# Syllabus for Second Semester

## APPLIED MATH-II

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**Rationale**

Applied mathematics forms the backbone of engineering discipline. Basic elements of differential calculus, integral, calculus, differential equation and coordinate geometry have been included in the curriculum as foundation course and to proved base for continuing education to the students

**Detailed contents**

**1. Integral Calculus**

1.1 Indefinite Integrals

1.2 Physical meaning of integration

1.3 Integration as inverse process of differentiation

1.4 Integration by substitution, by parts and by partial fractions

1.5 Integration of rational and irrational quadratic expressions viz

$$\frac{dx}{ax^2 + bx + c}, \quad \frac{dx}{ax^2 + bx + c'}, \quad ax^2 + bx + cdx$$

1.6 Definite Integrals

1.6.1 Evaluation of Definite Integrals

1.6.2 Simple problems of Integration

$\sin^n X\, dx$, $\cos X\, dx$

$\sin X \cos dx$ (without proof)

1.6.3 Numerical Integration by Simpson's Rule

**2. Fourier series**

2.1 Periodic function, equation of waves

2.2 Determination of Fourier coefficients, expansion of a periodic function by Fourier series

2.3 functions defined in two or more sub ranges.

**3 Laplace Transform**

3.1 Introduction

3.2 Laplace transform

3.3 Important Formulae
3.4 Properties of Laplace Transforms
3.5 Inverse Transforms
3.6 Laplace Transform of the Derivative of f(t)
3.7 Laplace Transform of Derivative of order n
3.8 Laplace Transform of Integral of f(t)
3.9 Laplace Transform of Integral of f(t)
3.10 Laplace Transform of Integral of 1/t[f(t)]

**4 Set Theory**

4.1 Sets
4.2 Subsets
4.3 Equality of two sets
4.4 Notation for describing sets
4.5 The Empty set
4.6 Venn diagrams
4.7 Unions and Intersections
4.8 Difference of sets
4.9 Family of sets Indexed by a set
4.10 Arbitrary union and intersection of sets
4.11 Complement of a set

**REFERENCE BOOKS**


1. Integral Calculus-Shanti Naraynan
2. Laplace Transform-Schaum Series
3. Fourier Series-Schaum Series
4. Set theory and Number System-R.S. Aggarwal
5. Applied Mathematics for polytechnic (8 the Ed.)-H.K. Dass

# APPLIED PHYSICS (THEORY)

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## 1. MEASUREMENT

### 1.1 Units and Dimensions

**Fundamental and Derived Units:**

S.I. Units. Dimensions of Physical quantities. Dimensional formula and Dimensional equation. Principle of homogeneity of dimensions and applications of homogeneity principle in:

(i) Checking the correctness of physical equation,

(ii) Deriving relations among various physical quantities, and

(iii) Conversion of numerical values of physical quantities from one system of units into others,

1.2 **Limitations of dimensional analysis.**

## 2. BASIC MECHANICS

2.1 Newton,s laws of motiona and their applications conservation of linear momentum. Circular motion, angular velocity, angular acceleration and centripetal force. Conservation of angular momentum. (only conceptual explanations of the physical parameters) Vector and scalar quantities addition, subtraction and multiplication of vectors (Physical examples).

2.2 Concept of work, power and energy, different firms of energy. Mass Energy relation.

## 3. PROPERTIES OF MATERIALS

### 3.1 Elasticity

Elasticity, stress and strain, Hook's law, elastic limit, Yielding point and breaking point. Modulus of elasticity, Youn's modulus, bulk modulus and modulus of rigidity.

### 3.2 Surface Tension

Introduction, cohesive and adhesive forces, Molecular theory of surface tension. Angle of contact. Application of surface tension.

### 3.3 Viscosity

Fluid motion, streamline and turbulent motion, viscous forces, co-efficient of viscosity and its determination by Stoke's method and Poisuelle's method.

## 4. HEAT AND TEMPERATURE

4.1 Concept of heat and temperature on the basis of kinetic theory. Units of heat. Basic principles of measurement of temperature. Various thermometers like mercury thermometer thermocouples, bimetallic thermometer, resistance thermometer, Pyrometers (Principle, construction and working). Criteria for the selection of a thermometer.

4.2 **Heat Transfer**

Modes of heat transfer, coefficient of thermal conductivity and its determination by (i) Searle's method for good conductor and (ii) Lee's method for poor conductors conduction of heat through compound media. Radiation of energy. Prevost's theory of heat exchange. Absorptivity and emissivity. Black body.

## 5. SIMPLE HARMONIC MOTION

Periodic motion, characteristics of sismple harmonic motion, equation of S.H.M. and determination of velocity and acceleration. Graphical representation. Simple pendulum. Derivation of their periodic time. Energy consideration in S.H.M. definition of free, forced, damped and resonant vibration.

## 6. WAVES

Generation of waves by vibration bodies. Progressive waves. Equation of wave. Super-position of waves and its applications of interference, beats and stationery wave-graphical method. Sound and light as wave frequencies, wavelengths, velocities and nature.

## 7. GEOMETRICAL OPTICS

Defects in image formation (qualitative) Microscope (simple and compound) and telescope (Astronomical, terrestrial theodolite) and their magnifying powers. Optical projections principles. Epidiascope and overhead projector.

## 8. WAVE OPTICS

Interference of light waves. Young's experiment. Applications of interference (paleness testing, measurement of small thicknesses). Diffraction of light wave. Polarization of light and its engineering applications. Simple concept of electromagnetic spectrum.

## 9. ATOMIC STRUCTURE

Atomic structure, Bohr's theory, energy level diagram, excitation, ionization, de-excitation and radiation. Quantum numbers n.1, m,s.Paulis's principle Bonds in

molecules and solids.

## 10. SEMICONDUCTOR PHYSICS

Energy band formation. Band structure of conductors insulators and semiconductors. Intrinsic and extrinsic semiconductors, effect of temperature.

## 11. NUCLEAR PHUSICS

Binding energy mass defect, energies of nuclear reactions. Nuclear instability radioactive emission. Radiation damage. Nuclear fission and fussion. Nuclear reactors and their application.

## LIST OF EXPERIMENTS

1. Use of varnier calipers, screw gauge and spherometer in measurement.
2. Determination of centripetal force.
3. Verification of law of conservation of energy.
4. Determination of 'Y' (Young's Modulus) by Searle's method.
5. Study of vibration of simple pendulum.
6. * Determination of surface tension by capillary rise method.
7. * Determination of coefficient of viscosity (Stoke's method).
8. * Study of interference of sound waves by quinke's tube and determination of wavelength.
9. Combination of suitable lenses to form a telescope and determine its magnifying power.
10. Measurement of small thickness by interference method.
11. Measurement of thermal conductivity of a good conductor by Searle's method.
12. Measurement of Conductivity of a poor conductor by Lee's method.
13. * Combination of suitable lenses to form a compound microscope and determine its magnifying power.
14. To study Newton's ring experiments and determine the wavelength of sodium light.

NOTE: At least 10 experiments must be done by a student. These could be taken as optimal experiment.

* These experiments are optional.

# BASIC ELECTRONICS

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**Rationale**

This subject gives the knowledge of fundamental concepts of basic electronics for effective functioning in the field of electronics service industry.

## DETAILED CONTENTS

### 1. INTRODUCTION

1.1 Definition of electronics, application of electronics.
1.2 Introduction to active and passive components.
1.3 Circuit control and protective devices.
1.4 Voltage and current source.

### 2. SEMICOMDUCTOR PHYSICS

2.1 Intrinsic semiconductor: Conductivity, atomic and crystal structure of germanium and silicon, covalent bonds. Generation and recombination of carriers, effect fo Temperature on conductivity of intrinsic semiconductor.
2.2 Extrinsic semiconductor: Doping of impurity P & N type semiconductors and their Conductivity, minority and majority carriers, drift and diffusion currents
2.3 Hall effect.

### 3. SEMICONDUCTOR DIODES

3.1 P-N junction diode: Formation of depletion layer in the P-N junction. P-N junction as forward bias and as reverse bias.
3.2 Semiconductor diode characteristics, static and dynamic resistance their calculation from diode characteristic.
3.3 Diode as rectifier: half wave, full wave, bridge rectifiers, ripple factor and its value for half and full wave rectified output. Calculation of DC voltage output, RMS voltage and efficiency.
3.4 Filter circuits: capacitor input filter, choke input filter, LC filter, RC filter and PI filter.
3.5 Brief idea and applications of power diodes, zener diode, and varacter diode.

### 4. INTRODUCTION TO THE BIPOLAR TRANSISTORS AND FETS

4.1 Concept of bipolar transistor as to junction three terminal device, PNP and NPN transistors their symbols and mechanism of current flow, explanation of fundamental current relations, concept of leakage current, effect of temperature on leakage current.
4.2 CB, CC & CE configuration: input and output characteristics. Determination of the transistor parameters current amplification factor.
4.3 Transistor as an amplifier in CE configuration, DC load line, concept of power gain.
4.4 JFET: construction, operation, characteristic, JFET parameters.
4.5 MOSFET: introduction, theory of operation, MOSFET parameters, applications
4.6 Comparisons between BJT and FET

4.7 Basic BJT and FET amplifier
4.8 Introductory idea of single stage, multistage and feedback amplifiers.

## 5. TRANSISTOR BIASING & STABLISTION OF OPERATING POINT

5.1 The DC operating points and load line
5.2 Stability factor, factors affecting stability of Q-point
5.3 Conditions for proper biasing of the transistors.
5.4 Methods of transistor biasing: base bias, ammeter feedback bias, collector feedback bias, voltage divide bias
5.5 Hybrid parameters: Introduction. H-parameters of linear circuits, hybrid equivalent circuit of transistor, approximate hybrid formula for transistor amplifier.

## 6. INTEGRATED CIRCUITS

6.1 Integrated circuits, analysis of principle of analog integrated circuits and digital integrated circuits
6.2 Ideal OPAMP, parameters of OPAMP, inverting, non-inverting, OPAMP as summer subtractor, or differentiate and integrator, voltage follower

## 7. OPTOELECTRONICS DEVICES

7.1 Working principles and characteristics and applications of photo diode, photo transistor, photo voltaic cells, LEDs, LCDs and opto couplers.

## 8. POWER AMPLIFIERS

8.1 Thyristors: Introdction to the thyristor family, SCR theory of operation characteristics, applications of SCR
8.2 UJT: Basic theory of operation, characteristics and structure, applications.

### List of Practical

1. Familiarization with operation of following instruments
   (a) Multimeter
   (b) C.R.O.
   (c) Signal Generator
   (d) Regulated Power Supply
2. Plot V-I Characteristics for P-N Junction diode & Zener diode
3. Observe the wave shape of following rectifier circuits
   (a) Half Wave rectifier
   (b) Full Wave rectifier
   (c) Bridge rectifier
4. Plot the wave shape of full wave rectifier with
   (a) Shunt capacitor filter
   (b) Series inductor Filter
   (c) II Filter
5. Plot input and output characteristic and calculate parameters of transistors in CE & CB configuration.

6. Plot V-I characteristic of FET amplifier.
7. Measure the Q-point and note the variation of Q-point
   (a) By increasing the base resistance in fixed bias circuit
   (b) By changing out of bias resistance in potentials divider circuit
8. Measure the voltage gain input output impedance in single state CE amplifier circuit.
9. Study of Opamps as
   (a) ADDER
   (b) SUBTRACTOR
   (c) INTEGRATOR
   (d) DIFFENTIATOR

## REFERENCE BOOKS


1. Basic Electronics and Linear circuit-N.N. Bhargava and Kulshreshta.
2. Integrated circuits and semiconductor devices by Deboo Burrous
3. Electronics devices- Flayd
4. Applied Electronics- R.S. Sedha

# ELECTRICAL ENGINEERING

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## Rationale

This course will enable the students to understand the basic concepts and principles of d.c and a.c fundamentals, a.c. circuits, batteries, electromagnetic induction e.t.c including constants voltage and current sources. A diploma holder may be involved in various jobs ranging from preventive maintenance of electrical installation to local faults location e.t.c. In addition he may be working in testing laboratories where he uses measuring instruments. To carry out these similar jobs effectively knowledge of basic concepts, principles and their application is very essential

## Detailed contents

### 1. DC Circuits

1.1 Nature of electricity, basic terms – Current, Voltage potential difference, Power, Energy & Heating Effect of electrics Current.
1.2 Ohm's Law, Concept of resistance, Resistivity and Conductance.
1.3 Effect of temperature on resistance, Resistance in series and parallel.
1.4 Kirchoff's Current Law and Voltage Law and their application in Simple DC Circuit, Conversion from Star to Delta and Delta to Star.

### 2. Network theorems

Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem & Maximum power transfer theorem.

### 3. Electrostatics

3.1 Static electricity – absolute & relative permittivity of medium, Laws of electrostatics.
3.2 Concept of electric field, electric flux, electric field intensity, electric flux density, Gauss's theorem (definition only), Coulomb's Law.
3.3 Potential, Potential at a point, potential of a charged sphere, equipotential surface, potential and electric intensity inside a conducting sphere, concept of Breakdown voltage and Dielectric strength.
3.4 Capacitor, capacitance, cylindrical and spherical capacitor, energy stored in a capacitor, parallel plate capacitor, series & parallel combination of capacitor.

### 4. Magnetism and Electromagnetism

4.1 Absolute and relative permeability, Coulomb's Law. Magnetic Field Strength, Magnetic Flux and Flux density, Intensity of Magnetization.
4.2 Analogy between Electric and Magnetic Circuit.
4.3 Magnetic field around a current carrying conductor and circular loop, Force between two parallel current carrying conductor.
4.4 Faraday's Law, Lenz's Law, Self & Mutually induced EMF.
4.5 Energy stored in a Magnetic Circuit.

## 5. AC Theory

Concept of alternating voltage and current. Difference between AC and DC, Concept of Cycle, Frequency, Time period, Amplitude, Instantaneous value, Average Value, rms value, Form Factor (Definition only).

## 6. Measuring Instrument

6.1 Working Principles & Construction of Moving Coil and Moving Iron Instrument. Extension of their range.
6.2 Principle & Working of Wattmeter (Dynamometer type)
6.3 Energy Meter (Induction type)

## 7. Transformer & UPS

a. Principle, operation and constructional features of single phase transformer – core-type, shell type.
b. Isolation transformer.
c. Brief study of various types of power problems use of UPS and CVT their working.

## LIST OF PRACTICAL

1. Verification of Kirchoff's Current Law and Voltage Law in a DC Circuit.
2. Prove the series combination of Resistance Req= R1----------a
3. Prove the parallel combination of Resistance 1/Req+----------
4. Verification of Theremin's Theorem, superposition theorem and Maximum power transfer theorem.
5. Determine the Iron and Copper losses by performing open and short circuit test on single phase transformer.
6. Conversion of Galvanometer into Ammeter and Voltmeter.
7. Measurement of single phase power in a.c. circuit using wattmeter.
8. Measurement of energy of a given load by single phase KWH meter.

## Reference Books


1. Electrical Technology - B.L. Theraja
2. Electrical technology -J.B.. Gupta
3. Basic Electrical & Electronics Engg. -S.K. Sahdev
4. Principle of Electrical Engg. - V.K. Mehta

# PROGRAMMING IN 'C'

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**Rationale**

In order to enable the student's use of computer effectively in problem solving, this course offers the model programming language along with exposure to various application of computer. The knowledge of C language will be reinforced by the practical exercises.

**Detailed contents**

1. **Introduction of 'C' Language**- Structure of a 'C' Program, some simple c programs, procedure to execute a 'C' program Data type, constants and variables C character sets, Identifiers and keywords, Date type constants, variables, expression, statement, symbolic constants.
2. **Operators and expressions**
   Arithmetic operators, Relational and logical operators, Unary Operators, Assignment operators. Conditional operators.
3. **Data Input and output**
   Library functions, unformatted input output-getchar, putchar, gets, puts, getch, and getche. Formatted input output-scanf, print F
4. **Control statements and loop structure**
   Branching: The if-else statement, looping: While, do-while, for. Nested co structure, switch statement, break, continue, exit. Comma operator, jumping: go to statement.
5. **Function**
   Introduction to function, need of functions, function definition, function declaration and prototype, passing arguments of function, passing arguments by value, recursion.
6. **Arrays**
   Introduction to arrays, array declaration, single and multidimensional arrays Examples: Array order reversal, removal of duplicates from an ordered array, binary search, matrix multiplication.
7. **Strings**
   Introduction to strings, string constants, variables, input/output of string date, standard library string function-strlen(), strcat(),strcpy(),strcmp().
8. **Pointers**
   Introduction to pointers, address operator and indirection operator, declaring and initialize pointers, pointers in parameter passing, call by reference, pointers and one dimensional arrays, operation on pointers and one dimensional arrays, operations on pointers, dynamic memory location-maballaoc, calloc.
9. **Structures and unions**
   Introduction to structures, declaration of structure, accessing structure members initialization Arrays of structure, user defined data type (typedef), Introduction to unions.

## 10. Files

Introduction to file handling-fopen, fclose, fscanf, fprinft, getc, putc
Additional feature of C:
Enumerations, macro, c pre-processor

## LIST OF PRACTICALS

1. Programming exercises on executing and editing c programs
2. Programming exercises on defining variables and assigning values to variables
3. Programming exercises on arithmetical, relational operators
4. Programming exercises on arithmetic expression and their evaluation.
5. Programming exercises on formatting input/output using printf and scanf.
6. Programming exercises using if-statement.
7. Programming exercises using if-else statement.
8. Programming exercises on switch statement.
9. Programming exercises on do-while statement.
10. Programming exercises on for statement.
11. Programs on 1 dimensional array.
12. Programs on 2 dimensional arrays.
13. Programs on strings
    (a) Programs for putting two strings together.
    (b) Programs for comparing two strings.

14 Simple programs using pointes.
15 Simple programs using structures.
16 Simple programs using files.

## Reference books


9. Programming with C- Byron c. Gottfried
10. Let us C – Yashwant Kanetkar
11. Sprit of C – Moolish Cooper
12. Teach yourself C- Herbert Schildt
13. Programming in C – Stephen G. Kochan
14. C Programming language – Kerning & Ritchie
15. Ansi C -Balaguruswamy