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
Electronics and Communication 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**

MANUU Polytechnics **With effect from the academic year 2020-2021**

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**

MANUU Polytechnics **With effect from the academic year 2020-2021**

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**

MANUU Polytechnics **With effect from the academic year 2020-2021**

Semester II – 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	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**

MANUU Polytechnics **With effect from the academic year 2020-2021**

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 $\lim_{x\to a}\frac{x^n-a^n}{x-a}$, $\lim_{x\to 0}\frac{\sin x}{x}$, $\lim_{x\to a}\left(\frac{a^x-1}{x}\right)$ and $\lim_{x\to a}(1+x)^{1/x}$.

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 $nP_r \text{ and } nC_r$.
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

APPLIED PHYSICS-I

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. Determinationofflashandfirepointoflubricatingoilusing Able‟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.

MANUU Polytechnics **With effect from the academic year 2020-2021**

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,
    - Choosing words
    - Voice
    - Modulation
    - Clarity
    - Time
    - 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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MANUU Polytechnics **With effect from the academic year 2020-2021**

Environmental Science

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.

MANUU Polytechnics **With effect from the academic year 2020-2021**

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

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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.

Applied Physics –II

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.

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Applied Physics Labs –II

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.

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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.

MANUU Polytechnics **With effect from the academic year 2020-2021**

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

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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

MANUU Polytechnics **With effect from the academic year 2020-2021**

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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COURSE STRUCTURE AND DETAILED SYLLABUS

DIPLOMA IN

ELECTRONICS AND COMMUNICATION ENGINEERING

(II - YEAR SYLLABUS)

MANUU POLYTECHNICS

Semester III

Curriculum Structure

S. No	Category	Code	Course Title	Hours per week			Total contact hrs/ week	Scheme of Evaluation		Credits
				L	T	P		CIE	SEE	
1	Program core course	DPCS311PCT	Computer Programming	2	1	0	3	40	60	3
2	Program core course	DPEL305PCT	Principles of Electronic Communication	3	0	0	3	40	60	3
3	Program core course	DPEL306PCT	Electronic Devices and Circuits	3	0	0	3	40	60	3
4	Program core course	DPEL307PCT	Digital Electronics	2	0	0	2	40	60	2
5	Program core course	DPEL308PCT	Electric Circuits and Networks	2	1	0	3	40	60	3
6	Program core course	DPCS311PCP	Computer Programming Lab	0	0	4	4	60	40	2
7	Program core course	DPEL305PCP	Principles of Electronic Communication Lab	0	0	2	2	60	40	1
8	Program core course	DPEL306PCP	Electronic Devices and Circuits Lab	0	0	2	2	60	40	1
9	Program core course	DPEL307PCP	Digital Electronics Lab	0	0	2	2	60	40	1
10	Summer Internship-I (4 weeks) after II Sem	DPCC301SEP	Summer Internship-I						50	2
	Total Credits									**21**

Semester III

Course Title: **Computer Programming** Course Code:DPCS311PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration: 45 Hrs Periods / Week: 2+1 Credits:3 Instruction Mode: Lecture + Tutorial	Maximum Marks: 100 Internal Evaluation: 40 External Evaluation: 60 Exam Duration: 3 Hours

Course Learning Objectives:

To enable student, develop structured solutions to problems and implementing them using computers. This involves two parts

- Formulating a solution for a given problem as a well-defined sequence of actions
- Expressing solution in a machine-readable form or a programming language.

For the second part, we will learn the common units of programming languages. The first part can only be learned through the repeated practice of solving problems.

Course Content:

UNIT I: PROGRAMMING CONSTRUCTS

Sequential structure: History, Various types of data, Arithmetic operators, Assignment statement, Assignment operators, printf, scanf, Type conversion techniques, Macro define. **Selective Structure:** Relational operators - Logical operators - Logical expressions - Conditional operator – bit wise operators -Conditional statements - Multi way condition statement - Switch statement. **Repetitive structures:** Iterative loops, Nesting, break, continue statements null statement, comma operator.

UNIT II: ARRAYS, STRINGS AND FUNCTIONS

Array - Array declaration - Access to array elements - Initialization of Array elements and - Arrays as arguments String – Declaration of Strings – various String Functions. Function- Return statement – Function prototypes - local and external variables – Automatic and static variables, Recursion.

UNIT III: POINTERS

Pointer Address and de-referencing operators - Declaration, Assignment and Initialization of a pointer - Pointer Arithmetic - Pointer comparison, conversion parameter passing by reference – Relation between arrays and pointer – String manipulation using pointer - Pointer arrays - Pointer to function- Dynamic memory management functions.

UNIT IV:STRUCTURES AND UNION

Structures initialization, access concept - Size of a structure - Pointers to structure – Relationship between structure and function - Structures function arguments and function values - Relation between structure and arrays –Structure containing pointers –self Referential structure – Unions

File processing and Pre-processor directives: File processing facility - Pre-processor directives.

Text Books and References:

1. Let Us C - Yashavant Kanetkar
2. Problem Solving and Programming in C - R.S. Salaria, Khanna Publishing House
3. C Programming Absolute Beginner's Guide - Dean Miller and Greg Perry
4. The C Programming Language, Kernighan and Ritchie, Prentice Hall of India
5. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill
6. C Programming & Data Structures, B. A. Forouzan and R. F. Gilberg, CENGAGE Learning.
7. Outline of Programming with C, Byron Gottfried, Schaum, McGraw-Hill

Course Outcomes:

- At the end of the course, the student should be able to computationally formulate basic problems and write code snippets to execute them.

Semester III

Course Title: **Principles of Electronic Communication** Course Code: DPEL305PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Score : 100 Internal Evaluation : 40 End/ External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

On completion of the study of the subject the student should be able to comprehend the following:

- To gain knowledge of communication system and modulation techniques.
- To impart the knowledge of AM, FM and VSB Systems.
- To study the Characteristics of Transmitters and Receivers

Course Content:

UNIT I: Analog Modulation

Introduction to communication systems: Elements of communication system, Frequency spectrum, Need for modulation, types of modulation,

Concept of frequency translation: Description of AM & FM in time and frequency domains.

VSB in time and frequency domains.

UNIT II:Pulse Analog Modulation:

Introduction to sampling, sampling theorem, types of sampling(natural and flat-top), ideal sampling, aliasing and Interpolation, types of pulse modulation (PAM, PWM & PPM).

Description of PCM & Delta Modulation, Quantization: Uniform and Non Uniform quantization

UNIT III:Transmitters and Receivers.

Characteristics of Transmitters, low level modulation, high level modulation, AM and FM transmitters.

Characteristics of Receivers, TRF receiver, Superheterodyne AM receiver, FM receiver. Comparison of AM & FM receivers.

UNIT IV:Spread Spectrum Modulation

Introduction, Pseudo-Noise Sequences, Direct Sequence Spread Spectrum (DSSS), Processing gain, Frequency Hop Spread Spectrum (FHSS), Application of Spread Spectrum: CDMA

Test Books and References:

1. Communication System by Umesh Sinha.
2. Electronic communications systems by Roy Blake, Thomson Delmar
3. Communication Systems (Analog & Digital) by R.P. Singh, S.D. Sapre, T.M.H
4. Communication Systems by Simon Haykin, John Wiley
5. Electronic Communication Modulation and Transmission 2nd Edition-Schoenbeck Publisher PHI

Course Outcomes:

- Ability to understand the basic signals, their analysis and frequency spectra, and their impact on modern communication systems.
- The ability to design and analyze basic analog transmitters and receivers.
- The ability to describe spread spectrum techniques. .

Semester III

Course Title: **Electronics Devices and Circuits** Course Code: DPEL306PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration: 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks: 100 Internal Evaluation: 40 External Evaluation: 60 Exam Duration: 3 Hours

Course Learning Objectives:

On completion of the study of the subject the student should be able to comprehend the following:

- Study the working principle of PN junction diode and transistor & FET
- Understand the working principle of different types of rectifiers
- Understand the different transistor configurations and analyse them
- Understand the significance of IC regulators
- Understand the concept of biasing and theory of stabilization in amplifiers
- Understand the importance of feedback, oscillators and negative feedback amplifier topologies

Course Content:

UNIT I: SEMICONDUCTOR DEVICES

Introduction of PN Junction diode, Diode Rectifiers – Half Wave and Full Wav Filters – C, LC and PI Filters. Introduction of Bipolar Junction Transistor (BJT), BJT configurations with characteristics and current gain factors (alpha, beta & gamma). Introduction of FET, N Channel/ P-Channel MOSFETs – characteristics, enhancement and depletion mode

UNIT II: BIASING OF BJT

Need of Biasing, concept of DC load line, selection of operating point (Q point), need of stabilization of Q point (thermal runaway concept). Types of biasing circuits -Fixed bias, Collector to Base bias and Voltage divider bias.

UNIT III: SMALL SIGNAL AMPLIFIERS

Concept of amplification, Classification of amplifiers, small signal amplifier using BJT, AC Load Line, Small signal analysis of single stage CE Amplifier with importance of emitter bypass capacitor and coupling capacitors.

UNIT IV: NEGATIVE FEEDBACK AMPLIFIERS AND OSCILLATORS

Introduction to positive and negative feedback amplifiers, Effect of feedback on gain, bandwidth, input and output impedances. Basic feedback Amplifier Topologies: Voltage Series, Voltage Shunt, Current Series and Current Shunt. Oscillators- Basic principles, Classification of oscillator, RC phase shift, Hartley, Colpitts & Crystal oscillator

Text Books and References:

1. Analog Circuits - A.K. Maini, Khanna Publishing House Ed. 2018 (ISBN: 978-93-86173-584).
2. Electronic Devices and Circuits - S. Salivahanan and N. Suresh Kumar, McGraw Hill Education; Fourth edition (1 July 2017) ISBN: 978-9339219505
3. Electronics Devices and circuit theory - Boyestad & Nashelsky, Pearson Education India; 11 edition (2015) ISBN: 978-9332542600
4. Electronic Principles - Albert Malvino & David Bates, Tata McGraw Hill Publication 2010 ISBN: 978-0070634244
5. ElectronicsDevices &Circuits - Jacob Millman, McGraw Hill Education; 4 edition (2015) ISBN: 978-9339219543

Course Outcomes:

- Understand the working of Transistors, FET, Semiconductor diodes and their applications.
- Ability to analyse circuits like Transistor as an amplifier, graphical analysis and small signal equivalent circuit models.
- Ability to analyse BJT circuits i.e., Modes of operation, biasing of BJT.
- Ability to analyse different oscillator circuits
- Ability to define and analyse the different negative feedback amplifiers

Semester III

Course Title: **Digital Electronics** Course Code: DPEL307PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration : 30 Hours Periods / Week: 2 Credits: 2 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

On completion of the study of the subject the student should be able to comprehend the following:

- Understand the different building blocks in digital electronics using logic gates and implement simple logic function using gates.
- Understand different number system and their conversions.
- Explain functional blocks of a sequential logic circuit and understand the essence of clocking.
- Understanding the basics of memory devices & their types.

Course Content:

UNIT I:NUMBER SYSTEMS, BOOLEAN ALGEBRA AND LOGIC GATES

Binary, Octal, Decimal, Hexadecimal Conversion from one number system to another (with a major focus on Decimal number conversion). Review of Rules and laws of Boolean Algebra, De-Morgan's Theorem, Simplification of expressions, Karnaugh map to simplify Boolean expression (up to 4 variables only**),** Logic Gates – AND, OR, NOT, NAND, NOR, XOR, XNOR, Realization of basic gates using universal gates, Implementation of logic functions using gates.

UNIT II: COMBINATIONAL LOGIC CIRCUITS

Arithmetic Circuits – Addition, Subtraction, 1's & 2's Complement, Half Adder, Full Adder, Half Subtractor, Full Subtractor, 4-bit Parallel and Serial Adder, Encoder, Decoder (up to 3-bit binary inputs/outputs), Multiplexer – 2 to 1 MUX, 4 to 1 MUX, 8 to 1 MUX and applications, De-multiplexer– 1 to 2 DEMUX, 1 to 4 DEMUX, 1 to 8 DEMUX and applications.

UNIT III: SEQUENTIAL LOGIC CIRCUITS

Flip Flops – SR, T, D, JK, level and edge triggering. Counters – Asynchronous/Ripple Counter, Mod-3, Mod-7 Counters, Ring Counter. Registers – 4-bit Shift Register: Serial in Serial Out, Serial in Parallel Out, Parallel in Serial Out, Parallel in Parallel Out.

UNIT IV: MEMORY DEVICES

Classification of memories-RAM organization ($2^k \times n$), address lines and word length- Introduction to Static RAM, Dynamic RAM, Read-only memory – ROM organization (mXn), Expanding memory, PROM, EPROM, EEPROM, Flash memory.

Text Books and References:

1. Digital Electronics and Computer Architecture in Urdu - Mahboob ul Haque, Directorate of Translations and Publications, MANUU, Hyderabad.
2. Digital Logic and Computer Design - Morris Mano, Prentice-Hall of India.
3. Digital Computer Electronics - Malvino and leach, 3rd edition Tata McGraw-Hill Education
4. Modern Digital Electronics - R P Jain, TMH
5. Digital Design - John F. Wakerly, Fourth Edition, Pearson/PHI, 2008
6. Digital Electronics - GK Kharate, Oxford University Press.
7. Digital Electronics - R. Anand

Course Outcomes: upon completing this course the student will be able to

- Understand the basics of Digital Electronics.
- Understand the working of MUX, DE-MUX, Encoder and Decoder circuits.
- Understand the working of Sequential logic circuits including registers and counters.
- Understand organization and working of semiconductor memories.

Semester III

Course Title: **Electric Circuits and Networks** Course Code: DPEL308PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Score : 100 Internal Evaluation : 40 End/ External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To study the basics of circuit analysis
- To learn a number of powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation and several methods of simplifying networks.
- To introduce students with the fundamental concepts in graph theory and concept of graphical solution to electrical network
- To distinguish between tie set and cut set methods for solving various circuits.

Course Content:

Unit I: Basics of Network and Network Theorem

Network elements, branch, junction, Node, Mesh, Ohm's law, Kirchhoff's Current and Voltage Law, Star and Delta Transformations, Mesh and Node analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power transfer theorem, Reciprocity theorem and problems on above theorems.

Unit II: Graph Theory

Network Graph, tree, incidence matrix, tie-set matrix, cut-set matrix, analysis of resistive network using cut-set and tie-set. Duality.

Unit III: Time Domain and Frequency Domain Analysis

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, Initial and Final conditions in network elements, forced and free response, time constants, steady state and transient Response.

Unit IV: Two Port Network

Open Circuit Impedance (Z) Parameters, Short Circuit Admittance (Y) Parameters, Transmission (ABCD) Parameters, Hybrid (h) Parameters, Interrelationships of different parameters.

Reference Books:

1. Engineering Circuit Analysis by W. H. Hayt, J. E. Kemmerly and S. M. Durbin McGraw Hill

Text Books :

1. Electrical Circuits by Joseph Edminister Schaum's Outline, TataMcGraw Hill
2. Network & Systems by D. Roy Choudhury Wiley Eastern Ltd.

Course outcomes:

Students will be having knowledge and skill to:

- Understand the basic concepts of graph and analyze the basic electrical circuits using graph theory.
- Apply time and frequency concepts of analysis.
- Ability to Solve Circuits using Tree, Node, Branch ,Cut set ,Tie Set Methods.
- Ability to Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits.

Semester III

Course Title: **Computer Programming Lab** Course Code: DPCS311PCP

Scheme of Instruction	**Scheme of Examination**
Total Duration : 30 Hrs Periods / Week: 4 Credits: 2 Instruction Mode: Practical	Maximum Marks : 100 Internal Evaluation : 60 External Evaluation : 40 Exam Duration : 3 Hours

Course Learning Objectives:

- To make students proficient in computer programming.
- To make students solve programming problems.

Course Content:

1. Familiarization with programming environment (Editor, Compiler, Raptor tool etc.)
2. Programs using I/O statements and various operators
3. Programs using expression evaluation and precedence
4. Programs using decision making statements and branching statements
5. Programs using loop statements
6. Programs to demonstrate applications of n dimensional arrays
7. Programs to demonstrate use of string manipulation functions
8. Programs to demonstrate parameter passing mechanism
9. Programs to demonstrate recursion
10. Programs to demonstrate use of pointers
11. Programs to demonstrate command line arguments
12. Programs to demonstrate dynamic memory allocation
13. Programs to demonstrate file operations

Text Books and References:

1. Let Us C - Yashavant Kanetkar
2. Problem Solving and Programming in C - R.S. Salaria, Khanna Publishing House
3. C Programming Absolute Beginner's Guide - Dean Miller and Greg Perry
4. The C Programming Language - Kernighan and Ritchie, Prentice Hall of India
5. Programming in ANSI C - E. Balagurusamy, Tata McGraw-Hill
6. C Programming & Data Structures - B. A. Forouzan and R. F. Gilberg, CENGAGE Learning

Course Outcomes:

Student will be able to write code snippets, and then compile, debug and execute them.

Semester III

Course Title: **Principles of Electronic Communications Lab** Course Code: DPEL305PCP

Scheme of Instruction	**Scheme of Examination**
Total Duration : 30 Hrs Periods / Week: 2 Credits: 1 Instruction Mode: Practical	Maximum Marks : 100 Internal Evaluation : 60 External Evaluation : 40 Exam Duration : 3 Hours

Course Learning Objectives:

- To explain the fundamental concepts of communication systems.
- To demonstrate and compare different analog modulation schemes.

Course Content:

CYCLE-I

1. Harmonic analysis of a sinusoidal wave of modulated waveform: Measure Modulation Index
2. Harmonic analysis of a square wave of modulated waveform: Measure Modulation Index
3. To modulate a high frequency carrier with sinusoidal signal to obtain AM signal
4. To modulate a high frequency carrier with sinusoidal signal to obtain FM signal
5. To observe phase modulated waveform and its demodulation

CYCLE-II

6. To observe the operation of a PCM Encoder and Decoder.
7. Study of AM super heterodyne receiver.
8. Measurement of sensitivity of a radio receiver using field strength meter.
9. Measurement of selectivity of a radio receiver using field strength meter.
10. To study & observe the amplitude response of Automatic gain controller (AGC).

Text Books and References:

1. Electronic Communication Systems by George Kennedy, Bernard Davis and SRM Prasanna, McGraw Hill Education.
2. Principles of communication systems By Taub Schilling, T.M.H.
3. Communication Systems: Analog and Digital by R P Singh & S D Sapre, Second Edition Tata McGraw-Hill Publishing Company Limited

Course Outcomes:

- Understanding the different techniques of signal modulation and demodulation.
- Ability to understand and verify the AM super heterodyne receiver
- Understanding the variation in amplitude response of AGC.

Semester III

Course Title: **Electronic Devices and Circuits Lab** Course Code: DPEL306PCP

Scheme of Instruction	**Scheme of Examination**
Total Duration : 30 Hrs Periods /Week: 2 Credits: 1 Instruction Mode: Practical	Maximum Marks : 100 Internal Evaluation : 60 External Evaluation : 40 Exam Duration : 3 Hours

Course Learning Objectives:

- To understand the concepts of different electronic components and circuits.
- To facilitate the practical exposure for different devices and circuits.

Course Content:

CYCLE 1

1. Construct a Half Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters
2. Construct a Full Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters
3. Construct a Bridge Rectifier and obtain regulation characteristics – Without Filters and with Filters
4. Input and Output Characteristics of CE BJT
5. Drain and Transfer characteristics of JFET
6. Biasing of BJT

CYCLE 2

7. Frequency response of Single stage RC Coupled CE Amplifier
8. RC Phase Shift Oscillator
9. Hartley Oscillator
10. Colpitts Oscillator
11. Simulate half wave, full wave and bridge rectifier using simulation tool like PSpice/ Orcad/ Multisim.
12. Develop a simulation model for Voltage Series and Voltage Shunt Feedback Amplifiers
13. Develop a simulation model for Current Series and Current Shunt Feedback Amplifiers

Text Books and References:

1. ElectronicsDevices and Circuit Theory - Boyestad & Nashelsky, Pearson Education India; 11 edition (2015)
2. ElectronicsDevices &Circuits - Jacob Millman, McGraw Hill Education; 4 edition (2015)

Course Outcomes:

- The ability to understand the transistor & FET characteristics.
- An ability to verify the rectifier circuits using diodes and implement them using hardware.
- Observe the amplitude and frequency responses of amplifier circuits
- Design, construct, and take measurement of various circuits to compare experimental results in the laboratory with theoretical analysis.

Semester III

Course Title: **Digital Electronics Lab** Course Code: DPEL307PCP

Scheme of Instruction	**Scheme of Examination**
Total Duration : 30 Hrs Periods / Week: 2 Credits: 1 Instruction Mode: Practical	Maximum Marks : 100 Internal Evaluation : 60 External Evaluation : 40 Exam Duration : 3 Hours

Course Learning Objectives:

- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- To impart the knowledge to construct, verify and study the operation of various digital electronic circuits.

Course Content:

CYCLE 1

1. To verify the truth tables for all logic gates – NOT, OR, AND, NAND, NOR, XOR & XNOR
2. Implement Half Adder and Full Adder using ICs
3. Implement Half Subtractor and Full subtractor using ICs
4. Realization of basic gates (AND, OR & NOT) using NAND and NOR gates
5. Implement Multiplexer and De-multiplexer using multiplexer ICs

CYCLE 2

6. Verification of the function of SR, D Flip Flops
7. Verification of the function of JK and T Flip Flops
8. Construct a Simple Counter
9. Implement shift registers
10. Study of different memory ICs

Text Books and References:

1. Digital Electronics – An Introduction to Theory and Practice - William H. Goth, Prentice Hall India Learning Private Limited, 2 Edition
2. Digital principles & Applications - Albert Paul Malvino & Donald P. Leach, McGraw Hill Education; Eighth edition
3. Digital Electronics - R. Anand Khanna Publications, New Delhi

Course Outcomes:

- Understand of the fundamental concepts and techniques used in digital electronics
- Ability to construct various combinational and sequential circuits and study their operations.

Semester IV

Curriculum Structure

Sl. No	Category	Code	Course Title	Hours per week			Total contact hrs/ week	Scheme of Evaluation		Credits
				L	T	P		CIE	SEE	
1	Mandatory Course	DPCC401PET	Essence of Indian Knowledge and Tradition	2	0	0	2	20	30	0
2	Program core course	DPEL406PCT	Microcontrollers and Applications	3	0	0	3	40	60	3
3	Program core course	DPEL407PCT	Digital Communications	3	0	0	3	40	60	3
4	Program core course	DPEL408PCT	Linear Integrated Circuits	3	1	0	4	40	60	4
5	Program core course	DPEL409PCT	Electronic Measurements and Instrumentation	3	0	0	3	40	60	3
6	Program core course	DPEL410PCT	Consumer Electronics	3	0	0	3	40	60	3
7	Program core course	DPEL406PCP	Microcontrollers and Applications Lab	0	0	2	2	60	40	1
8	Program core course	DPEL407PCP	Digital Communications Lab	0	0	2	2	60	40	1
9	Program core course	DPEL408PCP	Linear Integrated Circuits Lab	0	0	2	2	60	40	1
10	Minor Project	DPCC402SEP	Minor Project	0	0	4	4	60	40	2
	Total Credits									**21**

Semester IV

Course Title: Essence of Indian Knowledge and Tradition Course Code: DPCC401PET

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

Course Learning Objectives:

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

Course Contents :

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

Text Books and References:

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/

Course Outcomes:
At the end of the Course, Student will be able to:

- Identify the concept of Traditional knowledge and its importance.
- Understand the need and importance of protecting traditional knowledge.
- Illustrate the various enactments related to the protection of traditional knowledge.
- Explain the importance of Traditional knowledge in Agriculture and Medicine.

Semester IV

Course Title: **Microcontrollers and Applications** Course Code: DPEL406PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

On completion of the study of the subject the student should be able to comprehend the following:

- To impart the Basic Concept of 8051 microcontroller.
- Get familiarize with the architecture and the instruction set of a microcontroller, Assembly language programming will be studied as well as the design of various types of interfaces.
- To study addressing modes of 8051.
- To introduce the need & use of Interrupt structure.

Course Content:

UNIT I: INTRODUCTION

Introduction to Microprocessors and Microcontrollers. Intel MCS- 51 family features, Architecture of 8051. 8051 - Interrupts, counters, timers and Stack. Instruction Cycle, Machine cycle, T- state.

UNIT II:INSTRUCTION SET OF 8051

Addressing Modes, Instruction format, 8051 Instruction set. Data Transfer Instructions, Arithmetic instructions, logic instructions, branch instructions and Boolean instructions.

UNIT III:PROGRAMMING AND INTERFACING OF 8051

Data transfer, single and multibyte addition and subtraction. Subroutines, Debugging and Time delay programs. Peripheral Devices: 8255, 8251, 8259, 8279 and Communication Interface [RS232].

UNIT IV:BASIC INTRODUCTION OF ARM PROCESSOR CORE BASED MICROCONTROLLERS

Need for RISC Processor. Fundamentals of ARM processor. Basics of ARM Core based controller [LPC214X]

Text Books and References:

1. The 8051 Micro Controller and Embedded Systems - Muhammad Ali Mazidi & Janice Gillispie Mazidi, R.D.Kinely, PHI Pearson Education, 5th Indian reprint
2. Microprocessor and Microcontrollers - Krishna Kant, Eastern Company Edition, Prentice Hall of India, New Delhi
3. Microprocessor & Microcontroller Architecture: Programming & Interfacing using 8085,8086,8051 - Soumitra Kumar Mandal, McGraw Hill Edu
4. Microcontrollers: Architecture implementation and Programming - Tabak Daniel, Hintz Kenneth j, Tata McGraw Hill, 2007
5. ARM Developer's Guide.UM10139, LPC214X User manual - Rev.4 - Andrew N.Sloss, Dominic Symes, Chris Wright, User manual – Rev.4
6. Microprocessors and interfacing: programming and hardware - Douglas V. Hall, Tata McGraw Hill, 2editon, 2007
7. Microcontroller - Fundamentals and Applications with Pic - Valder–Perez, Yeesdee Publishers, Tayler & Francis

Course Outcomes:

- Ability to understand the architecture of 8051 microcontroller.
- Impart the knowledge about the instruction set of 8051 microcontroller.
- Understand the basic idea about the data transfer schemes and its applications.
- Develop skill in simple program writing for 8051 and applications.
- Interface a microcontroller system to user controls and other electronic systems.
- Describe the internal architecture of microcontroller systems, including counters, timers, ports, and memory.

Semester IV

Course Title: **Digital communications** Course Code: DPEL407PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Score : 100 Internal Evaluation : 40 End/ External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

On completion of the study of the subject the student should be able to comprehend the following:

- To study the digital communication system and data codes.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To study the digital communication system in presence of interference.
- To study the concept of information theory, coding theory and line coding.

Course Content:

UNIT I: Digital Communication:

Introduction to digital communication, Need of data codes, types of data codes (Morse code, Baudot, ASCII and ARQ codes).
Asynchronous Transmission and Synchronous Transmission, Error detection and correction.

UNIT II: Digital Modulation:

Need for digital Modulation, Types of digital Modulation, Description of ASK,FSK,PSK and QAM schemes, Comparison of Digital Modulation Schemes. Geometric representation of signals.

UNIT III: Multiplexing and multiple access techniques:

Data modem, cable modem, digital subscriber lines, ADSL
Multiplexing and Multiple access: TDM and FDM, Comparison of TDM and FDM.
TDMA and FDMA, Code division multiple access (CDMA).

UNIT IV: Information Theory:

Information measure, Shanon entropy, Differential entropy and Mutual information.
Coding Theory: Linear block codes: Definitions and properties
Some specific codes: Hamming and RS codes
Baseband Transmission: Line Coding (RZ, NRZ), Inter-Symbol Interference, Pulse shaping.

Test and References Books:

1. Electronic communications systems by Roy Blake, Thomson Delmar
2. Electronic Communication System by George Kennedy.
3. Antenna Systems by K. D. Prasad.
4. Transmission and Propagation by Glazier.
5. Communication System by Umesh Sinha.
6. Communication Systems by Simon Haykin, John Wiley

Course Outcomes:

On completion of the course, the student will be able to

- Analyse the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
- Perform the time and frequency domain analysis of the signals in a digital communication system.
- Select the blocks in a design of digital communication system.

Semester IV

Course Title: **Linear Integrated Circuits** Course Code: DPEL408PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration : 60 Hours Periods / Week: 4 Credits: 4 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

On completion of the study of the subject the student should be able to comprehend the following:

- To Impart the knowledge of operational amplifiers and their applications, which is the backbone for the basics of Linear integrated circuits.
- To understand the basic principles and operation of oscillators, sweep circuits, PLL, IC regulators, converters, multi-vibrators and timers.

Course Content:

UNIT I: INTRODUCTION OF OPERATIONAL AMPLIFIER

BJT Differential Amplifier, General Operational Amplifier Stages and Internal Circuit diagram of IC 741, Current Mirror Circuit, DC and AC performance Characteristics, Slew rate, Open and Closed Loop Configurations.

UNIT II: APPLICATIONS OF OPERATIONAL AMPLIFIER

Sign Changer, Scale Changer, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Integrator, Differentiator, Comparators, Schmitt trigger, clipper and clamper. Low-pass, high-pass and band-pass Butterworth filters.

UNIT III: PLL AND IC REGULATORS

Operation of the basic PLL & Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565. Application of PLL for AM detection and FM detection. IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator.

UNIT IV: ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS & WAVEFORM GENERATORS

D/A converter specifications - weighted resistor type, R-2R Ladder type D/A Converters. A/D Converter specifications - Flash type - Successive Approximation type A/D Converters. Timer IC

555 and its applications - Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator & Schmitt trigger.

Text Books and References:

1. Design with Operational Amplifiers and Analog integrated circuits, 3rd Edition - Sergio Franco, Tata McGraw-Hill, 2007
2. Linear Integrated Circuits - D. Roy Choudhry & Shail Jain, New Age International Pvt. Ltd
3. System design using Integrated Circuits - B. S. Sonde, New Age Publication, 2nd Edition, 2001
4. Analysis and Design of Analog Integrated Circuits - Gray and Meyer, Wiley International, 2005.
5. OP-AMP and Linear ICs - Ramakant A. Gayakwad, Prentice Hall / Pearson Education, 4th Edition, 2001
6. Operational Amplifier and Linear Integrated Circuits - K Lal Kishore, Pearson Education, 2006

Course Outcomes:

- Ability to understand the characteristics and applications of operational amplifiers.
- Ability to explain the fundamentals involving PLL, IC regulators, converters, multi-vibrators and timers.

Semester IV

Course Title: **Electronic Measurements & Instrumentation** Course Code: DPEL409PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- Introduction to electronic measurement techniques and errors
- Use of different types of analog and digital meters for measuring electrical quantities.
- Learn the principle, working and applications of CRO.

Course Content:

UNIT I: BASICS OF MEASUREMENTS, BRIDGES AND POTENTIOMETERS

Accuracy, precision, resolution. Type of errors. DC Bridges – Wheatstone Bridge, Kelvin Bridge. AC Bridges – Maxwell Bridge, De-Sauty Bridge. Overview of DC and AC potentiometers and their applications.

UNIT II: MEASURING INSTRUMETNS

Permanent Magnet Moving Coil Instruments (PMMC). Moving Iron type instruments (MI). Electronic voltmeter and digital voltmeter. Electronic Multimeter. Q-meter.

UNIT III:OSCILLOSCOPES

Cathode Ray Tube (CRT): Construction, operation, screens, graticules. Cathode Ray Oscilloscope: Front Panel Controls, Vertical deflection system, Horizontal deflection system, Delay line. Measurement of frequency and time delay. Overview of oscilloscope probes. Multiple trace CRO.

UNIT IV:TRANSDUCERS

Selection criteria, characteristics, Construction, Working Principle and Applications of the following transducers: Resistance Temperature Detector (RTD), Thermocouple, Thermistor. Linear Variable Differential Transformer (LVDT), Strain gauge. Piezoelectric Transducers.

Text Books and References:

1. Electronic Measurements and Measurement Techniques - Cooper, Prentice Hall of India
2. Electronic Instrumentation, Kalsi, Tata McGraw-Hill
3. A Course in Electrical and Electronic Measurement and Instrumentation, A.K. Sawhney, Dhanpat Rai & Sons
4. Electronic Measurement and Instrumentation, Oliver Cage, McGraw Hill
5. Students Reference Manual for Electronic Instrumentation Lab, Wolf and Smith, Prentice Hall of India

Course Outcomes:

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

- Identify electronics Instruments, their use, peculiar errors associated with the instruments and how to minimise such errors.
- Analyse the working of different Equipment used in Instrumentation.
- Use an oscilloscope to determine frequency and phase of a sinusoidal signal.
- Analyse various measuring techniques for both electrical and non-electrical quantities

Semester IV

Course Title: **Consumer Electronics** Course Code: DPEL410PCT

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Score : 100 Internal Evaluation : 40 End/ External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To impart understanding of engineering concepts used in consumer electronics systems.
- Impart in-depth knowledge of various audio and video devices and systems.

Course Content:

UNIT I:AUDIO DEVICES AND SYSTEMS

Characteristics of Sound signal, Audio level metering, Decibel level in acoustic measurement. Microphone & types. Speakers – types and working principle. Sound recording – principle and types. CD Player. Home theatre sound system, Surround Sound. Digital console – Block diagram, working principle, applications. Public Address System

UNIT II:TELEVISION SYSTEMS

Characteristics of Human Eye, Persistence of Vision. Monochrome TV standards, Scanning process, Aspect Ratio, Flicker, Interlaced Scanning, Picture resolution, Composite Video Signal. Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance**.** Types of TV camera, Transmission standards

UNIT III:TELEVISION RECEIVERS AND VIDEO SYSTEMS

PAL-D colour TV receiver**.** Digital TVs : LCD, LED, Plasma, HDTV, 3D TV, Projection TV**.** DTH receiver**.** Digital Video : SDI, HDMI

UNIT IV:HOME/OFFICE APPLIANCES

Diagrams, operating principles and controller, and preventive maintenance for: Photocopier, Microwave Oven, Washing Machine, Digital Camera, Camcorder.

Text And Reference Books:

1. Audio and Video Systems (Second Edition, 2010) - R. G. Gupta, McGraw Hill Education Limited
2. Modern Television Practice (Revised edition, 2007) - R. R. Gulati , New Age International Publishers.
3. Audio Video Systems- Principles Practices and Troubleshooting - Bali & Bali, Khanna Publishing Company.
4. Television & Video Engineering (Second edition) - A. M. Dhake, McGraw Hill Education Limited. 4. Video Demystified – Keith Jack, LLH Technology Publishing.
5. Consumer Electronics - S.P. Bali, Pearson Education

Course Outcomes:

On completion of the study of the subject the student will be able to

- Understand engineering concepts used in Audio and video systems.
- Understand the working principles and main features of electronic gadgets/devices
- Identify the need of preventive maintenance in various electronic appliances

Semester IV

Course Title: **Microcontrollers and Applications Lab** Course Code: DPEL406PCP

Scheme of Instruction	**Scheme of Examination**
Total Duration : 30 Hours Periods / Week: 2 Credits: 1 Instruction Mode: Practical	Maximum Marks : 100 Internal Evaluation : 60 External Evaluation : 40 Exam Duration : 3 Hours

Course Learning Objectives:

- To impart the knowledge of 8051 microcontroller programming using Keil µvision

Course Content:

CYCLE 1

1. Programming 8051 Micro controller using ASM and implementation in flash 8051 microcontroller.
2. Programming with Arithmetic instructions – Addition, Subtraction
3. Programming with Arithmetic instructions – Multiplication, Division
4. Program to transfer block of data
5. Program to find sum of given n numbers

CYCLE 2

6. Program to find sum of first n natural numbers
7. Program for HEX to BCD conversion and BCD to HEX conversion
8. Testing the Interfacing with 8255
9. Testing the Interfacing with 8279, Keyboard and display interface
10. Testing the Interfacing with ADC/DAC
11. Testing the Interfacing with stepper motor.

Text Books and References:

1. The 8051 Micro Controller and Embedded Systems - Muhammad Ali Mazidi & Janice Gillispie Mazidi, R.D.Kinely, PHI Pearson Education, 5th Indian reprint
2. Microprocessors and interfacing: programming and hardware - Douglas V. Hall, Tata McGraw Hill, 2editon, 2007

Course Outcomes:

- Able to apply the fundamentals of assembly level programming of microcontroller
- Able to apply the principles of Assembly Language Programming logical development of programs on the 8051
- Will have the basic idea about the data transfer schemes

Semester IV

Course Title: **Digital Communications Lab** Course Code: DPEL407PCP

Scheme of Instruction	**Scheme of Examination**
Total Duration : 30 Hrs Periods / Week: 2 Credits: 1 Instruction Mode: Practical	Maximum Marks : 100 Internal Evaluation : 60 External Evaluation : 40 Exam Duration : 3 Hours

Course Learning Objectives:

- To understand and analyze the signal flow in a digital communication system
- To learn the fundamental concepts on different types of pulse modulation and digital modulation techniques.

Course Content:

CYCLE-I

1. Implementation of Amplitude Shift Keying
2. Implementation of Frequency Shift Keying
3. Implementation of Phase Shift Keying
4. Time Division Multiplexing: PLL (CD 4046) based synch, clock and data extraction
5. Time Division De-multiplexing: PLL (CD 4046) based synch, clock and data extraction

CYCLE-II

6. PCM modulator and demodulator.
7. Performance Analysis of Band Pass Signal Transmission and Reception • Amplitude Shift Keying • Frequency Shift Keying • Phase Shift Keying.
8. QPSK Modulation & Demodulation
9. Pulse Width modulation & Demodulation
10. Pulse Position Modulation & Demodulation

Text Books and References:

1. Communication Systems – Haykin. S, 4th Ed., John Wiley & Sons
2. Modern Digital and Analog Communication Systems – Lathi. B.P and Ding. Z, Intl. 4th Ed., Oxford University Press
3. Digital Communications – Proakis. J.G and Saheli. M, 5th Ed., McGraw-Hill
4. Digital Communications: Fundamentals and Applications – Sklar. B and Ray. P.K, 2nd Ed., Dorling Kindersley

Course Outcomes:

- Understand the basics of digital modulation system.
  Analyse the generation of signals in various digital modulation schemes

Semester IV

Course Title: **Linear Integrated Circuits Lab** Course Code: DPEL408PCP

Scheme of Instruction	**Scheme of Examination**
Total Duration: 30 Hours Periods / Week: 2 Credits: 1 Instruction Mode: Practical	Maximum Marks: 100 Internal Evaluation: 60 External Evaluation: 40 Exam Duration: 3 Hours

Course Learning Objectives:

- To familiarize with theory and applications of 555 timers.
- To make the students design filters

Course Content:

CYCLE I

1. Operational Amplifiers (IC741) application - Adder, subtractor
2. Operational Amplifiers (IC741) application - Integrator, Differentiator
3. Operational Amplifiers (IC741) application - Clipper, Clamper
4. Waveform Generation using Op-Amp (IC741)
5. Astable Multivibrator using Timer IC555

CYCLE II

6. Monostable Multivibrator using Timer IC555
7. Design of Low pass Butterworth filter
8. Design of High pass Butterworth filter
9. Fixed IC voltage Regulators
10. PLL

Text Books and References:

1. Linear Integrated Circuits - D. Roy Choudhry, Shail Jain, New Age International Pvt. Ltd
2. OP-AMP and Linear ICs - Ramakant A. Gayakwad, Prentice Hall/ Pearson Education, 4th Edition, 2001

Course Outcomes:

- Students will have a thorough understanding of operational amplifier (741).
- Students will be able to design circuits using operational amplifiers for various applications.
- Students will be able to design various circuits using IC 555.
- They can know the differences between Linear and Digital Integrated IC's.
- Students will demonstrate their knowledge by designing Analog circuits & Digital circuits.

Semester IV

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.

COURSE STRUCTURE AND DETAILED SYLLABUS

DIPLOMA IN

ELECTRONICS AND COMMUNICATION ENGINEERING

(III - YEAR SYLLABUS)

MANUU POLYTECHNICS

Semester V

Curriculum Structure

S. No	Category	Code	Course Title	Hours per week			Total contact hrs/ week	Scheme of Evaluation		Credits
				L	T	P		CIE	SEE	
1	Program core course		Embedded Systems	3	0	0	3	40	60	3
2	Program core course		Mobile and Wireless Communication	3	0	0	3	40	60	3
3	Program core course		Embedded Systems Lab	0	0	2	2	60	40	1
4	Program core course		Mobile and Wireless Communication Lab	0	0	2	2	60	40	1
5	Program Elective course		Industrial Automation or Control systems and PLC	3	0	0	3	40	60	3
6	Program Elective course		Microwave and RADAR or Optical Communication and Networking	3	0	0	3	40	60	3
7	Open Elective		Renewable Energy Technologies or Internet of Things	3	0	0	3	40	60	3
8	Summer Internship-II (6 weeks) after IV Sem		Summer Internship-II	0	0	0	0	--	100	3
9	Major Project			0	0	2	2			^
	Total Credits									20

Semester V

Course Title: **Embedded Systems** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration: 45 Hrs Periods / Week: 3 Credits:3 Instruction Mode: Lecture	Maximum Marks: 100 Internal Evaluation: 40 External Evaluation: 60 Exam Duration: 3 Hours

Course Learning Objectives:

- To enable the students to understand Embedded-System programming
- To apply the knowledge to design and develop embedded solutions
- Designing and implementing software of embedded devices and systems.
- Programming knowledge of ARDUINO.

Course content:

Unit -I

Introduction to Embedded System-Definition, Characteristics of an Embedded System, Basic Structure of Embedded System, Embedded Processor in a System, Types of processors in a system. Introduction to Embedded C- Embedded C basics operators for Arduino, Familiarizing with the Arduino IDE, Sketch designing for Arduino, Communication interface using serial port, Basic understanding of the code with Boolean operations, Pointer access operations, bitwise operations, compounded operations.

Unit -II

Embedded C control structure blocks, looping mechanism – for, do and while. The branching operations based on conditions expression.

Unit -III

Introduction to Arduino Mega, Arduino Mega specifications including power ratings, digital and analog peripherals. Difference between the C language and Embedded C language, Arduino Mega Ports, Pins, Digital and Analog Peripherals

Unit -IV

Communication with Arduino, Different communication modules available with their real-life application, Communication interface.

Text and Reference Books:

1. Arduino Projects For Dummies (For Dummies Series) Kennedy George; Davis Bernard; Prasanna Wiley (5 July 2013)
2. Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Massimo Banzi and Michael Shiloh Shroff/Maker Media; Third edition (27 December 2014).

Course Outcome:

On completion of the study of the subject the student should be able to comprehend the following:

- Understands the main features of the Arduino based Embedded System development environment
- To Design new embedded systems using Arduino system.
- Understand the hardware interfacing of the peripherals to Arduino system.
- Students will be specialized in embedded system design using Arduino

Semester V

Course Title: **Mobile and Wireless Communication** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Score : 100 Internal Evaluation : 40 End/ External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To understand the concept and implementation of frequency reuse and Handoff techniques and to analyse interference and capacity enhancement.
- To appreciate the factors influencing outdoor and indoor propagation systems.
- To analyze various multiple access protocols based on their merits and demerits.
- To visualize the system architectures and implementation of CDMA based mobile communication systems.
- To understand the concepts in various Mobile Technologies.

Course content:

Unit -I

Overview of Cellular Systems Evolution 2g/3G/4G/5G Cellular Concepts – Frequency reuse, Cochannel and Adjacent channel Interference.

Unit -II

Wireless propagation Link budget, Free-space path loss, Noise figure of receiver Multipath fading, Shadowing, Fading margin, Shadowing margin

Unit -III

Cell Tower Antenna/radiation pattern, Mobile antennas/ radiation patterns Antenna diversity, wireless channel capacity and MIMO

Unit -IV

Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM and LTE. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

Text and Reference Books:

1. Wireless Communications – Principles and Practice, S. Rappaport, (2nd edition) Pearson ISBN 9788131731864.
2. Modern Wireless Communications, Haykin & Moher, Pearson 2011 (Indian Edition) ISBN : 978-8131704431

Course Outcomes:
After completing this course, the student will be able to

- Understand the method of selection and reuse of a set of frequency channels, Base station requirement, signals required for communication and hand over between Base stations .

- Appreciate and understand the methods of electromagnetic wave propagation in cellular communication. The evaluation of the electromagnetic energy reaching the mobile Unit .

- Explain features, authentication, operational details of CDMA OFDM & LTE mobile cellular systems along with data frame structure details.

- The development and limitation of the preliminary and advanced generation of mobile systems. Present trends in Cellular communications and the future communication requirements.

Semester V

Course Title: **Embedded Systems Lab** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration: 30 Hours Periods / Week: 2 Credits: 1 Instruction Mode: Practical	Maximum Marks: 100 Internal Evaluation: 60 External Evaluation: 40 Exam Duration: 3 Hours

Course Learning Objectives:

- To enable the students to understand Embedded-system programming
- Designing and implementing software of embedded devices and systems.
- Programming knowledge of ARDUINO.

Course content:

Cycle I:

1. Built-in LED state control by push button sketch implementation
2. Built-in LED blinking sketch implementation
3. Built-in LED blinking by toggling states based on binary operation
4. Built-in LED state control by user interface through serial port
5. User interface for boolean operation and bit wise operation through serial port

Cycle II:

6. User interface for compounded operation through serial port
7. Looping mechanism to check the state of pin and if change print its status on serial port
8. Controlling multiple LEDs with a loop and an array
9. Use a potentiometer to control the blinking of an LED
10. Temperature sensor interfacing and sending its reading over serial port

Note: All Experiments can be performed based on the availability of Software/Hardware in the Laboratory.

Text Books and References:

1. Arduino Projects For Dummies (For Dummies Series) Kennedy George; Davis Bernard; Prasanna Wiley (5 July 2013)
2. Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Massimo Banzi and Michael Shiloh Shroff/Maker Media; Third edition (27 December 2014).

Course Outcome:

On completion of the study of the subject the student should be able to comprehend the following:

- Understands the main features of the Arduino based Embedded System development environment
- To Design new embedded systems using Arduino system.
- Understand the hardware interfacing of the peripherals to Arduino system.

Semester V

Course Title: **Mobile and Wireless Communication Lab** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 30 Hours Periods / Week: 2 Credits: 1 Instruction Mode: Practical	Maximum Marks : 100 Internal Evaluation : 60 External Evaluation : 40 Exam Duration : 3 Hours

Course Learning Objectives:

- Understand the characteristics the concept of cellular system
- understand the path loss
- understand the fading concept

Course content:

Cycle I:

1. To understand the cellular frequency reuse concept to find the co-channel cells for a particular cell.
2. To understand the path loss
3. Understand the path loss with shadowing
4. Understanding the Flat fading

Cycle II:

5. Understanding the Frequency selective fading.
6. Understanding the Multipath channel for the following objectives
   No Fading
   Flat Fading
   Dispersive Fading
7. To simulate a dipole antenna (λ, λ/4, λ/2, 3λ/2) for a particular frequency using 4NEC2
8. Perform following experiments using CDMA trainer kit
   PSK modulation and demodulation experiment
   Bit synchronization extraction experiment
   Error correction encoding experiment

Text and Reference Books:

1. Wireless Communications – Principles and Practice, S. Rappaport, (2nd edition) Pearson ISBN 9788131731864.
2. Modern Wireless Communications, Haykin & Moher, Pearson 2011 (Indian Edition) ISBN : 978-8131704431

Course Outcome:

- Able to explain the reuse of a set of frequency channels
- Able to explain the fading
- Able to explain the Modulation & Demodulation concepts,
- Able to explain Error correction &Error detection techniques

Semester V

Course Title: **Industrial Automation** Course Code:

Scheme of Instruction	Scheme of Examination
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Score : 100 Internal Evaluation : 40 End/ External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To impart understanding of concepts in automation and data acquisition systems
- Impart in-depth knowledge of various control systems and their applications.

Course content:

Unit -I

Industrial Automation Overview and Data Acquisition: Architecture of Industrial Automation Systems, Measurement Systems Characteristics, Data Acquisition Systems.

Unit -II

Control Generation: Introduction to Automatic Control, PID Control, Feedforward Control, Ratio Control

Unit -III

Sequential control and PLC: Introduction to Sequence Control, PLC, RLL. PLC Hardware Environment.

Unit -IV

Industrial control application: Hydraulic Control Systems, Pneumatic Control Systems, Energy Savings with Variable Speed Drives

Text And Reference Books:

1. Industrial Instrumentation, Control and Automation S. Mukhopadhyay, S. Sen and A. K. Deb Jaico Publishing House, 2013 ISBN : 978-8184954098

2. Electric Motor Drives, Modelling, Analysis and Control R. Krishnan Prentice Hall India, 2002 ISBN : 978-0130910141

Course Outcome:

On completion of the study of the subject the student should be able to comprehend the following:

- Understand measurement system characteristics.
- Understand the working principles of sequential control systems
- Understand the various applications of industrial automation.

Semester V

Course Title: **Control Systems and PLC** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hrs Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To Analyze the stability and performance of dynamic systems in both time and frequency domain
- To provide knowledge of state variable models and fundamental notions of state model design.
- To understand the generic architecture and constituent components of a Programmable Logic Controller.

Course content:

Unit -I

Control System fundamentals and Components: Classification of control systems including Open and Closed loop systems, Transfer function representation: Block diagram representation, Block diagram algebra and reduction and Signal flow graphs and Mason's gain formula.

Unit II

Time Response: Transfer function and, types of input. Transient response of second order system for step input. Time domain specifications. Characteristic Equation of Feedback control systems Types of systems, Static Error Coefficients, Error series, Stability: Concept of Stability.

Unit -III

PLC Architecture: Introduction to PLC, Configuration of PLC (components for modularized PLC), Architecture of PLC, Working of PLC, PLC peripherals, PLC symbols, Selection criteria of PLC, Advantages and disadvantages of PLC, PLC application.

Unit –IV

PLC Hardware: Discrete Input Modules: Block diagram ,specifications, Discrete output modules: Block diagram ,specifications, Analog input and output modules: Block diagram and specifications.

Text and Reference Books:

1. Nagrath, I.J, and Gopal, M., "Control System Engineering", 5/e, New Age Publishers, 2009
2. Nagoor Kani.," Control systems", Second Edition, RBA Publications.
3. Ogata, K., "Modern Control Engineering", 5/e, PHI.
4. Introduction to Programmable Logic Controller by dunning gray 3rd edition

Course Outcome:

On completion of the study of the subject the student should be able to comprehend the following:

- Convert a given control system into equivalent block diagram and transfer function
- Analyze system stability using time domain techniques
- Analyze system stability using frequency domain techniques
- Design a digital control system in the discrete time domain
- Students will be able to state basic PLC terminology and their meanings.

Semester V

Course Title: **Microwave and RADAR** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hrs Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- Understand the concept of Guided waves and its propagation in different modes (TE, TM, and TEM) between parallel planes and to find out applications of different parameters. ¬
- Understand the concept of Microwave circuit and evaluate Scattering parameters of microwave components.
- Understand the high frequency limitations of conventional tubes and principle of bunching and velocity modulation analyse the operation of microwave tubes .
- Understand principle and operation of Microwave solid state devices &evaluate the characteristics of devices & concept of strip lines, slot lines and fin line.
- understand basics of RADAR systems

Course content:

Unit -I

Introduction to Microwaves History and applications of Microwaves Mathematical Model of Microwave Transmission-Microwave transmission modes, waveguides and transmission lines.

Unit -II

Passive and Active Microwave Devices Directional Coupler, Power Divider, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Microwave Tubes.

Unit -III

Microwave Measurements, Microwave Systems, System Aspects Of Antennas: Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficieny. Effect of Microwaves on human body.

Unit -IV

Radar Systems: Description of basic radar system, Block diagram and operation of a radar, Radar equation ,Radar frequencies, Prediction of range performance, Minimum detectable signal, Receiver noise figure, Effective noise temperature, Signal to noise ratio, Falroboticsse alarm time and probability of false alarm, Integration of radar pulses, Radar cross-section of target, Pulse-repetition frequency and range ambiguities, System losses ,Application of Radar,

Text and Reference Books:

1. Microwave Engineering, D.M. Pozar, Wiley; Fourth edition (2013) ISBN 978-8126541904
2. Foundation for Microwave Engineering, R.E. Collins, Wiley; Second edition (2007) ISBN : 978-8126515288

Course Outcomes :

- After completing this course, the student will be able to
- Explain principle, working and operation of Guided waves.
- Explain various parameters for Rectangular & Circular Waveguides &Cavity Resonators.
- Integrate the concept of bunching and velocity modulation to summarize the operation of microwave tubes and the high frequency limitations of conventional tubes.
- Illustrate various effects on microwaves on human body.
- Explain principle, working and operation of RADAR

Semester V

Course Title: **Optical Communication and Networking** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hrs Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

1. To understand optical communication system and discuss about fiber modes, configurations and losses
2. To learn optical sources and optical detectors.
3. To discuss the applications of fiber optic communication

Course content:

Unit -I

Fundamental laws of optics : refraction, Snell's law, critical angle, total internal reflection, Numerical Aperture and acceptance angle, General Configuration of Fiber Optic Communication System, Applications of fiber optic cables, Benefits of fiber optic cables over conventional electric cables, Basic construction of fiber optic cable , Different Modes in Optical Fibers.

Unit-II

Losses in Optical Fibers and fiber connections, Attenuation, absorption losses, linear scattering losses and fiber bend losses, Dispersion: Intermodal dispersion, intra-modal dispersion, Connection losses: Intrinsic parameters, Extrinsic parameters, Splicing: Fusion splices, mechanical splices, Fiber optic Connectors.

Unit -III

Optical sources: Construction and operating principle of LED, Construction and operating principle of Semiconductor LASER diode.

Optical detectors: Construction and Working principle of p-n photodiode, Construction and working principle of p-i-n photodiode, Construction and working principle of avalanche photodiode. Coupling between fiber and source/detector

Unit -IV

Semiconductor optical Amplifier, EDFA. WDM and DWDM in optical fibers, Industry and military applications of Fibers, Overview of LASERs used in industrial and medical applications.

Text And Reference Books:

1. Fiber Optic Communication -D.C. Agarwal, S Chand Publishers
2. Fiber Optics & Optoelectronics - R P Khare, Oxford University Press.
3. Textbook on Optical Fiber Communication and its Applications -Second Edition - S.C.Gupta - Prentice Hall India

4. Optical Fiber Communication -3rd Edition- John M Senior - - Pearson

5. Fundamentals Of Fibre Optics In Telecommunication And Sensor Systems - 5th Edition - Gerd Keiser, McGraw Hill Education.

Course Outcome:

On completion of the study of the subject the student should be able to comprehend the following:

- Understand the working principles and main features of optical fibers
- Understand the working principles and main features of optical sources and detectors

Semester V

Course Title: **Renewable Energy Technologies** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hrs Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learnings Objectives:

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
- To understand bio energy and its usage in different ways.
- To identify different available non-conventional energy sources.

Course Content:

UNIT-I: Introduction: World Energy Use, Environmental Aspects of Energy Utilisation, Renewable Energy Scenario in India and around the World, Potentials and Economics of renewable energy systems.

Unit-II: Solar energy: Solar Radiation, Measurements of Solar Radiation, Flat Plate and Concentrating Collectors, Fundamentals of Solar Photo Voltaic Conversion, Solar Cells, Solar PV Power applications.

Unit-III: Wind Energy:

Wind Data and Energy Estimation, Types of Wind Energy Systems, Performance, Site Selection, Details of Wind Turbine Generator. Safety and environmental aspects.

Unit-IV: Bio Energy and Other Renewable Energy Sources:

Biomass direct combustion, Biomass gasifiers, Biogas plants, Bio diesel, Biomass applications Tidal energy; Wave Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.

Text And Reference Books:

1. Energy Technology, O.P. Gupta, , Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.

7. Energy and The Environment, RA Ristinen and J JKraushaar, Second Edition, John Willey & Sons, New York, 2006. 8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

Course outcomes:

After Completing this Course, Students will be able to

- Understand the importance of renewable energy.
- Understand the methods of harnessing the solar energy.
- Understand the methods of harnessing the solar energy.
- Understand the biomass energy conversion and other hybrid systems.

Semester V

Course Title: **Internet of Things** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hrs Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Content:

Unit I - Introduction to Internet of Things

• Define the term "Internet of Things"
• State the technological trends which have led to IoT.
• Describe the impact of IoT on society.

Unit II - Design consideration of IoT

• Enumerate and describe the components of an embedded system.
• Describe the interactions of embedded systems with the physical world.
• Name the core hardware components most commonly used in IoT devices.

Unit III - Interfacing by IoT devices

• Describe the interaction between software and hardware in an IoT device.
• Explain the use of networking and basic networking hardware.
• Describe the structure of the Internet.

SUGGESTED LEARNING RESOURCES:

1. Internet of Things Raj Kamal McGraw Hill Education; First edition (10 March 2017) ISBN 978-9352605224
2. internet of Things: A Hands-On Approach Arsheep Bahge and Vijay Madisetti Orient Blackswan Private Limited - New Delhi; First edition (2015) ISBN : 978-8173719547

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.raspberrypi.org/blog/getting-started-with-iot/
2. https://www.arduino.cc/en/IoT/HomePage
3. https://www.microchip.com/design-centers/internet-of-things
4. https://learn.adafruit.com/category/internet-of-things-iot
5. http://esp32.net/

Semester VI

Curriculum Structure

Sl. No	Category	Code	Course Title	Hours per week			Total contact hrs/ week	Scheme of Evaluation		Credits
				L	T	P		CIE	SEE	
1.	Program Elective course		Computer Networking and Data Communication or Signals and Systems	3	0	0	3	40	60	3
2.	Program Elective course		Electronic Equipment Maintenance or Biomedical Instrumentation	3	0	0	3	40	60	3
3.	Humanities and Social Science course		Entrepreneurship and Start-ups	3	0	0	3	40	60	3
4.	Open Elective		Robotics or Mechatronics	3	0	0	3	40	60	3
5.	Open Elective		Artificial Intelligenceor Product Design	3	0	0	3	40	60	3
6.	Mandatory Audit Course		Indian Constitution	2	0	0	2	40	60	0
7.	Major Project			0	0	6	6	120	80	4
8.	Seminar			1	0	0	1			1
	Total Credits									**20**

Semester VI

Course Title: **Computer Networking and Data Communication** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hrs Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To introduce the concepts of data communication
- To familiarize with different network topologies and the OSI model
- To familiarize with various communication protocols

Course content:

Unit-I

Introduction to data communication: Concept of Analog and Digital signals**,** Types of Computer Networks – Personal Area Network, Local Area Network, Metropolitan Area Network, Wide Area Network, Internetwork. Computer Network Topologies – Point to Point, Bus topology, Star topology, ring topology, mesh topology, tree topology, hybrid Topology.
Network connecting devices: Hub, switch, router, repeater, bridge, gateway, modem.

Unit-II

Digital & Analog Transmission: Digital Transmission – Digital to Digital Conversion, Line Coding, Unipolar Encoding, Polar Encoding, Bipolar Encoding.
Analog Transmission - Analog-to-Digital Conversion, Digital to analog Conversion, Analog to Analog Conversion. Sampling, Quantization, Encoding.
Switching Techniques: Circuit switching, Packet switching, Messege switching.

Unit-III

Reference Models: OSI Reference Model- Layered Architecture-Functions of each layer, TCP/IP reference Model-Internet Layer, ARP Protocol, Transport Layer-TCP, UDP, Application Layer protocols-SMTP, FTP, TELNET, DNS,SNMP. Difference between OSI model and TCP/IP model.

Unit-IV

Transmission media & Transmission Control Protocol:
Transmission media- Guided media: Types of cables-twisted pair cable (UTP, STP), co-axial cable, fiber optic cable. Unguided media: Radio Transmission, Microwave Transmission, Infrared Transmission, TCP Protocol– Features, Header, Addressing, Connection Management, Error Control and Flow Control, Multiplexing, Congestion Control, Timer Management, Crash Recover.

Textbooks &References:

1. Data Communication and Networking by Godbole TMH
2. Computer Networks by Andrew S. Tanenbaum 4th Ed. PHI.
3. Data and Computer Communications: William Stallings 7th edition. PHI
4. Data Communication and Networking: Behrouz Forouzan 3rd edition.TMH.
5. Computer Communications and Network Technologies by Michael A.Gallo& William Hancock Thomson.

Course Outcome:

On completion of the study of the subject the student should be able to comprehend the following:

- Identify different types of network topologies and their architecture
- Identify various protocols used in communication

Semester VI

Course Title: **Signals and Systems** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To explain signals and systems representations/classifications
- To understand the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
- To understand the time and frequency domain analysis of discrete time signals with Z-Transform.
- To understand the properties in the context of signals/systems and lay down the foundation for advanced courses.

Course content:

Unit -I

Introduction to signals and systems: Some useful operations on signals: Time shifting, Time scaling, Time inversion. Signal models: Impulse function, Unit step function, Exponential function, Even and odd signals. Systems: Linear and Non-linear systems, Constant parameter and time varying parameter systems, Static and dynamic systems, Causal and Non-causal systems, Continuous-time and discrete- time systems, Analog and digital systems.

Unit -II

Fourier series: Signals and Vectors, Signal representation by orthogonal signal set, Trigonometric Fourier Series, Exponential Fourier Series, LTI system response to periodic inputs.

Unit -III

Continuous-Time Signal Analysis: Fourier Transform: Definition, Fourier Transform of some useful functions, Properties of Fourier Transform, Signal transmission through LTI Systems, Signal energy. Laplace transform: Definition, some properties of Laplace transform, solution of differential equations using Laplace transform.

Unit -IV

Discrete-time signal analysis: Introduction of discrete time signals, Z-Transform, some properties of Z-Transform, Solution to Linear difference equations using Z-Transform. Relation between Laplace transform and Z-Transform.

Text and Reference Books:

1. B. P. Lathi, *Linear Systems and Signals,* Oxford University Press, 2nd Edition, 2009
2. Alan V O P Penheim, A. S. Wlisky, *Signals and Systems*, 2nd Edition, Prentice Hall
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, *Signals and Systems*, 4th Edition, Pearson1998.
4. Douglas K. Linder, *Introduction to Signals and Systems*, McGraw Hill, 1999
5. P. Ramakrishna Rao, *Signals and Systems,* TMH.

Course Outcome:

On completion of the study of the subject the student should be able to comprehend the following:

- Define and differentiate types of signals and systems in continuous and discrete time
- Apply the properties of Fourier transform for continuous time signals
- Relate Laplace transforms to solve differential equations and to determine the response of theContinuous Time Linear Time Invariant Systems to known inputs
- Apply Z-transforms for discrete time signals to solve Difference equations

Semester VI

Semester IV

Course Title: **Electronic Equipment and Maintenance** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Score : 100 Internal Evaluation : 40 End/ External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

1. To understand the various types of drawings and diagrams in assembling equipment
2. To identify different faults and their causes in electronic equipment
3. To test various types of components and equipment.

Course content:

Unit -I

Introduction, Reading Drawings And Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram, Dis-assembly and reassembly of equipment, Equipment Failures and causes such as poor design, production, deficiencies, careless storage and transport, inappropriate operating conditions, Nature of faults and Fault location procedure, Fault finding aids – Service and maintenance manuals and instruction manuals, Test and Measuring Instruments, special tools Troubleshooting techniques, Approaching components for tests, Grounding systems in Electronic Equipment, Temperature sensitive, Intermittent problems, Corrective actions, Situations where repairs should not be attempted.

Unit -II

Passive Components and Their Testing: Passive Components- Resistors, Capacitors, Inductors, Failures in fixed resistors and testing of resistors, Types of capacitors and their performance, Failures in capacitors, Testing of capacitors and precautions therein, Testing of inductors and inductance measurement.

Unit -III

Testing of Semiconductor Devices: Types of semiconductor devices, Causes of failure in Semiconductor Devices and Types of failure, Test procedures for Diodes, special types of Diodes, Bipolar Junction Transistors and Field Effect Transistors.

Unit -IV

Logic IC Families: Packages in Digital ICs, IC identification, IC pin-outs, Handling ICs, Digital troubleshooting methods–typical faults, testing digital ICs with pulse generators, Logic clip, Logic Probe, Special consideration for fault diagnosis in digital circuits, Handling precautions for ICs sensitive to static electricity, Testing flip-flops, counters, registers.

Text And Reference Books:

1. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance, Khandpur, TMH 2006.
2. Electronic Instruments and Systems: Principles,Maintenance and Troubleshooting- R. G. Gupta, Tata McGraw Hill Edition. 2001
3. Student Reference Manual for Electronic Instrumentation Laboratories -David L Terrell, Butterworth-Heinemann Publications
4. Electronic Testing and Fault Diagnosis G. C. Loveday, A. H Wheeler Publishing

Course Outcome:

On completion of the study of the subject the student will be able to

- Understand the aids in understanding, assembling and dis-assembling equipment.
- Test different resistors, capacitors and inductors for faults
- Test various semiconductor devices and logic circuits for faults.

Semester VI

Course Title: **Biomedical Instrumentation** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 60 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Biomedical applications of different transducers used.
- To introduce the student to the various sensing and measurement devices of electrical origin. To provide awareness of electrical safety of medical equipments
- To provide the latest ideas on devices of non-electrical devices.
- To bring out the important and modern methods of imaging techniques.
- To provide latest knowledge of medical assistance / techniques and therapeutic equipments.

Course content:

Unit -I

Components of Medical Instrumentation System: Bio amplifier. Static and dynamic characteristics of medical instruments. Bio signals and characteristics. Problems encountered with measurements from human beings. **Organisation of cell:** Nernst equation for membrane Resting Potential Generation and Propagation of Action Potential, Conduction through nerve to neuromuscular junction.
Bio Electrodes: Biopotential Electrodes-External electrodes, Internal Electrodes. Biochemical Electrodes.

Unit -II

Mechanical function: Electrical Conduction system of the heart. Cardiac cycle. Relation between electrical and mechanical activities of the heart.
Cardiac Instrumentation: Blood pressure and Blood flow measurement. Specification of ECG machine. Einthoven triangle, Standard 12-lead configurations, Interpretation of ECG waveform with respect to electro mechanical activity of the heart.

Unit -III

Neuro-Muscular Instrumentation: Specification of EEG and EMG machines. Electrode placement for EEG and EMG recording. Interpretation of EEG and EMG.

Unit -IV

Therapeutic equipment: Pacemaker, Defibrillator, Shortwave diathermy. Haemodialysis machine.
Respiratory Instrumentation: Mechanism of respiration, Spirometry, Pnemuotachograph Ventilators.

Test Book And References:

1. Principles of Applied Biomedical Instrumentation – by L.A. Geoddes and L.E. Baker, John Wiley and Sons.
2. Biomedical Equipment Technology – Carr & Brown, Pearson.
3. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
4. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.
5. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
6. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2000.
7. R.S.Khandpur, Hand Book of Biomedical Instrumentation, Tata McGraw Hill Publishing Company Ltd. 3rd Edition New Delhi, 2014

Course Outcome:

On completion of the study of the subject the student will be able to

- Ability to understand the physiology of various systems in human body.
- Ability to understand the applications of electronics in Medical field.
- Will be able to identify various sensing devices and their applications in medical field
- Ability to understand the working of bioelectronics systems such as EEG, ECG, MRI etc. and various imagining techniques.

Semester VI

Course Title: **Entrepreneurship and start-ups** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

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

Semester VI	
Course Title: **Robotics**	Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Score : 100 Internal Evaluation : 40 End/ External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To select the robots according to its usage.
- To discuss about the various applications of robots, justification and implementation of robot.

Course Contents

Unit -I

Fundamentals of Robotics: Brief history**,** Definition of Robot; Robot anatomy and its working; Robot Components: Manipulator, End effectors; Construction of links, Types of joints; Degrees of freedom, work envelope and work volume, Classification of robots; Cartesian, Cylindrical, Spherical, SCARA, Characteristics of robots; Effect of structure on control work envelope and work volume; comparison; Advantages and disadvantages of robots.

Unit -II

Robotic Drive System and Controller: Actuators; Characteristics of Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion; Feedback devices; Potentiometers; Optical encoders; DC tachometers; Robot controller; Levels of Controller; Open loop and Closed loop controller; Microprocessor based control system; Robot path control: Point to point, Continuous path control.

Unit -III

Sensors: Requirements of a sensor; Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers, Piezo-electric); Range sensors (Triangulation Principle, Structured lighting approach); Proximity sensing; Force and torque sensing.

Introduction to Machine Vision: Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Vidicon camera (Working principle & construction); Applications of Robot vision system: Inspection and Identification.

Unit -IV

Robot kinematics and Robot Programming: Definition of Forward Kinematics; Inverse Kinematics; Forward and Inverse Kinematics of R-R planar manipulator.

Definition of Path and Trajectory Planning; Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effecter commands.

Industrial Applications: Application of robots in material handling; welding; painting and assembly operations.

Text and Reference Books:

1. Introduction to Robotics: Analysis, Systems, Applications - Saeed B. Niku, Pearson Education Inc. New Delhi 2006.
2. Industrial Robotics: Technology, Programming and Applications - M.P. Groover, Tata McGraw Hill Co, 2001.
3. Robotics Control, Sensing, Vision and Intelligence - Fu.K.S. Gonzalz.R.C and Lee C.S.G, McGraw Hill Book Co, 1987.
4. Robotics for Engineers - Yoram Koren, McGraw Hill Book Co, 1992.
5. A Text book on Industrial Robotics - Ganesh S. Hedge, Laxmi Publications Pvt. Ltd., New Delhi, 2008.
6. Robotics Technology and Flexible Automation - S.R. Deb & Sankha Deb, Tata McGraw-Hill, 2010.
7. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018.

Course Outcomes:

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

- Explain the robot anatomy, classification, characteristics of robot, advantages and disadvantages.
- Explain the various use of robotic actuators like hydraulic, pneumatic and electrical drives.
- Explain the various types of sensors and concept of robot vision system.
- Understand the concept of robot programming and the various applications of robots.

Semester VI

Course Title: **Mechatronics** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Objectives:

- Understand the basics of mechatronics and the elements used
- Understand the different types of power transmission elements and drives
- Know about the various types of hydraulic and pneumatic systems

Course Content:

Unit-I :Introduction

Introduction to Mechatronics, Importance, Examples of mechatronic systems, System Concept, Analysis and Design Process, Systems with mixed disciplines.
Mechanical Systems, Characteristics, Types of motions, Kinematic Links and Kinematic chains, Basics of Four bar mechanism.
Electronics Fundamentals Review: Resistor, capacitor, inductor, transistor

Unit-II: Elements in Mechatronics

Sensors and transducers: Definition and classification of transducers, Schematic diagram, working principle and applications of Proximity Sensor and Hall Effect sensor; Definition of micro-sensors.
Signal processing devices: Circuit, working principle and applications of Electronic filters (LPF, HPF, BPF, BRF) and Operational Amplifier; Data conversion devices: Overview of ADCs and DACs; Circuit, working and applications of 3-bit Flash ADC and Binary-weighted DAC.
Microprocessors: Generic architecture, features and applications.
PID Controllers: Block diagram, operation and applications.

Unit-III: Power transmission elements and Drives

Characteristics and applications of Belt and chain drives; Gears: Types, Gear trains: Simple and compound gear train, Velocity ratio, applications; Cams and their applications.
Stepper Motors, Servo Drives, Solenoids.

Unit-IV: Hydraulic and Pneumatic Systems

Flow, Pressure and Direction Control Valves, Actuators, Supporting Elements, Hydraulic Power Packs, Pumps, Production, Distribution and conditioning of compressed air, System Components and symbolic representations. Applications of Electro-hydraulic and Hydro-pneumatic systems.

Reference Books:

1. Mechatronics- Bolton, W Pearson Education
2. Mechatronics, HMT Ltd, Tata McGraw Hill, New Delhi, 1998,
3. Analysis and design of Dynamic Systems - Cochin, Era and Cadwallender Addison Wesley, 1997
4. Mechatronics Engineering -Tomkinson, D. And Horne, J. Longman, McGraw Hill, 1996
5. Fundamentals of mechatronics -M. Jouaneh Cengage Learning, ISBN – 978-1111569020
6. Mechatronics – An Integrated Approach - Clarence W. de Silva CRC Press

Course Outcomes:

On completion of the study of the subject the student will be able to

- Understand the basics of Mechatronics and its importance
- Understand the various types of sensors and processing devices used in mechatronics
- Understand the working of belt, chain, gear, stepper motors and servo drives
- Understand the elements, functioning of hydraulic and pneumatic systems

Semester VI

Course Title: **Artificial Intelligence** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration : 45 Hrs Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks : 100 Internal Evaluation : 40 External Evaluation : 60 Exam Duration : 3 Hours

Course Learning Objectives:

- To understand foundations and Applications of AI
- To learn Probabilistic Reasoning and other search algorithms.
- To study different models of evolution and learning of fuzzy techniques, their applications
- To learn the concepts of Biological and Artificial Neural Network and learning mechanism

Course content

Unit -I

Introduction to Artificial Intelligence • Artificial Intelligence (AI) definition • Goals of AI • History of AI • Applications of AI**.**

Unit -II

Search Algorithms Terminology • Brute Force Search Strategies – Breadth First Search, Depth First Search. • Heuristic Search Strategies, Local Search Algorithms.

Unit -III

Fuzzy Logic Systems Introduction to Fuzzy Logic and Fuzzy systems, • Membership functions, • Fuzzification/Defuzzification

Unit -IV

Neural Networks Basic structure of Neural Networks • Perceptron • Back-propagation

Text and Reference Books:

1. Artificial Intelligence By Example: Develop machine intelligence from scratch using real artificial intelligence use cases. Denis Rothman. Packt Publishing

2. Artificial Intelligence – A Modern Approach (3rd Edition), Authors Russell, Norvig, Edition: 3rd Edition, 2015, Pages: 1168

Course Outcome:

After completing this course, the student will be able to

- Understand and analyze working of an AI technique using Heuristic search
- Explain the concept of Fuzzy logic
- To differentiate between Biological Neuron & Artificial Neuron and different Neuron Models
- To analyze activation & synaptic dynamics of Neural Networks

Semester VI

Course Title: **Product Design** Course Code:

Scheme of Instruction	**Scheme of Examination**
Total Duration: 45 Hours Periods / Week: 3 Credits: 3 Instruction Mode: Lecture	Maximum Marks: 100 Internal Evaluation: 40 External Evaluation: 60 Exam Duration: 3 Hours

Course Learning Objectives:

- To acquire the basic concepts of product design and development process.
- To understand the engineering and scientific process in executing a design from concept to finished product.
- To study the key reasons for design or redesign.

Course Content:

UNIT-I: Definition of a product; Types of products; Levels of product; Product-market mix; New product development (NPD) process; Idea generation methods; Creativity; Creative attitude; Creative design process; Morphological analysis; Analysis of interconnected decision areas; Brain storming

UNIT-II: Product life cycle; The challenges of Product development; Product analysis; Product characteristics; Economic considerations; Production and Marketing aspects; Characteristics of successful Product development; Phases of a generic product development process; Customer need identification; Product development practices and industry-product strategies.

UNIT-III: Product design; Design by evolution; Design by innovation; Design by imitation; Factors affecting product design; Standards of performance and environmental factors; Decision making and iteration; Morphology of design (different phases); Role of aesthetics in design.

UNIT-IV: Introduction to optimization in design; Economic factors in design; Design for safety and reliability; Role of computers in design; Modeling and Simulation; The role of models in engineering design; Concurrent design; Six sigma and design for six sigma; Introduction to optimization in design; Economic factors and financial feasibility in design; Rapid Prototyping (RP); Application of RP in product design; Product Development versus Design.

Reference Books:

1. Product Design and Development, Karl T. Ulrich and Steven D. Eppinger, Tata McGraw–Hill edition.
2. Engineering Design –George E. Dieter. McGraw Hill.
3. An Introduction to Engineering Design methods, Vijay Gupta. Tata McGraw Hill

Course outcomes:

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

- CO1: Understand the basic concepts of product design and development process.
- CO2: Illustrate the methods to define the customer needs
- CO3: Understand the intuitive and advanced methods used to develop and evaluate a concept.
- CO4: Apply modelling and embodiment principles in product design and development process.

Publishers.
4. New Product management, Merie Crawford : McGraw-Hill Irwin.
5. Product Design and Manufacturing, Chitale A K and Gupta R C, Prentice Hall of India, 2005.
6. Product Design, Techniques in Reverse Engineering and New Product Development, Kevin Otto and Kristin Wood, Pearson education.

Semester VI

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/

Semester VI

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.