Co., New Delhi (ISBN: 978- 93-86173- 294)

2. Mittle, V.N. and Mittle, Arvind., Basic Electrical Engineering, McGraw Hill Education New Delhi, ISBN :9780070593572 161

3. Electrical Engineering Curriculum Structure Kothari, D. P. and Nagrath, I. J., Electrical Machines, McGraw Hill Education. New Delhi, ISBN: 9780070699670

4. Janardanan E. G, Special Electrical Machines, Prentice Hall India, and New Delhi ISBN: 9788120348806

5. Hughes E., Electrical Technology, ELBS

6. Cotton H., Electrical Technology, ELBS

7. Charbs.I. Hubert: Electric Machines –Second Edition –Pearson 2003.

8. Stephen.J.Chapman: Electric achinery –McGraw Hill International Edition, 2005.

9. A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans: Electric Machinery –Sixth Edition TMH 2003

Induction, Synchronous and Special Electric Machines Laboratory

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

• Maintain Induction, Synchronous and FHP Machines used in different applications.

Course outcomes:

After completing this course, students will be able to

- Maintain three phase induction motor used in different applications.
- Maintain single phase induction motor used in different applications.
- Maintain three phase alternators used in different applications.
- Maintain synchronous motors used in different applications.
- Maintain FHP motors used in different applications.

Practicals:

1) Identify the different parts (along with function and materials) for the given single phase and three phase induction motor.

2) Connect and run the three-phase squirrel cage induction motors (in both directions) using the DOL, star-delta, auto-transformer starters (any two)

3) Perform the direct load test on the three-phase squirrel cage induction motor and plot the i) efficiency versus output, ii) power factor versus output, iii) power factor versus motor current and iv) torque – slip/speed characteristics.

4) Conduct the No-load and Blocked-rotor tests on given 3- phase squirrel cage induction motor and determine the equivalent circuit parameters.

5) Control the speed of the given three phase squirrel cage/slip ring induction motor using the applicable methods: i) auto- transformer, ii) VVVF.

6) Measure the open circuit voltage ratio of the three- p h a s e slip ring induction motor.

7) Conduct the direct load test to determine the efficiency and speed regulation for different loads on the given single phase induction motor; plot the efficiency and speed regulation curves with respect to the output power.

8) Perform the direct loading test on the given three phase alternator and determine the regulation and efficiency.

9) Determine the regulation and efficiency of the given three phase alternators from OC

and SC tests (Synchronous impedance method)

10) Conduct the test on load or no load to plot the „V" curves and inverted „V" curves (at no-load) of 3-phase synchronous motor.

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Industrial Instrumentation and Condition Monitoring

(Program Elective-I)

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

• Use instrumentation equipment for condition monitoring and control

Course outcomes:

After completing this course, students will be able to

• Select relevant instruments used for measuring electrical and non-electrical Quantities.

• Select relevant transducers/sensors for various applications.

• Use relevant instruments for measuring non-electrical quantities.

• Check the signal conditioning and telemetry system for their proper functioning.

• Use data acquisition systems in various applications.

• Undertake condition monitoring for diagnostic analysis of electrical equipment

Course contents:

Unit – I Fundamentals of instrumentation

Basic purpose of instrumentation. Basic block diagram (transduction, signal conditioning, signal presentation) and their function. Transducers Distinguish between Primary and Secondary, Electrical and Mechanical, Analog and Digital, Active and Passive. Construction and principle of Inductive transducers-L.V.D.T. and R.V.D.T, their applications. Construction, principle and applications of transducers – Piezo- Electric transducer, photoconductive cells, photo voltaic cells.

Unit – II

Measurement of Non-Electrical Quantities Temperature measurement - Construction and Working of RTD, Thermistor and Thermocouple, Construction and Working of Speed Measurement by contacting and non-Contact Type- DC tachometer, photo- electric tachometer, toothed rotor tachometer. Construction and Working of Flow measurement by electromagnetic and Turbine Flow meter. Signal Conditioning Basic Concept of signal

conditioning System. Draw pin configuration of IC 741. Use of op-amp as inverting, non-inverting mode, adder, subtractor, and Working of Differential amplifier and instrumentation amplifier. Filters: Types of RC filters and frequency response -no derivation. Sample and hold circuits - operation and its application.

Unit– III
Digital to Analog conversion- Construction and Working of binary weighted resistance method. Concept and methods of data transmission of electrical and electronic transmission. LED and LCD applications.

Unit-IV
Different tests on transformer, their purpose, and the necessary condition of machine. Tests on Circuit breaker, purpose and required condition of machine Tests on CT, purpose, item to be tested and required condition of machine

References:
1. Sawhney, A.K. Electric and Electronic Measurement and instrumentation, Dhanpat Rai and Co. Author, Nineteenth revised edition 2011 reprint, 2014**,** ISBN:10: 8177001000

2. Rangan, C.S. G.R. Sharma. andV.S.V. Mani, Instrumentation devices and system, Pen ram International Publishi*ng* India Pvt. Ltd. Fifth edition, ISBN:10: 007463350

3. Mehta, V.K. Electronics and instrumentation, Third edition-S. Chand and company Pvt Ltd Reprint, 2010, ISBN:81-219-2729-3

4. Singh, S.K. Industrial instrumentation and control, Tata McGraw-Hill, 1987. ISBN: 007451914X, 9780074519141.

5. J.G. Joshi, Electronic Measurement and Instrumentation, Khanna Publishing House, New Delhi (ISBN: 978-93-86173-621)

Industrial Drives (Program Elective-I)

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

• Maintain electric AC and DC Drives.

Course outcomes:

After completing this course, students will be able to

- Select relevant AC motor for various electric drive applications.
- Maintain DC Drives.
- Maintain AC Drives.
- Maintain microprocessor/micro controlled electric motors.

Course contents:

Unit – I Electric

Drives

Need of Electric Drives, Functional Block diagrams of an electric drives.

DC Motors, Motor Rating

a. Series, Shunt and compound DC motors.

b. Universal motor

c. Permanent magnet motor

d. DC servo motor

e. Moving coil motor

f. Torque motor.

Starting and Braking of DC Motors. Brushless DC Motors for servo applications.

Maintenance procedure.

Unit –II AC Motors

Single phase AC Motors

a) Resistance split phase motors

b) Capacitor run motors

c) Capacitor start motors

d) Shaded pole motors.

Three phase Induction Motors

a) Squirrel cage Induction motor

b) Slip ring Induction Motor

c) Starting methods of Induction Motor

Braking methods of Induction Motor. Determination of Motor Rating. Maintenance

procedure

Unit–III DC Drives

Single phase SCR Drives

a) Half wave converter

b) Full wave converter

c) Semi converter.

Three Phase SCR Drives

a) Half wave converter

b) Full wave converter

c) Semi converter.

Speed control methods of DC series Motor. Chopper Controlled DC Drives. Solar andbattery

powered vehicles. Maintenance procedure.

Unit-IV AC Drives

Stator voltage control Variable Frequency Control

Voltage Source Inverter Control Current Source Inverter Control RotorResistance

Control

Slip Power Recovery

Solar powered pump drives Maintenance procedure for AC drives.

Sequences of stages & drives required in each stage for following applications:

a) Textile mills

b) Steel rolling mills

c) Paper mills, Sugar mills.

References:

1. P.S. Bimbhra, Electric Machines, Khanna Book Publishing Co., New Delhi(ISBN: 978-93- 86173- 294).

2. Theraja, B. L. ;Theraja, A. K., A Text Book of Electrical Technology Vol-II, S.Chand and Co. Ramnagar, New Delhi, ISBN :9788121924.

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4. Dubey Gopal K., Fundamentals of Electrical Drives, Second Edition, Narosa Publishing House, New Delhi.ISBN :9788173194283.

5. Subrahmanyam, Vedam, Electrical Drives Concepts and Applications, Mcgraw-Hill Publishing CompanyLimited, New Delhi.ISBN:9780070701991.

Communication Technologies (Program ELECTIVE-I)

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

• Use relevant data communication technique.

Course outcomes:

After completing this course, students will be able to

• Identify the different types of data communication equipment and techniques.

• Use relevant digital modulation techniques.

• Interpret the specifications of the data communication media.

• Maintain the fibre optics networks for data communication.

• Use OSI model and relevant data communication protocols.

• Maintain wireless network environment

Course contents:

Unit – I Data Communication and Modulation& Demodulation:

Block diagram of communication system, Types of communication system: synchronous and asynchronous, simplex, half- duplex, Full duplex, serial and parallel communication Classification of communication technique, Modulation and demodulation, Block diagram of AM, FM and PM Pulse Modulation: Block diagram for wave form generation of PAM, PWM & PPM, working principle, advantages, disadvantages and applications.

Unit-II Digital Modulation Techniques:

Digital Communication: Block diagram and working principle, waveforms, strength and limitations. Sampling process, Nyquist sampling theorem, quantization process, quantization error, quantization noise, PCM: Block diagram, working principle, waveforms, application of PCM. Principle of ASK, PSK, FSK

Unit– III Data Communication Media &Fiber optics:

Introduction, Types of errors in data communication. Types of communication media and frequency band of operation Guided media: Unguided media: Microwave communication, Infrared communication, fiber optic cable. Introduction to Fiber optic communication.Strength and limitations of fiber optic system.

Unit– IV Data Communication Protocols, Interfacing Standard:

OSI (Open Systems Interconnection) Reference model Introduction to protocol, FTP, SMTP, TCP/I, UDP LAN standards. Introduction to IEEE Standards for LAN and GPIB RS-232 standard, Introduction, and working principle Network topologies, introduction star, ring, tree, bus, mesh, hybrid Basic functions of networking devices: modem, switches, routers, repeaters, hubs, bridges, gateway. Introduction to Wi-Fi, Universal serial bus (USB) architecture.

Text Books and References:

1. Wayne Tomasi, Electronic Communication System, Prentice Hall of India, ISBN 13:9780130494924
2. Reynders D., Steve Macky, Wright Edvin, Practical Industrial Data Communications, Newnes publication, ISBN 10:07506639523
3. George F. Kennedy, Barnard Davis, Electronic Communication System, Tata McGraw Hill, , ISBN 13:9780074636824Electrical Engineering Curriculum Structure 186
4. Forouzan B.A., Data Communication & Networking, McGraw Hill Education; 5thedition ISBN13: 0073376226-978
5. Prasad K.V.K.K., Principles of Digital communication systems and computernetworks, Dreamtech press, New Delhi, ISBN 13:9788177223620
6. Tanenbaum, Andrew S. David J. Wetherall , Computer Networks, Pearson; 5 edition ISBN 13:9788121924252
7. Kumar A.,Text Book of Communication Engineering, Umesh Publication, ISBN 13:978818114160
8. Kumar, D. Manjunath, Joy Kuri, Communication Networking, Academic Press Publication ISBN 13:9780124287518
9. Hemant Kumar Garg, Soni Manish,Electronic Communication & Data Communication, University Book House Private Ltd., ISBN 13:9788181980717
10. Kao, Charles K., Optical Fiber Systems: Technology, Design, and Applications, Published by McGraw-Hill Inc., US ISBN 13: 9780070332775.
11. Agrawal, Govind P., Fiber Optic Communication System, Wiley; 4 edition ISBN 13 9780470505113 12. Keiser, Gerd, Optical communications essentials, McGraw- Hill, New Delhi-2003, ISBN13:9780071412049

Industrial Automation and Control (Program Elective-II)

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

        • Maintain Industrial Automation Systems.

Course outcomes:

After completing this course, students will be able to

- : Identify different types of automation systems.
- Interface I/O devices with the PLC modules.
- Develop PLC ladder programs for various applications.
- Select the suitable motor drives for different applications
- Prepare simple SCADA applications.

Course contents:

Unit – I Introduction to Industrial Automation:

Automation: Need and benefits. Types of automation system: Fixed, Programmable, Flexible Different systems used for Industrial automation: PLC, HMI SCADA, DCS, and Drives. Evolution of PLC.

Unit – II PLC Fundamentals:

Building blocks of PLC: CPU, Memory organization, Input- output modules (discrete and analog), Specialty I/O Modules, Power supply Fixed and Modular PLC and their types, Redundancy in PLC module I/O module selection criteria Interfacing different I/O devices with appropriate I/O modules

Unit– III PLC Programming and Applications:

PLC I/O addressing PLC programming Instructions: Relay type instructions, Timer instructions: On delay, off delay, retentive, Counter instructions: Up, Down, High speed, Logical instructions, Comparison Instructions, Data handling Instructions, Arithmetic instructions. PLC programming language: Functional Block Diagram (FBD), Instruction List. Structured text, Sequential Function Chart (SFC), Ladder Programming. Simple Programming examples using ladder logic: Language based on relay, timer counter, logical,

comparison, arithmetic and data handling instructions. PLC Based Applications, Motor sequence control, Traffic light control, Elevator control, Tank Level control, Conveyor system, Stepper motor control, Reactor Control Gate trigger circuits – Resistance and Resistance-Capacitance circuits.

Unit-IV Supervisory Control and Data Acquisition System (SCADA):

Introduction to SCADA: Typical SCADA architecture/block diagram, Benefits of SCADA Various editors of SCADA Interfacing SCADA system with PLC: Typical connection diagram, Object Linking & embedding for Process Control (OPC) architecture, Steps in Creating SCADA Screen for simple object, Steps for Linking SCADA object (defining Tags and Items) with PLC ladder program using OPC. Applications of SCADA: Traffic light control water distribution pipe line control.

References:

1. Dunning, G., Introduction to Programmable Logic Controllers, Thomson /Delmarlearning, New Delhi, 2005,ISBN 13 : 9781401884260

2. Jadhav, V. R., Programmable Logic Controller, Khanna publishers, New Delhi,2017, ISBN : 9788174092281

3. Petruzella, F.D., Programmable Logic Controllers, McGraw Hill India, NewDelhi, 2010, ISBN: 9780071067386

4. Hackworth, John; Hackworth, Federic, Programmable Logic Controllers, PHILearning, New Delhi, 2003, ISBN : 9780130607188

5. Stenerson Jon, Industrial automation and Process control, PHI Learning, NewDelhi, 2003, ISBN: 9780130618900

6. Mitra, Madhuchandra; Sengupta, Samarjit, Programmable Logic Controllers and Industrial Automation- An introduction, Penram International Publication, 2015,ISBN: 9788187972174

7. Boyar, S. A., Supervisory Control and Data Acquisition, ISA Publication, USA,ISBN: 978-1936007097

8. Bailey David ; Wright Edwin, Practical SCADA for industry, Newnes (an imprint of Elsevier), UK 2003, ISBN:0750658053

Electrical Testing and Commissioning (Program ELECTIVE –II)

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

  • Follow standard safety procedures in testing and commissioning of electrical equipment

Course outcomes:

After completing this course, students will be able to

  • Follow safety procedures with respect to earthing and insulation of electrical equipment
  • Select proper tools, equipment, for installation, testing, maintenance of electrical machines and transformers
  • Test and commission electrical equipment in accordance with IS codes
  • Make plans for troubleshooting electrical machines.
  • Undertake regular preventive and breakdown maintenance.

Course contents:

Unit – I Electrical Safety and Insulation:

Do's and don'ts regarding safety in domestic electrical appliances and substation operators. Electrical safety in industry/ substations at the time of operation/ control/ maintenance. Fire detection alarm, fire-fighting equipment's. Factors affecting insulating materials and classifications of as per IS:1271-1958.Measuring insulation resistance by Megger. Properties of insulating oil, testing of transformer oil as per IS 1866-1961.

Unit – II Installation and Erection:

Concept and requirement of foundation for installation of static and rotating electrical machinery. Concept of leveling and aligning procedure for direct coupled drive. Requirements of installation for rotating electrical machines as per I.S. 900 - 1965, pole mounted transformer and procedure of installation of transformer as per I.S.- 1886-1967, Devices and tools required for loading, unloading, lifting, and carrying heavy equipment and precautions to be taken while handling them.

Unit– III Testing and Commissioning:

Concept and objective of testing, role of ISS in testing of electrical equipment. Routine tests, supplementary test, special tests. Methods of testing Direct/Indirect/Regenerative testing. Commissioning, Tests before Commissioning for transformer, induction motor, alternator, testing of transformer as per I.S.1886- 1967 and I.S.2026- 1962, Testing of three-phase Induction motor as per I.S.325 – 1970 and single-phase induction motor as per I.S.990- 1965.

Unit– IV Troubleshooting Plans and maintenance:

Internal and external causes for failure / abnormal operation of equipment. List of mechanical faults, electrical faults and magnetic faults in the electrical equipment. Preparation of trouble shooting charts for D.C. Machines, AC Machines and transformers, Concept of maintenance, types, Routine, causes of failure of electrical machines. Concept of TPM, Pillars of TPM, Preventive maintenance- procedure and factors affecting, breakdown maintenance.

Text Books and References:

1. Deshpande.M. V. PHI Learning Pvt. Ltd., 2010, Design and Testing of Electrical Machines ISBN No 8120336453, 9788120336452.
2. Rao, B V S Asia Club House, First Reprint, 2011, Operation and Maintenance of Electrical Equipment Vol-I, ISBN No 8185099022
3. Rosenberg. Mc GRAW-HILL, 1st Edition, May 2003, Maintenance and Repairs, ISBN No 9780071396035
4. Sharotri, S.K. Glencoe/ Mcgraw- Hill; 2ndEdition , June 1969; Preventive Maintenance of Electrical Apparatus, ISBN No 10: 007030839X 13: 978-0070308398

Electrical Estimation and Contracting (Program ELECTIVE –II)

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

• Design electrical installation with costing for tendering

Course outcomes:

After completing this course, students will be able to

- Follow National Electrical Code 2011 in electrical installations.
- Estimate the electrical installation works 193 Electrical Engineering Curriculum Structure
- Estimate the work of non-industrial electrical installations.
- Estimate the work of industrial electrical installations.
- Prepare abstract, tender, quotation of public lighting and other installations.
- Prepare abstract, tender, quotation of low tension (LT) substations.

Course contents:

Unit – I Electric Installation, Safety, Estimation and Costing :

Electrical Installation: Types, Fundamental Principle and National Codes.

Meaning and purpose of- rough estimate, detailed estimate, supplementary estimate, annual maintenance estimate and revised estimate.

Contracts- Concepts of contracts, types of contracts, contractor, role of contractor.

Tenders and Quotations- Type of tender, tender notice, preparation of tender document, and method of opening of tender.

Quotation, quotation format, comparison between tender and quotation

Principles of execution of works, planning, organizing and completion of work, Billing ofwork.

Unit – II Industrial and Non-Industrial Installations:

Classification of industrial buildings based on power consumption, Design consideration in industrial installations Design procedure of installation-detailed steps, Design electrical installation scheme of factory/ small industrial unit, Preparation of material schedule and detailed estimation. Types of Non-industrial installations: office buildings, shopping and commercial centre, residential installation.

Design consideration of electrical installation in commercial buildings.

Design procedure of installation- steps involved in detail, Estimating and costing ofunit. Earthing of commercial installation.

Unit– III Public Lighting Installation:

Classification of outdoor installations: streetlight/public lighting installation, Street light pole structures. Selection of equipment's, sources used in street light installations. Cables, recommended types and sizes of cable. Control of street light installation. Design, estimation and costing of streetlight. Preparation of tenders and abstracts.

Unit– IV Distribution Lines and LT Substation:

Introduction to overhead and underground distribution line.

Materials used for distribution line HT and LV. Cables used for distribution line, factors determining selection of LT/ HT power Cables, cable laying and cable termination method according to IS.

Types of 11KV Distribution substations their line diagram, Estimation of load, Load factor, diversity factor and determination of rating of distribution Transformer. Design, estimation and costing of outdoor and indoor 11 KV substation

Text Books and References:

1) Ra Raina, K.B.; Dr. S. K. Bhattacharya New Age International Publisher First, Reprint2010, Electrical Design Estimating and Costing ISBN: 978-81-224-0363- 3

2) Allagappan,,N.S.Ekambarram, Tata Mc-Graw Hill Publishing Co. Ltd, Electrical Estimating and Costing, ISBN 13: 9780074624784

3) Singh, Surjit Ravi Deep Singh, Dhanpat Rai and Sons, Electrical Estimating and Costing, ISBN 13:1234567150995

4) Gupta, J.B. S.K. Katariaand Sons Reprint Edition, A Course in Electrical InstallationEstimating and Costing ISBN 10: 935014279113: 978-9350142790.

5) Bureau of Indian Standard. IS: 732-1989, Code of Practice for Electrical Wiring Installation

6) Bureau of Indian Standard. SP-30:2011, National Electrical Code 2011

Essence of Indian Knowledge and Tradition

Learning Outcomes:

1) To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the important roots of knowledge system.
2) To make the students understand the traditional knowledge and analyse it and apply it in their day to day life

Course Outcomes:
At the end of the Course, Student will be able to:
1. Identify the concept of Traditional knowledge and its importance.
2. Understand the need and importance of protecting traditional knowledge.
3. Illustrate the various enactments related to the protection of traditional knowledge.
4. Explain the importance of Traditional knowledge in Agriculture and Medicine.

UNIT I:
Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge (Unani / Siddha/ Ayurveda), Indigenous Knowledge (IK)

UNIT II:
Protection of traditional knowledge: The need for protecting traditional knowledge, Significance of traditional knowledge Protection, value of traditional knowledge in global economy, Role of Government to harness traditional knowledge

UNIT III:
Traditional Knowledge in different Sectors: Traditional knowledge and engineering, Traditional medicine system, traditional knowledge in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of traditional knowledge

Suggested Reading:
1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor.
3. Madhya Himalayi Sanskriti mein Gyan, Vigyan evam Paravigyan by Prof PC Pandey.
Suggested Online Link: Web Links:
1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

Implementation of AICTE Model Curriculum 2019 for Diploma inEngineering Courses

in MANUU Polytechnics (Hyderabad, Bangalore, Darbhanga, Kadapa, Cuttack)

Semester V

Curriculum in Electrical and Electronics Engineering

Course Code	Description	Course Title	Hours/Week			Credits	Total Contact Hours/ Week
			L	T	P		
	Professional Core Courses	Microcontroller Applications	3	0	0	3	3
	Professional Core Courses	Microcontroller Applications Laboratory	0	0	2	1	2
	Professional Core Courses	Control Systems	3	0	0	3	3
	Professional Core Courses	Control Systems Laboratory	0	0	4	2	4
	Programme Elective III	Programme Elective III	3	0	0	3	3
	Programme Elective IV	Programme Elective IV	3	0	0	3	3
	Open Elective	Open Elective I	3	0	0	3	3
	Internship	Summer Internship- II	0	0	0	3	0
	Project	Major Project	0	0	2		2
Total						**21**	**23**

List of Program Elective III

Course Code	Course Title
	Illumination Practices
	Building Electrification
	Solar Power Technologies

List of Program Elective IV

Course Code	Course Title
	Wind Power Technologies
	Biomass and Micro-hydro Power Plants
	Electric Vehicles

List of Open Elective I

Course Code	Course Title
	Renewable Energy Technologies
	Soft Computing Techniques
	Energy Efficiency and Audit

Microcontroller Applications

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain different types of microcontroller-based systems

Outcomes:

- Interpret the salient features of various types of microcontrollers.
- Interpret the salient features of architype of types microcontrollers IC 8051
- Maintain the program features of the Microcontroller based application
- Develop assembly language program

Course Contents:

Unit – I: Introduction to Microcontrollers

What is Microcontroller, Evolution of Microcontrollers, Classification of Microcontrollers, Block diagram of Microcomputer, elements of Microcomputer, Advantages and Disadvantages of Microcontrollers, Application Microcontrollers.

Unit – II: Microcontroller 8051

Block & Architecture of Microcontrollers 8051, Memory, Bit Configuration, instruction set, Classification of instructions, Various addressing modes, Interrupts in 8051 Microcontrollers, Concept of Embedded system, Embedded system tools & Peripherals, Application of 8051 Microcontrollers in Embedded system

Unit– III: Assembly Language Programming

Software development steps and tools - Editor, Assembler, Linker, Loader and Hex, converters. Role of various files created at various levels in running an Assembly program using simulators like RIDE or KEIL. Various directives of Assembly language programming, Programs using directives.

Unit– IV: 8051 Internal Peripherals and Related Programs

I/O ports- List, diagram, read write operation, instructions and related SFRs, Timers/counters – list, related SFRs, programming modes, operations with diagram. Serial communication- Basics of serial communication, baud rate, related SFRs, programming modes, operations with diagram. Interrupts- related SFRs,

References:

1. Kenneth, Ayala, 8051 Microcontroller Architecture Programming and Application, PHI Learning, New Delhi,ISBN: 978-1401861582

2. Mazidi, Mohmad Ali; Mazidi, Janice Gelispe; Mckinlay Roline D., The 8051 Microcontroller and Embedded system, Pearson Education, Delhi, ISBN 978-8177589030

3. Pal, Ajit, Microcontroller Principle and Application, PHI Learning, New Delhi, ISBN13: 978-81-203-4392-4

4. Deshmukh, Ajay, Microcontroller Theory and Application, McGraw Hill., New Delhi, ISBN-9780070585959

5. Kamal, Raj, Microcontroller Architecture Programming, Interfacing and System Design, Pearson Education India, Delhi, ISBN: 9788131759905

6. Mathur; Panda, Microprocessors and Microcontrollers, PHI Learning, New Delhi, ISBN:978-81-203-5231-5

7. Krishna Kant, Microprocessors and Microcontrollers: Architecture programming and System Design, PHI Learning, New Delhi, ISBN:978-81-203-4853-0

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Microcontroller Applications Laboratory

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain microcontroller-based systems.

Outcomes:

- Interpret the salient features of various types of microcontrollers.
- Interpret the salient features of architype of types microcontrollers IC 8051
- Maintain the program features of the Microcontroller based application
- Develop assembly language program
- Develop program to interface 8051 microcontrollers with LED/SWITCH

Practicals:

1. Interpret details of Hardware Kit for Microcontroller and practice to write and execute programs.
2. Develop and execute Assembly language programs using Arithmetic Instructions and demonstrate outcome for a given input data
3. Develop and execute Assembly language programs using Logical Instructions and demonstrate outcome for a given input
4. Develop and execute an Assembly language program for Addition of series of 8-bit nos, 16-bit result and demonstrate outcome for a given input data
5. Develop and execute Assembly language program for addition/subtraction of 16 bit no/multibyte nos. and demonstrate outcome for a given input data
6. Develop and execute Assembly language program for Block transfer from and to Internal/External memory using directives and demonstrate outcome for a given input data.
7. Develop and execute Assembly language program Largest/smallest of given series of no. from Internal/External memory and demonstrate outcome for a given input data.
8. Develop and execute Assembly language program arrange no in ascending/descending order from Internal/External memory and demonstrate outcome for a given input data.
9. Develop and execute Assembly language program for LED blinking/LED sequences using delay/ timer mode.
10. Develop and execute Assembly language program to interface LED with microcontroller.

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Control Systems

Course Objectives:

- To develop basic skills of utilizing mathematical tools needed to analyze and design classical linear control systems.
- To understand and develop the state space representation of control systems.

Outcomes:

At the end of the course students will be able to

- Understand the concept of the terms control systems, feedback, Mathematical modelling of Electrical and Mechanical systems.
- Explain the time domain and frequency response analysis of control systems.
- Acquire the knowledge of various analytical techniques used to determine the stability of control systems.
- Able to understand the importance of design of compensators
- Able to demonstrate controllability and observability of modern control systems.

Course Contents:

Unit – I Introduction to Control Systems: Classification of control systems. Components of control systems, Transfer function, Mathematical modelling of Electrical and Mechanical systems, Block diagram reduction technique, Signal flow graph, Mason's gain formula

Unit-II Time Domain Analysis: Standard test signals, Time response of first order systems, Transient response of second order system for unit step input, Time domain specifications, Steady state response, Steady state errors and error constants, Effects of P, PD, Pl and PID controllers.

Unit-III Stability Analysis: The concept of stability, Routh's stability Criterion, Root locus concept, construction of root loci, Effects of adding poles and zeros on the root loci, Bode plot, Stability analysis from Bode plots.

Unit-IV State Space Analysis: Concepts of state, State variables and state model, Derivation of state models of linear time invariant systems - Controllable, Observable and Diagonal state models, State transition matrix, Solution of state equation, Concepts of Controllability and Observability

References:

1. Nagrath I.J. & Gopal.M - Control System Engineering, Wiley Eastern, 2003.

2. B.C.Kuo - Automatic Control Systems, Wiley India edition, 7th Edition, 2002.

3. K.Ogata - Modern Control System, Prentice Hall of India, 4th edition, 2002.

4. N.C.Jagan - Control Systems, B.S Publications, 2nd edition,2008

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Control SystemsLaboratory

Outcomes:

- To study the concept of time response and frequency response of the system
- This course aims to familiarize with the modeling of dynamical systems, to simulate and analyze the stability of the system using MATLAB.

Outcomes:

At the end of the course, a student will be able to:

- Discuss the need of software tools (MATLAB, PSPICE) to illustrate modeling and simulation of any system
- Classify and evaluate the performance parameters of a system and then with simulation prepare an advance tool to modify the values of the parameter of the system in order to meet the desired need
- Prepare professionals in laboratory to compute or to predict the characteristics of a system by visualizing experimental data and its graphical representation.
- Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory by introducing the concepts of different stability theorems.

Practicals:

1. 1. Introduction to MATLAB. To learn how to represent the polynomial in MATLAB, find its roots, create polynomials when roots are known, perform multiplication, division, differentiation, evaluation and obtain its partial fraction.
2. Represent a transfer function and perform series, parallel and feedback using MATLAB
3. Compute the poles and zeros of a transfer function and plot them on pole zero map using MATLAB.
4. Compute the step and impulse response of first order system using MATLAB.
5. Compute the step and impulse response for a second order system with different damping ratios using MATLAB.
6. Determine the step and impulse response for a Type-0, Type-1 and Type-2 systems.
7. To study the effect of P, PI, PD and PID controller on step response of a feedback control system
8. To study the effect of addition of zeros to the forward path transfer function of a closed loop system.
9. To study the effect of addition of poles to the forward path transfer function of a closed loop system.

Illumination Practices (Programme Elective-III)

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

• Design illumination schemes and associated electrification of buildings.

Course outcomes:

- To select relevant lamps for various applications considering illumination levels
- To select the lighting accessories required for selected wiring scheme.
- To design relevant illumination schemes for interior applications.
- To design Illumination schemes for various applications
- To design Illumination schemes for various outdoor applications

Course contents:

Unit – I Fundamentals of illumination

Laws of illumination, Polar curves, Concept of Photometry, Measurement of illumination, Lighting calculation methods, Watt /m2 method, Lumens or light flux method, Point to point method.

Unit- II Types of lamps

Incandescent lamp, ARC lamps, fluorescent lamp, Mercury vapour lamp, HPMV lamp, Sodium vapour lamp, Neon Lamps. LED lamps, CFL, Lasers.

Unit– III Illumination Control and Control Circuits

Purpose of lighting control and Dimmer, working principle and operation of Dimmer, working principle and operation Electronic Dimmer, Control of Enhance Lighting, Methods used for light control, Control circuits for lamps: single lamp controlled by single switch, two switches. Single Lamp control by two-point method, three-point method

Unit– IV Illumination for Interior Applications

Illumination scheme for different Interior locations of Residential, Commercial, industrial unit, Factory Lighting, Street Lighting (Latest Technology), Railway Lighting, Lighting for advertisement /Hoardings/sports lighting, Health Care Centres / Hospitals, Decorating Purposes, Stage Lighting.

References:
1. Lindsey, Jack L., Applied Illumination Engineering, The Fairmont Press Inc.
2. Simons, R. H., Bean, Robert; Lighting Engineering: Applied Calculations, Architectural Press. ISBN: 0750650516.
3. Casimer M Decusatis, Handbook of Applied Photometry, Springer, ISBN 1563964163.
4. Butterworths, Lyons Stanley, Handbook of Industrial Lighting, Butterworths
5. Simpson Robert S, Lighting Control Technology and Applications, Focal Press

Building Electrification (Programme Elective-III)

Course objectives:

The aim of this course is to help the student to attain the following industry identify competency through various teaching learning experiences:

- Design electrical installation systems in building complexes.

Course outcomes:

- Select accessories, wires, cables and wiring systems for electrification.
- Design electrical wiring installation system for residential unit.
- Design proper illumination scheme for residential unit.
- Prepare wiring layouts on wiring board.
- Locate and diagnose faults in electrical wiring installation.
- Do proper earthing for building electrification

Course contents:

Unit-I: Wiring Tools and Accessories

Various tools required for wiring and their BIS specifications, application, care & maintenance of tools. Classification of electrical accessories, Types of switches according to construction and working. Holders and their types, various types of socket outlets and plugs, distribution box, neutral link, bus-bar chamber. Wooden/ mica boards, Moulded/ MS Concealed boxes.

Unit-II: Electrical Wires and Underground Cables

Conductors- solid conductor, stranded conductor. Wire- PVC wires, CTS wire, LC wire, FR (Fire retardant) wire, Size of wire according to BIS, Wire jointing methods. Cable- armoured cable, flexible cable, Classification of cables, low tension, high tension, and extra high-tension cables, solid, oil filled and gas filled type Cable, Cable jointing methods, Cable laying methods. Factors determining selection of electric cables.

Unit-III: Wiring Methods and wiring layout

PVC casing-capping wiring- wiring rules according to IS: 732-1983. Conduit wiring, types of conduit wiring (Surface/Concealed). Conduit wiring accessories, BIS rules for Metal and PVC conduit wiring. General BIS rules for domestic installations. Design, working and drawing of Simple light and fan circuits, Stair case wiring, Go-down wiring circuit, Bedroom lighting circuit, Corridor lighting circuit, Series parallel circuit, Master switch control circuit.

Unit-IV Residential Building Electrification and Protection.

Electrical diagrams and symbols as per IS: 732. Wiring and circuit Schematic diagram according to IS: 2042(Part-I)-1962: multiline and single line representation. Load assessment: Selection of size of conductor, Selection of rating of main switch and protective switch gear. Design and drawing, estimation and costing of a residential installation having maximum 5 KW load. Fuse in electric circuit: fuse element, fuse current rating, minimum fusing current, cut-off current, fusing factor, Fuse material, Miniature circuit Breaker (MCB)-Construction, Principle rating and uses, Earth Leakage Circuit Breaker (ELCB)-Construction, Principle rating and uses.

References:

1. Raina, K.B. and S.K.Bhattacharya, Electrical Design Estimating and Costing, New Age International Ltd., New Delhi, ISBN 978-81-224-0363-3

2. Allagappan,N. S.Ekambarram, Electrical Estimating and Costing, New Delhi, ISBN-13: 9780074624784

3. Singh, Surjit, Electrical Estimating and Costing, Dhanpat Rai and Co. New Delhi, ISBN: 1234567150995

4. Gupta, J B: A Course in Electrical Installation Estimating and Costing, S K Kataria and Sons,New Delhi, ISBN:978-93-5014-279-0

5. Bureau of Indian Standard, IS: 732-1989, Code of practice for electrical wiring installation

6. Bureau of Indian Standard, SP 30 National Electrical Code 2010

7. Bureau of Indian Standard, SP 72 National Lighting Codes 2010

8. E-REFERENCES:-

- http://nptel.ac.in/courses/108108076/1 , assessed on 18th January 2016

- http://www.electrical4u.com, assessed on 18th January 2016

- https://www.youtube.com/watch?v=A9KSGAnjo2U, assessed on 18th January 2016

- http://www.electricaltechnology.org/2015/09, assesed on 30 Jan 2016

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Solar Power Technologies (Programme Elective-III)

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the efficient operation of various types of solar power technologies

Course outcomes:

After Completing this Course, Students will be able to

- Maintain the solar non-electric equipment.
- Maintain CSP plants
- Maintain solar PV systems.
- Maintain solar PV electronics and MPPT systems
- Maintain off-grid and on-grid solar power plants

Course contents:

Unit – I Solar Energy

Solar Map of India, Global solar power radiation, Different types of Solar water heaters, Solar Heating systems, Solar drying and different types of Solar cookers, Solar lighting.

Unit – II Concentrated Solar Power (CSP)

Concentrated Solar Power (CSP) plants or solar thermal electric systems, Construction, working and specifications -Parabolic Trough, Parabolic Dish, Power Tower, Fresnel Reflectors.

Unit– III Solar PV Systems

Solar PV cell, Solar PV working principle-Series and parallel connections of solar modules, Solar Photovoltaic (PV) system, Solar modules and arrays, Roof top and streetlight solar PV systems. Solar Charge controllers, Solar Inverters, Solar Power tracking: construction, working, tilt angle, solar radiation, I-V, P-V characteristics, maximum power point tracking (MPPT)

Unit– IV *Solar PV Off–grid and Grid Tied Systems*

Solar off grid systems, Solar Grid tied (on grid) systems-Working principle of grid-tied dc-ac inverter, grid synchronization and active power export, Net metering-main features and working, Solar-wind Hybrid systems.

References:

1. Solanki, Chetan Singh, - Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning, New Delhi, ISBN: 9788120351110

2. Solanki, Chetan Singh, - Solar Photovoltaic Technology and Systems - A Manual For Technicians, Trainers and Engineers, PHI Learning, New Delhi, ISBN: 9788120347113

3. Kothari, D.P. et aL: Renewable Energy Sources and Emerging Technologies, PHI 3. David M. Buchla, Thomas E. Kissell, Thomas L. Floyd, - Renewable Energy Systems, Pearson Education New Delhi ,ISBN: 9789332586826

4. Rachel, Sthuthi, Earnest, Joshua; -Wind Power Technologies, PHI Learning 5. O.P. Gupta, Energy Technology, Khanna Publishing House, ISBN: 978-93-86173-683

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Electric Vehicles (Programme Elective-IV)

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences

- Maintain electric vehicles

Course outcomes:

After Completing this Course, Students will be able to

- Interpret the salient features of Hybrid electric vehicles.
- Interpret the Dynamics of hybrid and Electric vehicles
- Maintain the DC-DC converters in EV applications.
- Maintain the DC-AC converters in EV applications
- Select the batteries for EV applications

Course Contents:

Unit-I: Introduction to Hybrid Electric Vehicles

Evolution of Electric vehicles, Electric vehicles (EV), Hybrid Electric drive (HEV), Plug in Electric vehicle (PIEV), Components used in Hybrid Electric Vehicle Economic and environmental impacts of Electric hybrid vehicle.

Unit-II: Dynamics of hybrid and Electric vehicles

Factors affecting vehicle motion, Drive train configuration, Automobile power train, classification of vehicle power plant, Classification of motors used in Electric vehicles, Basic architecture of hybrid drive trains. HEV Configurations-Series, parallel, Series-parallel, complex.

Unit-III: Converters, inverter for EV and HEV

EV and HEV configuration based on power converters, Classification of converters, Boost and Buck-Boost converters, Two quadrant converters; multi quadrant converters. Principle of operation of half bridge DC-AC inverter (R load, R-L load), Single phase Bridge DC-AC inverter with R load, R-L load

Unit-IV: Batteries:

Battery Parameters, types of batteries, Battery Charging, Control system for EVs and HEVs, Electronic control unit ECU, Regenerative braking in EVs.

References:

1. A.K. Babu, Electric & Hybrid Vehicles, Khanna Publishing House, New Delhi (Ed. 2018)

2. Fuhs, A. E. Hybrid Vehicles and the Future of Personal Transportation, CRC Press,

3. Gianfranco, Electric and Hybrid Vehicles: Power Sources, Models, Sustainability, Infrastructure And The Market, Pistoia Consultant, Rome, Italy,

4. Ehsani, M. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press

5. Husain, I. Electric and Hybrid Electric Vehicles, CRC Press

6. Chan C. C. and K. T. Chau, Modern Electric Vehicle Technology, Oxford Science Publication,

7. Lechner G. and H. Naunheimer, Automotive Transmissions: Fundamentals, Selection,Design and Application, Springer

8. Rashid, M. H. Power Electronics: Circuits, Devices and Applications, 3rd edition, Pearson,

9. Moorthi, V. R. Power Electronics: Devices, Circuits and Industrial Applications, Oxford University Press

10. Krishnan, R. Electric motor drives: modelling, analysis, and control, Prentice Hall

11. Krause, O. P. ; C. Wasynczuk, S. D. Sudhoff, Analysis of electric machinery, IEEE Press.

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Biomass and Micro-Hydro Power Plants (Programme Elective-IV)

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the efficient operation of various types of Biomass and Micro hydro power plants.

Course outcomes:

After Completing this Course, Students will be able to

- Select the relevant biomass power plant
- Undertake the preventive maintenance of different types of biomass gasifiers
- Undertake the breakdown maintenance of different types of biomass gasifiers
- Maintain the optimised working of large wind power plants
- Maintain the optimised working of small wind turbines.
- Maintain the optimised working of micro hydro power plants.

Course contents:

Unit-I: Basics of Biomass-based Power Plants

Properties of solid, liquid and gaseous fuel for biomass power plants. Layout of a Bio-chemical based (e.g. biogas), Thermo-chemical based (e.g. Municipal waste) and Agro-chemical based (e.g. bio-diesel) power plant.

Unit-II: Biomass Gasification Power Plants

The basic principle to convert Agriculture and forestry products and wood processing remains into combustible gas. General Construction and working of a typical gasifier. Power generating in gas engine.

Unit-III: Different Types of Gasifiers

Construction and working of Rice Husk Gasification Power Plant, Straw Gasification Power Plant, Gasification Power Plant, Bagasse/Sugar Cane Trash Gasification Power Plant, Gobar gas plant.

Unit-IV: Micro-hydro Power Plants

Energy conversion process of hydro power plant. Classification of hydro power plant: High, medium and low head. General Layouts of typical micro-hydro power

References:

1. Khoiyangbam, R S Navindu; Gupta and Sushil Kumar; Biogas Technology :Towards Sustainable Development; TERI, New Delhi; ISBN: 9788179934043

2. David M. Buchla; Thomas E. Kissell; Thomas L. Floyd - Renewable Energy Systems, Pearson Education New Delhi , ISBN: 9789332586826,

3. Kothari, D.P. et aL: Renewable Energy Sources and Emerging Technologies, PHI

4. Rachel, Sthuthi, Earnest, Joshua; -Wind Power Technologies, PHI Learning

5. O.P. Gupta, Energy Technology, Khanna Publishing House, ISBN: 978-93-86173-683

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Wind Power Technologies (Programme Elective-IV)

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain large wind power plants and small wind turbines.

Course outcomes:

After Completing this Course, Students will be able to

- Identify the various types of wind power plants and their auxiliaries.
- Maintain the normal working of large wind turbines.
- Optimize the aerodynamic and electric control of large wind power plants.
- Troubleshoot the common faults of large wind power plants.
- Maintain the normal working of small wind turbines.
- Troubleshoot small wind turbines.

Course contents:

Unit-I: Wind Energy and Wind Power Plants

Wind power scenario in the world and India, Characteristics of Wind Energy. Major parts and function of wind power plant. Types of Wind Power Plants (WPPs): Small and large wind turbines; Horizontal and Vertical axis; Upwind and Downwind, One, Two and Three blades; constant and variable Speed. Cut-in, cut-out and survival wind speeds, Threshold wind speeds.

Unit-II: Aerodynamic Control, Electric Generators and Grid Connection

Aerodynamic Control of WPPs. Braking mechanisms of large WPPs. Types Electric Generator used in WPP. Electric grid connection of WPPs.

Unit-III: Maintenance of Large Wind Power Plants

General maintenance of WPPs, Scheduled Maintenance of Stall and Pitch and Active Pitch controlled WPPs, Unscheduled maintenance: operational factors, design faults, wear and tear of components.

Unit-IV: Construction and Working Small Wind Turbines

Working of different type of small wind turbines (SWT), Direct-Drive and Geared; braking of SWTs Parts of SWTs: Rotor, generator, gearbox, tower, electric control panel, tale vane, anemometer, wind vane, temperature and rpm sensors.

References:

1. Hau, Erich: Wind Turbines Springer-Verlag, Berlin Heidelberg, Germany, ISBN: 978-3-642-

271502

2. Rachel, Sthuthi, Earnest, Joshua; -Wind Power Technologies, PHI Learning, New Delhi, ISBN: 978-93-88028-49- 3; E-book 978-93-88028-50-9

3. Gipe, Paul: Wind Energy Basics, Chelsea Green Publishing Co; ISBN: 978-1603580304

4. Wizelius, Tore, Earnest, Joshua - Wind Power Plants and Project Development, PHI Learning, New Delhi, ISBN:978-8120351660

5. Bhadra, S.N., Kastha, D., Banerjee, S, Wind Electrical Systems installation; Oxford University Press, New Delhi, ISBN: 9780195670936

6. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi (ISBN: 978-93-86173-683)

Implementation of AICTE Model Curriculum 2019 for Diploma in Engineering Courses in

MANUU Polytechnics(Hyderabad, Bangalore, Darbhanga, Kadapa, Cuttack)

Semester VI

Curriculum in Electrical and Electronics Engineering

Course Code	Description	Course Title	Hours/Week			Credits	Total Contact Hours/ Week
			L	T	P		
	Professional Core Courses	Switchgear and Protection	3	1	0	3	4
	Professional Core Courses	Switchgear and Protection Laboratory	0	0	3	2	3
	Humanities	Entrepreneurship and Start -ups	3	1	0	3	4
	Open Elective	Open Elective II	3	0	0	3	3
	Open Elective	Open Elective III	3	0	0	3	3
	Mandatory Audit Courses	Indian Constitution	2	0	0	0	2
	Project 2	Major Project	0	0	6	4	6
	Seminar	Seminar	1	0	0	1	1
Total						**19**	**26**

List of Open Elective II

Course Code	Course Title
	Internet of Things
	Artificial Intelligence
	Mechatronics

List of Open Elective III

Course Code	Course Title
	Energy Conservation & Audit
	Product Design
	Project Management

Entrepreneurship and start-ups

Course Learning Objectives:
- Acquiring Entrepreneurial spirit and resourcefulness.
- Familiarization with various uses of human resources for earning dignified means of living.
- Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation
- Acquiring entrepreneurial quality, competency, and motivation.
- Learning the process and skills of creation and management of entrepreneurial venture

Course contents

Unit -I

Introduction to Entrepreneurship and Start – Ups: Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation, Types of Business Structures, Similarities/differences between entrepreneurs and managers.

Unit -II

Business Ideas and their implementation: Discovering ideas and visualizing the business, Activity map, Business Plan.

Unit -III

Idea to Start-up: Market Analysis – Identifying the target market, Competition evaluation and Strategy, Development. Marketing and accounting, Risk analysis, Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy.

Unit -IV

Management, and Financing & Protecting Ideas
Company's Organization Structure, Recruitment and management of talent, Financial organization and management, Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses.

Text And Reference Books:

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company Steve Blank and Bob Dorf K & S Ranch ISBN – 978-0984999392
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses Eric Ries Penguin UK ISBN – 978-0670921607
3. Demand: Creating What People Love Before They Know They Want It Adrian J. Slywotzky with Karl Weber Headline Book Publishing ISBN – 978-0755388974
4. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business Clayton M. Christensen Harvard business ISBN: 978-142219602

Course Outcome:
On completion of the study of the subject the student will be able to
- Understanding the dynamic role of entrepreneurship and small businesses
- Organizing and Managing a Small Business
- Financial Planning and Control
- Forms of Ownership for Small Business
- Strategic Marketing Planning
- New Product or Service Development
- Business Plan Creation

Switchgear and Protection

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain switchgear and protection schemes used in electrical power systems.

Course Outcomes:

At the end of the course students will be able to learn:

- Understand various protective systems.
- Select relevant switchgears as per their applications.
- Test the performance of different protective relays.
- Maintain protection systems of alternators, transformers and transmission lines

Course Content:

Unit – I: Basics of Protection

Necessity, functions of protective system, Normal and abnormal conditions, Protection zones and backup protection. Need of current limiting reactors and their arrangements.

Unit – II: Circuit Interruption Devices

Arc formation process, methods of arc extinction (High resistance and Low resistance), Arc voltage, Recovery voltage, Re-striking voltage, RRRV, Isolators, HRC fuses, Construction and Working of (Sulphur-hexa- Fluoride (SF6), Vacuum circuit breaker), Working and applications of Air circuit breakers (ACB), Miniature circuit breakers (MCB) and Earth leakage circuit breaker (ELCB), Circuit breaker rating.

Unit – III: Protective Relays

Fundamental quality requirements: Selectivity, Speed, Sensitivity, Reliability, Simplicity, Economy.
Basic relay terminology: Protective relay, Relay time, Pick up, Reset current, current setting, Plug setting multiplier, Time setting multiplier.
Protective relays: Classification, principle of working, construction and operation of Electromagnetic (Attracted armature type, Solenoid type, Watt-hour meter type) relay, Block diagram and working of Static relay, Time current characteristics of Overcurrent relay, Operation of current and voltage differential relay, Distance relay, Directional relay.

Unit – IV: Protection of Power System Components

Alternator Protection: Faults, Differential protection Over current, earth fault, overheating, field failure, Reverse power protection.

Transformer Protection: Faults, Differential, over current, earth fault, Limitations of differential Protection, Buchholz relay
Motor: Short circuit protection, Overload protection, Single phase preventer.

Transmission line: Over current, Distance and Pilot wire protection.

Text Books and References:

1. Mehta V. K, Rohit Mehta, Principles of Power System, S. Chand and Co., New-Delhi., ISBN: 978-81-2192-496-2.
2. Rao. Sunil S., Switchgear and Protection, Khanna Publishers, New Delhi, ISBN: 978-81-7409-232-3.
3. Singh, R. P., Switchgear and Power System Protection, PHI Learning, New Delhi. ISBN: 978-81-203-3660-5.
4. Gupta. J. B. Switchgear and Protection, S. K. Kataria and Sons, New Delhi, ISBN: 978-93-5014-372-8.
5. Veerapan, N, Krishnamurty, S. R., Switchgear and Protection, S. Chand and Co., New Delhi. ISBN: 978-81-2193-212-7.
6. Ram, Badri; Vishwakarma D. N., Power System Protection and Switchgear, McGraw-Hill, New-Delhi. ISBN: 978-07-107774-X

Switchgear and Protection Laboratory

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain switchgear and protection schemes used in electrical power systems.

Course Outcomes:

At the end of the course students will be able to learn:

- Identify various types of faults in power system.
- Select suitable switchgears for different applications.
- Test the performance of different protective relays.
- Maintain protection systems of alternators and transformers.
- Maintain protection schemes for motors and transmission lines.
- Maintain protection schemes for power system against overvoltage.

Course contents:

1. Identify various switchgears in the laboratory and write their specifications.

2. Test HRC fuse by performing the load test.

3. Test MCB by performing the load test

4. Dismantle MCCB/ELCB and identify various parts.

5. Dismantle ACB/VCB and identify different parts.

6. Set the plug and time (with PSM, TSM) of induction type electromagnetic relay.

7. Test electromagnetic over-current relay by performing load test.

8. Simulate differential protection scheme for transformer with power system simulation kit.

9. Test the working of the single phasing preventer using a three-phase induction motor.

10. Simulate transmission line protection by using the impedance relay/over current relay for various faults. (On transmission line protection simulation Kit).

11. Dismantle Thyrite type arrester and identify different parts.

12. Perform neutral earthing at different substations / locations.

Course Title: **Indian Constitution**   Course Code:

Scheme of Instruction	Scheme of Examination
Total Duration: 30 Hours Periods / Week: 2 Credits: 0 Instruction Mode: Lecture	Maximum Marks: 50 Internal Evaluation: 20 External Evaluation: 30 Exam Duration: 3 Hours

Course Content

Unit 1 – The Constitution - Introduction

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

Unit 2 – Union Government

- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

Unit 3 – State Government

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

Unit 4 – Local Administration

- District Administration
- Municipal Corporation
- Zila Panchayat

Unit 5 – Election Commission

- Role and Functioning
- Chief Election Commissioner, State Election Commission

Suggested Learning Resources:

S. No.	Title of Book	Author	Publication
1.	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2.	The Constitution of India	B.L. Fadia	Sahitya Bhawan; New edition (2017)
3.	Introduction to the Constitution of India	DD Basu	Lexis Nexis; Twenty-Third 2018 edition

Suggested Software/Learning Websites:

https://www.constitution.org/cons/india/const.html

http://www.legislative.gov.in/constitution-of-india

https://www.sci.gov.in/constitution

https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

MINOR PROJECT

Course Objectives:

1. To enable students learn by doing.
2. To develop capability to analyse and solve real world problems
3. To develop innovative ideas among the students

Course Outcomes: Students should be able to do the following:

1. To provide innovative solutions
2. To work in a team
3. To manage time and resources in the best possible manner

Students are required to choose a topic for minor project related to the courses of this semester. Student has to implement and present the project as per the given schedule. During the implementation of the project, student has to follow the schedule given below. Report of the project work has to be submitted for evaluation.

Schedule:

S.No	Description	Duration
1.	Problem Identification / Selection	4 weeks
2.	Preparation of Abstract	1 week
3.	Design, Implementation & Testing of the Project	5 weeks
4.	Documentation & Project Presentation	2 weeks

Guidelines for the Award of marks:

S.No.	Description	CIE Max. Marks 60	SEE Max. Marks 40
1.	Weekly Assessment	20	--
2.	Design/ Implementation	20	10
3.	Presentation	10	10
4.	Viva Voce	10	10
5.	Report	-	10

Final Minor Project demonstration and PPT presentation is to be evaluated for the entire class together by the entire faculty handling Minor project for that class.

MAJOR PROJECT

Course Objectives:

1. To impart team building and management skills among students.
2. To instill writing and presentation skills for completing the project.
3. Plan, Analyse, Design and implement a project.

Course Outcomes: Students should be able to do the following:

1. Find the solution of identified problem with the help of modern Technology and give priority to real time scenarios.
2. Plan to work as a team and to focus on getting a working project done and submit a report within a stipulated period of time.
3. Prepare and submit the Report and deliver presentation before the departmental Committee.

Students are required to choose a topic for major project related to the courses of this semester. Student has to implement and present the project as per the given schedule. During the implementation of the project, student has to follow the schedule given below. Report of the project work has to be submitted for evaluation.

Schedule:

S.No	Description	Duration
1.	Problem Identification / Selection	5 weeks
2.	Preparation of Abstract	2 week
3.	Design, Implementation & Testing of the Project	12 weeks
4.	Documentation & Project Presentation	5 weeks

Guidelines for the Award of marks:

S.No	Description	CIE Max. Marks 120	SEE Max. Marks 80
1.	Weekly Assessment	30	--
2.	Design/ Implementation	50	20
3.	Presentation	20	20
4.	Viva Voce	20	20
5.	Report	-	20

Final Major Project demonstration and PPT presentation is to be evaluated for the entire class together by the entire faculty handling Major Project for that class.