Math-233 **APPLIED MATHEMATICS - II**

Total Contact Hours

		T	P	C
Theory	96			
Practical	0	3	0	3

Pre-requisite: Must have completed Mathematics-I.

AIMSAt the end of the course, the students will be able to:

Solve problems of Calculus, Laplace Transformation and Fourier Series, and develop mathematical skills and logical perceptions in the use of mathematical instruments.

COURSE CONTENTS

1. FUNCTIONS & LIMITS. **6 hours**

- 1.1 Constant & Variable Quantities
- 1.2 Functions & their classification
- 1.3 The concept of Limit
- 1.4 Limit of a Function
- 1.5 Fundamental Theorems on Limit
- 1.6 Some important Limits
- 1.7 Problems

2. DIFFERENTIATION **6 hours**

- 2.1 Increments
- 2.2 Differential Coefficient or Derivative
- 2.3 Differentiation ab-initio or by first Principle
- 2.4 Geometrical Interpretation of Differential Coefficient
- 2.5 Differential Coefficient of X^n and $(ax + b)^n$
- 2.6 Three important rules
- 2.7 Problems

3. DIFFERENTIATION OF ALGEBRAIC FUNCTIONS **9 hours**

- 3.1 Explicit Functions
- 3.2 Implicit Functions
- 3.3 Parametric forms
- 3.4 Problems

4. DIFFERENTIATION OF TRIGONOMETRIC FUNCTIONS **6 hours**

- 4.1Differential Coefficient of Sin x, Cos x, Tan x from first principle.
- 4.2 Differential Coefficient of Cosec x, Sec x, Cot x

4.3Differential Coefficient of Inverse trigonometric functions.
4.4 Problems.

5. DIFFERENTIATION OF LOGARITHMIC & EXPONENTIAL FUNCTIONS 6 hours

5.1 Differentiation of ln x
5.2 Differentiation of Log a^x
5.3 Differentiation of a^x
5.4 Differentiation of e^x
5.5 Problems

6. RATE OF CHANGE OF VARIABLES 6 hours

6.1 Increasing and decreasing functions
6.2 Maxima and Minima
6.3 Criteria for maximum & minimum values
6.4 Methods of finding maximum & minimum
6.5 Rate measure
6.6 Slope of a line
6.7 Velocity and acceleration
6.8 Problems

7. INTEGRATION(SIMPLE BASIC RULES) 9 hours

7.1 Concept
7.2 Fundamental Formulas
7.3 Important Rules
7.4 Problems

8. METHODS OF INTEGRATION 9 hours

8.1 Integration by substitution
8.2 Integration by parts
8.3 Problems

9. DEFINITE INTEGRALS 6 hours

9.1 Properties
9.2 Application to area
9.3 Problems

10. DIFFERENTIAL EQUATIONS 6 hours

10.1 Introduction
10.2 Order and Degree
10.3 First order Differential Equation of Ist degree.
10.4 Solution of problems
10.5 Problems

11. LAPLACE TRANSFORMATIONS 9 hours

11.1 Laplace Transformations
11.2 Inverse Laplace Transformations
11.3 Problems.

12. FOURIER SERIES. 9 hours

12.1 Introduction
12.2 Periodic Functions
12.3 Even and Odd Functions
12.4 Problems

13.STATISTICS 9 hours

13.1Concept of mean, median and mode
13.2Standard Deviation
13.3Laws of probability
13.4Problems

RECOMMENDED BOOKS

1. Thomas Finny, Calculus and Analytic Geometry
2. Ghulam Yasin Minhas, Technical Mathematics Vol - I & II, Ilmi Kitab Khana, Lahore.
3.Riaz Ali Khan, Polytechnic Mathematic Series Vol I & II, Majeed Sons, Faisalabad
4. Sana Ullah Bhatti, Calculus and Analytic Geometry, Punjab Text Book Board, Lahore.

Math-233 APPLIED MATHEMATICS-II

INSTRUCTIONAL OBJECTIVES

1.USE THE CONCEPT OF FUNCTIONS AND THEIR LIMITS IN SOLVING SIMPLE PROBLEMS.

1.1 Define a function.
1.2 List all types of functions.
1.3 Explain the concept of limit and limit of a function.
1.4 Explain fundamental theorems on limits.
1.5 Derive some important limits.
1.6 Solve simple problems on limits.

2. UNDERSTAND THE CONCEPT OF DIFFERENTIAL COEFFICIENT.

2.1 Define differential coefficient.
2.2 Derive mathematical expression of a derivative.
2.3 Explain geometrically the meaning of differential coefficient.
2.4 Differentiate ab-initio x^n and $(ax+b)^n$.
2.5 Solve problems of these formulas.

3.USE RULES OF DIFFERENTIATION FOR SOLVING PROBLEMS OF ALGEBRAIC FUNCTIONS.

3.1 Derive product rule, quotient rule and chain rule.
3.2 Interpret the chain rule.
3.3 Differentiate explicit and implicit functions.
3.4 Find derivatives of parametric forms of a function w.r.t another function, by rationalization.
3.5 Use these important rules to find derivatives of relevant functions.

4.USE RULES OF DIFFERENTIATION TO SOLVE TRIGONOMETRIC FUNCTIONS.

4.1 Differentiate from first principle sin x, Cos x, tan x.
4.2 Derive formulas for derivatives of Sec x, Cosec x, Cot x.
4.3 Find derivatives of inverse trigonometric functions.
4.4 Solve problems based on these formulas.

5.USE RULES OF DIFFERENTIATION TO LOGARITHMIC AND EXPONENTIAL FUNCTIONS.

5.1 Derive formulas for differential coefficients of logarithmic and exponential functions.
5.2 Solve problems using these formulae.

6.UNDERSTAND RATE OF CHANGE OF ONE VARIABLE WITH ANOTHER

6.1 Derive formulas for velocity, acceleration and slope of a line
6.2 Use derivative as a measure of rate of change.
6.3 Explain an increasing and a decreasing function.
6.4Show graphically maxima and minima values and point of inflection.
6.5 Explain criteria for finding maxima and minima.
6.6 Solve problems based upon these topics.

7.USE PRINCIPLES OF INTEGRATION IN SOLVING RELEVANT PROBLEMS.

7.1 Explain concept of integration.
7.2 Write basic theorems of integration.
7.3 Define fundamental formulas of integration.
7.4 List some important rules of integration.
7.5 Solve problems based on these rules.

8. UNDERSTAND VARIOUS METHODS OF INTEGRATION

8.1 List standard formulas of integration.
8.2 Integrate a function by substitution method.
8.3Use method of integration by parts for finding integrals.
8.4 Employ these methods to solve problems.

9. UNDERSTAND THE METHODS OF SOLVING DEFINITE INTEGRALS.

9.1 Define definite integral.
9.2 List properties of definite integrals.
9.3 Use definite integral in the computation of areas.
9.4Solve problems involving definite integrals.

10.USE DIFFERENT METHODS OF INTEGRATION TO SOLVE DIFFERENTIAL EQUATIONS.

10.1 Define a differential equation, its degree and order.
10.2Explain method of separation of variables for solving differential equations of first order and first degree.
10.3Solve differential equations of first order and first degree.

11.USE LAPLACE AND INVERSE LAPLACE TRANSFORMATION FOR SOLVING PROBLEMS.

11.1Define Laplace and Inverse Laplace Transformation
11.2List properties of Laplace Transformation
11.3Solve problems using Laplace Transformations

12. EXPAND FUNCTIONS USING FOURIER SERIES

12.1 Define a Fourier series.
12.2 Write extended rule of integration by parts.

12.3 Illustrate periodic functions, even and odd functions.
12.4 Explain Fourier expansion and Fourier constants.
12.5 Expand the given functions of Fourier series.

13.UNDERSTAND THE BASIC CONCEPTS OF STATISTICS

13.1Define mean, median and mode
13.2Explain standard deviation
13.3State laws of probability
13.4Calculate the above mentioned quantities using the proper formula

Comp-214COMPUTER ORGANIZATION AND PROGRAMMING.

T	P	C
2	6	4

Total Contact Hours:

Theory 64 Hours
Practical 192 Hours

AIMS:

COURSE CONTENTS

1. **FUNDAMENTALS OF COMPUTER.**
   - 1.1 Generation.
   - 1.2 Computer types.
     - 1.2.1 Analog.
     - 1.2.2 Digital.
   - 1.3 Computer Application.
     - 1.3.1 Main Frame.
     - 1.3.2 Mini computer.
     - 1.3.3 Micro computer.

2. **CENTRAL PROCESSING UNIT.**
   - 2.1 Arithmetic logic unit.(ALU).
   - 2.2 Control unit.
   - 2.3 Memory.
   - 2.4 System bus,address, data bus and control.

3. **INPUT/OUTPUT DEVICES.**
   - 3.1 I/O devices.
     - 3.1.1 Keyboard.
     - 3.1.2 Mouse.
     - 3.1.3 Scanner.
     - 3.1.4 Monitor.
     - 3.1.5 Printer.
     - 3.1.6 Plotter.

4. **STORAGE DEVICES.**
   - 4.1 Floppy Disks.
   - 4.2 Hard disk.
   - 4.3 CD ROM
   - 4.4 Magnetic tape.

5. **DATA STRUCTURE.**

5.1 Data structure.
5.2 Types of Data structure.
5.3 Sorting & searching.
5.4 Stacks.
5.5 List-Algorithms for detection & inspection.
5.6 Tree.
5.7 Linked storage.
5.8 Sequential representation.

6. INTRODUCTION OF BASIC.

6.1 History of BASIC.
6.2 Structure of BASIC program
6.3 Compiler & interpreter.
6.4 Flow charting.
6.5 Constants.
  6.5.1 Numeric constants.
  6.5.2 String constants
6.6 Variable.
  6.6.1 Numeric variable.
  6.6.2 String variable.
6.7 Operates & formulas.
  6.7.1 Arithmetic operators.
  6.7.2 Relational operators.
  6.7.3 Logical operators.
6.8 Hierarchy of operation.
6.9 Entering BASIC programming
  6.9.1 Immediate mode/direct mode.
  6.9.2 Indirect mode/Program mode.
6.10 Line number.

7. COMMANDS AND STATEMENTS.

7.1 Using BASIC commands.
SAVE, LOAD, NEW, LIST, DELETE, EDIT, CLS, RENUM, AUTO, KILL, SYSTEM, RUN, NAME, SHELL, FILES, LUST etc.
7.2 Statement.
LET, PRINT, END, STOP, REM, INPUT, READ, DATA, RESTORE, LOCATE etc.
7.3 Program debugging or error function.
  7.3.1 Syntax error.
  7.3.2 Logical error.

8. BRANCHING & LOOPING.

8.1 Branching.
8.2 Un-conditional branching.

8.2.1 GOTO statement.

8.3 Conditional branching.

8.3.1 IF.....THEN

8.3.2 IF.....THEN.....ELSE.

8.4 Multiple Branching.

8.4.1 ON.....GOTO statement.

8.5 Looping statement.

8.5.1 WHILE.....WEND statement.

8.5.2 FOR.....NEXT statement.

8.6 Nested loops.

9. FUNCTIONS & SUBROUTINES.

9.1 Functions.

9.1.1 Numeric functions.

ABS, EXP, FIX, HEX, INT, LOG, OCT, RND, SGN, SQC.

9.1.2 Trigonometric functions.

COS, SIN, TAN and ATAN.

9.1.3 String functions.

ASC, CHR$, INSTR, LEN, LEFT$, MID$, RIGHT$, STR$, SPACE$, SPC, STRING$, VAL.

9.1.4 Screen functions.

POS, LPOS, CSRLIN, SCREEN, DATE/TIME functions and statement, TIMER functions, DEF FN statement.

9.2 Subroutines.

The GOSUB.....RETURN statement.

10. ARRAYS.

10.1 Introduction.

10.2 Subscript variable.

10.3 BM statement.

10.4 Memory requirement

10.5 Clear/Erase.

10.6 One Dimentional Array (list)

10.7 Two dimentional array (Table)

10.8 Searching

11.8.1 Serial search.

11.8.2 Binary search.

10.9 Sorting.

11.9.1 Bubble sort.

11.9.2 SWAP.

10.10 Matrix operation.

11. DATA FILES.

11.1 Sequential files.
11.2 Random files.

12. GRAPHICS.

12.1 Graph types.
12.1.1 Block or text based.
12.2.2 Dot or pixel based.
12.2 Screen
12.3 Color/platte.
12.4 Displaying a point.
12.5 Drawing lines, box, circles, ellipse and arc.
12.6 Filling a shape with colors.
12.6.1 Color fill.
12.6.2 Pattern fill
12.7 Animations.

DATABASE.

13. INTRODUCTION TO DATABASE.

13.1 What is a database.
13.2 Introduction to various databases.
13.3 Introduction to dBASE iv.

14. TYPES OF FILES.

14.1 Structure of Database file.
14.2 Data types, width, field, record.

15. COMMANDS IN DATABASE.

15.1 Creating a DBF file.
15.2 Adding records.
Browse, append, insert, list, edit, replace, update, deleting records, recall, pack, zap, locate, continue, GOTO, skip

16. WORKING WITH FILES.

16.1Use, close, rename, delete file, copy, copy file, index, find, seek, query.
16.2 Reporting.

17. SET COMMANDS.

17.1 Dohistory, status, help, heading.

MS-WINDOWS.

1. INTRODUCTION OF MS-WINDOWS.

1.1 Hardware requirement.
1.2 Running setup.
1.3 Network setup.
1.4 setting-up windows.
1.5 Setup facts
1.6 Changes in Autoexec.Bat and config.sys.

2. WINDOWS BASICS.

2.1 Windows modes.
2.2 types of windows.
2.3 Types of Icons.
2.4 Mouse and Keyboard techniques.
2.5 Moving.
2.6 Changing and closing windows.
2.7 Using Help.

3. PROGRAM MANAGER.

3.1 What is it?
3.2 Opening rearranging.
3.3 Creating and deleting groups.
3.4 Opening.
3.5 Rearranging.
3.6 Creating and deleting items.
3.7 Starting and setup of application.
3.8 Quit program.

4. APPLICATION BASICS.

4.1 Working with applications.
4.2 Starting applications.
4.3 Switching between application.
4.4 Working with documents.
4.5 Opening and saving files.

5. CONTROL PANEL.

5.1 What is control panel.
5.2 Installation of devices; Printers.
5.3 Mouse ports.
5.4 Desktop.
5.5 Fonts
5.6 Date & Time of system.
5.7 Keyboard.
5.8 Installing driver not supplied with windows.
5.9 Specify Driver setting.

5.10 Removing Driver.

6. PRINT MANAGER.

6.1 Installation of Printer.
6.2 Select print port.
6.3 Setting Printing option.
6.4 Delete and Resume print jobs.
6.5 Print documents.
6.6 Print speed.
6.7 Managing Network Printing.

7. WINDOWS AND NETWORKS.

7.1 Windows and networks
7.2 Guidelines for using windows.
7.3 Setting working for network.

Comp-214 COMPUTER ORGANIZATION & BASIC PROGRAMMING.

INSTRUCTIONAL OBJECTIVES.

1. COMPUTER FUNDAMENTS.

1.1 Describe the computer with the help of its block diagram.
1.2 Describe computer generation.
1.3 Differentiate between Analog, Digital and Hybrid computer.
1.4 Enlist computer classification.
1.5Differentiate between mainframe, mini and micro computers.

2. CENTRAL PROCESSING UNIT.

2.1 Enlist the constituents of C.P.U.
  2.1.1 Describe of ALU.
  2.1.2 Describe the control unit.
  2.1.3 Describe the memory unit.
2.2 Define system bus.
2.3 Define the Address, Data and control bus.

3. INPUT/OUTPUT DEVICES.

3.1 Define input devices (Keyboard, Mouse and Scanner)
3.2 Define output devices (Monitor, printer and plotter).

4. STORAGE DEVICES.

4.1 Define magnetic and optical storage.
4.2 Describe the floppy diskettes.
4.3 Describe the HD.
4.4 Describe the magnetic tape.
4.5 Define CD-ROM.

5. DATA STRUCTURE.

5.1 Enlist types of data structure.
5.2 Describe sorting and searching.
5.3 Describe the stacks.
5.4 Define list-Algorithms for deletion and insertion.
5.5 Explain the tree.
5.6 Explain the link storage.
5.7 Describe the sequential representation.

6. INTRODUCTION TO BASIC PROGRAMMING.

6.1 Describe the history of BASIC.
6.2 Explain structure of BASIC program
6.3 Differentiate Compiler & interpreter.

6.4 Identify Flow-charting.
6.5 Explain Constants.
6.5.1 Numeric constants.
6.5.2 String constants
6.6 Explain Variable.
6.6.1 Explain the Numeric variable.
6.6.2 Explain String variable.
6.7 Explain the Operates & formulas.
6.7.1 Enlist Arithmetic operators.
6.7.2 Describe the Relational operators.
6.7.3 Describe Logical operators.
6.7.4 Explain the Hierarchy of operation.
6.8 Writing BASIC programming
6.8.1Differentiated between direct mode & Indirect mode.
6.8.2 Describe Line number.

7. COMMANDS AND STATEMENTS.

7.1 Explain the BASIC commands.
SAVE, LOAD, NEW, LIST, DELETE, EDIT, CLS, RENUM, AUTO, KILL, SYSTEM, RUN, NAME, SHELL, FILES, LLIST etc.
7.2 Explain the following Statement.
LET, PRINT, END, STOP, REM, INPUT, READ, DATA, RESTORE, LOCATE etc.
7.3 Describe the Program debugging.
7.3.1 Describe the Syntax error.
7.3.2 Describe the Logical error.

8. BRANCHING & LOOPING.

8.1 Explain the Branching.
8.1.1Explain Un-conditional branching (GOTO statement).
8.1.2 Explain Conditional branching.
8.1.2.1 IF.....THEN
8.1.2.3 IF.....THEN.....ELSE.
8.1.3 Explain Multiple Branching.
8.1.3.1 ON.....GOTO statement.
8.1.4 Explain the Looping statement.
8.1.4.1 Explain WHILE.....WEND statement.
8.1.4.2 Explain FOR.....NEXT statement.
8.1.4.3 Explain Nested loops.

9. FUNCTIONS & SUBROUTINES.

9.1 Explain the Functions.
9.1.1 Explain the Numeric functions.
ABS, EXP, FIX, HEX, INT, LOG, OCT, RND, SGN, SQC.

9.1.2 Explain the Trigonometric functions.
COS, SIN, TAN and ATAN.
9.1.3 Explain String functions.
ASC, CHR$, INSTR, LEN, LEFT$, MID$, RIGHT$, STR$, SPACE$, SPC, STRING$, VAL.
9.1.4 Explain Screen functions.
POS, LPOS, CSRLIN, SCREEN, DATE/TIME functions and statement, TIMER functions,

9.2 Describe the DEF FN statement.
9.3 Explain Subroutines.
9.3.1 Explain The GOSUB.....RETURN statement.

10. ARRAYS.

10.1 Define the arrays.
10.2 Describe subscript variable.
10.3 Explain the DIM statement.
10.4 Describe the memory requirement
10.5 Define clear/Erase.
10.6 Explain the one Dimentional Array.
10.7 Explain two dimentional array
10.8 Differentiate between serial search & Binary search.
10.9 Explain the Sorting.
Bubble sort.
SWAP.
10.10 Explain the Matrix operation.

11. DATA FILES.

11.1 Explain the Sequential files.
11.2 Explain the Random files.

12. GRAPHICS.

12.1 Enlist Graph types.
12.1.1 Describe Block or text based.
12.2.2 Describe Dot or pixel based.
12.2 Explain Screen Color/platte.
12.3 Identify the displaying a point.
12.4 Draw a lines, box, circles, ellipse and arc.
12.6 Fill a shape with colors.
12.7 Describe Animations.

DATABASE.

13. INTRODUCTION TO DATABASE.

13.1 Define database.
13.2 Describe various databases.

14. TYPES OF FILES.

14.1 Enlist file types.
14.2 Describe structure of Database file.
14.3 Define field record and file.
14.4 Explain Data types;
Numeric, Character, Date, Logical, Memo.

15. COMMANDS IN DATABASE.

15.1 Explain the Dbase commands.
Browse, append, insert, list, edit, replace, update, deleting records, recall, pack, zap, locate, continue, GOTO, skip

16. WORKING WITH FILES.

16.1 Explain the file commands ;
Use, close, rename, delete file, copy, copy file, index, find, seek, query.
16.2 Create and display records.

Comp-223 ELECTRONIC DEVICES AND CIRCUITS-II

T	P	C
2	3	3

Total Contact Hours:

Theory 64 Hours
Practical 96 Hours

Pre-requisite:

1. Electronic devices and circuits-I
2. Electrical essentials of Electronics

AIMS To give an understanding of Electronic devices and components as used in linear and non linear, Digital and Analog Integrates circuits.

1. Identify the functions of amplifiers
2. Explain the operational amplifiers and their applications.
3. Identify Oscillators
4. Describe the filter concepts
5. Identify nonlinear Analog systems.
6. Identify various non linear Ic's; Sequentional and Combinational systems.

COURSE CONTENTS.

1. AMPLIFIERS. 4 WEEKS

1.1 Classification of amplifiers according to operations.
1.2 Classification of amplifiers according to feedback.
1.3 Positive and negative feedback
1.4 Gain with and without feedback

2. OSCILLATORS AND STABILITY. 3 WEEKS

2.1 Basic requirement of an oscillator
2.2 Stability conditions of an Oscillator.
2.3 Illustration of various Oscillators such as Hartley and Colpitis, Phase shift, Weinbridge and crystal Oscillators

3. OPERATIONAL AMPLIFIERS. 5 WEEKS

3.1 Linear, Analog Integrated circuits.
3.2 Ideal Apamp, characteristics and gain.
3.3 Inverting and non inverting apamp.
3.4 Characteristics and gain of a differential amplifier.
3.5 Opamp as a summer
3.6 Opamp as a voltage and current converter
3.7 Opamp as a current to voltage converter
3.8 Opamp as an Integrator

3.9 Opamp as a differentiator

4. FILTERS. 2 WEEKS.

4.1 Classification of filter

4.2Illustration of single order low pass and high pass filter.

5. NONLINEAR ANALOG SYSTEMS. 2 Weeks

5.1 Differential Amplifier as a comparator

5.2 Illustration of a sample and hold circuit

5.3 Functioning of a sample Hold circuit

6. D/A AND A/D SYSTEMS. 4 WEEKS

6.1Illustration of a D/A converter with binary weighted Resistors.

6.2 Ladder type D/A converter.

6.3 A/D convertor

7. NONLINEAR IC's; COMBINATIONAL DIGITAL SYSTEM.

7.1 Standard digital Ic gates.

7.2 TTL Nand gate

7.3 DTL NOR gate

7.4 ROM and its functioning.

7.5 ROM as used in 7 segment displays.

8. NONLINEAR IC's; SEQUENTIAL DIGITAL SYSTEMS

8.1 Sequential systems

8.2 Flip Flop as a 1 bit storage cell

8.3 Flip flop as a latch

8.4 Clocked Rs flip flop

8.5 Multiviberator

8.6 Monostable (one shot) Multiviberator.

8.7 Illustration of schmitt trigger.

8.8 Bistable behaviour of schmitt trigger.

Comp-223 ELECTRONIC DEVICES AND CIRCUITS-II

INSTRUCTIONAL OBJECTIVES.

1. UNDERSTAND THE CLASSIFICATION AND APPLICATION OF AMPLIFIERS.
   - 1.1 Define Amplifier.
   - 1.2 Classify the amplifiers according to the operation of transistor/FET as class A, B, AB, C.
   - 1.3 Enlist the application of amplifiers.
   - 1.4 Classify the amplifiers as voltage, current transconductance, transresistance.
   - 1.5 Draw each of the type specified in 1.4
   - 1.6 Develop formulas for Av, Ai, Gm, Rm.
   - 1.7 Define the feedback concept.
   - 1.8 Define close loop and open loop.
   - 1.9 Draw the block diagram of any single loop feedback connection around a basic amplifier.
   - 1.10 Explain the functioning of each block in 1.9
   - 1.11 Define negative and positive feedback
   - 1.12 List advantages of negative feedback
   - 1.13 Determine the gain with feedback for 1.9

2. UNDERSTAND THE REQUIREMENTS AND STABILITY CONDITIONS FOR OSCILLATIONS.
   - 2.1 Define the term Oscillators.
   - 2.2 Draw the block diagram.
   - 2.3 Determine the loop gain for 2.2
   - 2.4 Define the condition for Oscillators.
   - 2.5 Illustrate a phase shift Oscillator.
   - 2.6 Illustrate a Weinbridge Oscillator
   - 2.7 Illustrate a colpitis and Hartley Oscillator.
   - 2.8 Illustrate a crystal Oscillator.
   - 2.9 Enlist application of Oscillators.

3. UNDERSTAND THE OPERATIONAL AMPLIFIER AS A BASIC LINEAR (ANALOG) INTEGRATED CIRCUIT.
   - 3.1 Define the term linear, Integrated circuit.
   - 3.2 Sketch the schematic diagram for an apamp.
   - 3.3 List the characteristics of an ideal apamp.
   - 3.4 Define the terms; bias current, offset voltage, virtual ground.
   - 3.5 Illustrate and ideal inverting opamp.
   - 3.6 Determine gain for 3.5
   - 3.7 Illustrate an ideal non inverting apamp.
   - 3.8 Determine the gain for 3.7
   - 3.9 List the applications/usage of a differential amplifier.
   - 3.10 Sketch the schematic diagram for a differential amplifier.

3.11 Determine the gain for 3.10
3.12 List the applications of operational and differential amplifiers in linear system.
3.13 Illustrate the use of apamp as a summer.
3.14 Illustrate the use of apamp as a voltage to current convertor.
3.15 Illustrate the use of apamp as a current to voltage convertor.
3.16 List the applications of 3.14, 3.15.
3.17 Sketch the diagram of apamp as a Integrator
3.18 Determine gain for 3.17
3.19 Sketch the diagram of apamp as a differentiator
3.20 Determine the gain for 3.19
3.21 List the applications of differentiator and integrator.

4.UNDERSTAND THE CLASSIFICATION OF FILTERS WITH REGARDS TO FREQUENCY RESPONSE.

4.1 Define the term filters.
4.2 List the types of filters (LP, HP, BP, BR)
4.3 Define the terms; stop band, pass band and transition bands.
4.4 Sketch and discuss the ideal characteristic for the types of filters.
4.5 Sketch the circuit diagram and characteristic curve of a first order low pass filter.
4.6 Repeat 3.5 single order HPF.

5. UNDERSTAND THE NONLINEAR FUNCTIONS OF APAMP.

5.1 Define a comparator.
5.2 Sketch the schematic diagram of a sample and hold circuit.
5.3 Draw the practical circuit diagram of sample and hold circuit.
5.4 Explain the functioning of sample and hold circuit.
5.5 Enlist the application of sample and hold circuit.

6. UNDERSTAND THE BASIC D/A AND A/D CONVERTORS

6.1 Define a D/A converter.
6.2 Sketch a circuit diagram for a D/A converter with binary weighted resistors.
6.3 Explain the functioning of 6.2
6.4 Draw the circuit diagram for a ladder type D/A converter.
6.5 Explain the functioning of 6.4
6.6 Explain the application of D/A converter.
6.7 Define A/D converter.
6.8 Sketch the circuit diagram of an A/D converter.
6.9 Explain 6.8
6.10 Enlist the application of an A/D converter.

7.UNDERSTAND THE COMBINATIONAL LOGIC GATES AND IC LOGIC FAMILIES.

7.1 List the standard digital IC gates.
7.2 Define the terms; Dual incline and flat pack.

7.3 List all the available logic IC's families.
7.4 Sketch the schematic circuit of a TTL NAND gate.
7.5 Draw the standard symbol for NAND gate and its truth table.
7.6 Explain 7.3.
7.7 Give the important characteristics of and DTL family
7.8 Draw the standard symbol for DTL NOR gate and truth table.
7.9 Explain 7.8
7.10 Define encoding and decoding.
7.11 Sketch the block diagram of a ROM
7.12 Explain the function of ROM as used for converting one code into another.
7.13 Draw the block diagram of ROM as a decoder followed by an encoder.
7.14 Explain the functioning of 7.13
7.15 List the application of ROM.
7.16 Explain the application of ROM in a segment display.
7.17 Define EPROM and PROM.
7.18 Differentiate the functioning of EPROM and PROM from ROM.

8.UNDERSTAND THE SEQUENTIAL GATES AND BEHAVIOUR OF FLIP-FLOP AS MULTIVIBERATOR.

8.1 Define a sequential system.
8.2 Differentiate between sequential and combinational systems.
8.3 Define system clock.
8.4 Define flip-flop as a 1 bit storage cell.
8.5 Define latch.
8.6 Sketch the diagram of a clocked RS flip-flop.
8.7 Explain 8.6
8.8 Define multiviberator.
8.9 Draw the block diagram of a monostable multiviberator.
8.10 Explain 8.9
8.11 Draw the circuit diagram of schmitt trigger.
8.12 Explain the working of 8.11
8.13 Explain the bistable behaviour of schmitt trigger.

Comp 232 MOTORS AND POWER SUPPLIES.

	T	P	C
Total Contact Hours:	1	3	2

Theory 32 Hours
Practical 96 Hours

Pre-requisite: Electrical Essentials of Electronics. (Comp-115)

AIM: Study of the subject will enable the students to gain an understanding of motors, power supplies and their applications in the field of computer.

COURSE CONTENTS.

1. **RECTIFIERS.**
   - 1.1 Half wave & full wave.
   - 1.2 Voltage doubler

2. **FILTERS.**
   - 2.1 L, C and ii, M Filters.
   - 2.2 Active filters.

3. **VOLTAGE REGULATORS**
   - 3.1 Zener diode regulator
   - 3.2 Series regulators
   - 3.3 BJT regulator.
   - 3.4 IP AMP voltage regulator.

4. **VOLTAGE STABILIZERS**
   - 4.1 Monolithic power supplies.
   - 4.2 Positive voltage regulators
   - 4.3 Negative voltage regulators.

5. **POWER SUPPLIES.**
   - 5.1 switching regulator / switching mode.
   - 5.2 Power supplies.
   - 5.3 Positive switching regulators.
   - 5.4 Driven regulators
   - 5.5 Power supplies for computer.
   - 5.6 Production of square wave.
   - 5.7 Uninterrupted power supplies.

6. MOTORS.

- 6.1 D.C Motors.
  - 6.1.1 Principles of construction
  - 6.1.2 Back e.m.f.
  - 6.1.3 Type of DC motors (Series, Shunt and compound)
  - 6.1.4 Characteristics of DC motors.
- 6.2 DC Motor starters.
  - 6.2.1 Need of motor starter.
  - 6.2.1 Starting methods.
- 6.3 Polyphase Induction motor.
  - 6.3.1 Rotating magnetic field theory.
  - 6.3.2 Principles, type and construction of Induction motor.
  - 6.3.3 Slip
  - 6.3.4 Direction of rotation and reversal of direction.
- 6.4 Single phase motors (Fractional H.P.)
  - 6.4.1 Working principle of various types of single phase motors.
- 6.5 Permanent magnet DC motor.
  - 6.5.1 Construction
  - 6.5.2 Advantages as compared to field wound DC motor.
  - 6.5.3 Types of PM DC motors.
- 6.6 Torque motors.
  - 6.6.1 Construction & applications.
- 6.7 Brushless DC motors
  - 6.7.1 Construction, operation, characteristics and application.
- 6.8 Stepper Motors.
  - 6.8.1 Principle of operation.
  - 6.8.2 Concept of digital motor.
  - 6.8.3 Types; variable reluctance, permanent magnet and Hybrid.
  - 6.8.4 Step Angle, stepping rate, step response, speed.
  - 6.8.5 Construction and operation of permanent magnet Disc type stepper Motor.
  - 6.8.6 Construction and operation of variable reluctance stepper motor.
- 6.9 Synchronous Motors (Fractional H.P)
  - 6.9.1 Types such as Reluctance, Hysteresis and permanent magnet.
  - 6.9.2 Construction and operation.
- 6.10 Servo Motors.
  - 6.10.1 Principles, construction and types.
  - 6.10.2 Transmitter & receiver servos.

RECOMMENDED BOOKS.

1. James T. Humpheries, MOTORS & CONTROLS, 1988.
2. B.L. Tharaja, ELECTRICAL TECHNOLOGY.

Comp-232 MOTORS AND POWER SUPPLIES.

INSTRUCTIONAL OBJECTIVES.

1. UNDERSTAND RECTIFICATION AND VARIOUS RECTIFIER CIRCUITS.

1.1 Define rectification.
1.2 Classify rectifiers such as half wave, full wave and bridge rectifiers.
1.3 Explain the working of a half wave rectifier.
1.4 Explain the working of a full wave rectifier circuit using centre tapped transformer and two diode.
1.5 Explain the working of a bridge rectifier.

2. UNDERSTAND FILTRATION AND VARIOUS FILTERS.

2.1 Define the process of filtration.
2.2 Classify various filters commonly used for filtration such as L, C, ii and M filter.
2.3 Explain the working of L filter.
2.4 Explain the working of C filter.
2.5 Explain the working of ii filter.
2.6 Explain the working of M filter.

3. UNDERSTAND VOLTAGE REGULATORS AND VARIOUS REGULATORS.

3.1 Define voltage regulators.
3.2 Explain a simple Zener diode regulator.
3.3 Explain the working of a series regulator.
3.4 Explain the working of a BJT regulator.
3.5 Explain the working of an OP AMP voltage regulator.

4. UNDERSTAND VOLTAGE STABILIZATION.

4.1 Define voltage stabilization.
4.2 Illustrate Monolithic power supplies.
4.3 Illustrate positive voltage regulators.
4.4 Illustrate negative voltage regulators.

5.UNDERSTAND THE WORKING OF VARIOUS POWER SUPPLIES USED IN COMPUTERS.

5.1 Illustrate switching regulators.
5.2 Illustrate driven regulators.
5.3 Illustrate switching mode power supplies.
5.4 Enlist power supplies used for computers.
5.5 Explain the production of square wave
5.6 Explain the working of an Uninterrupted Power Supply (UPS).

6. UNDERSTAND THE BASIC PRINCIPLE OF MOTORS USED IN COMPUTERS.

6.1 Understand DC motor.

- 6.1.1 Define principles on which the DC motor operate.
- 6.1.2 Define Back e.m.f.
- 6.1.3 Describe the construction of a DC motor.
- 6.1.4 Enlist various types of DC motors such as series, shunt and compound motors.
- 6.1.5 Describe the characteristics of a DC motor.

6.2 Understand DC motor starters

- 6.2.1 Give the need to use the DC motor starter.
- 6.2.2 Identify starting methods of DC motors using motor starter.

6.3 Understand Polyphase Induction motors

- 6.3.1 Describe the rotating magnetic field theory.
- 6.3.2 Explain the principle of working of an Induction motor.
- 6.3.3 Give the construction of an Induction motor.
- 6.3.4 Enlist the types of an Induction motor.
- 6.3.5 Define slip.
- 6.3.6 Explain the direction of rotation and reversal of direction.

6.4 Understand single phase motors (fractional H.P.)

- 6.4.1 Give the working principle of a single phase motor.
- 6.4.2 Describe the construction of various types of single phase motors.

6.5 Understand permanent magnet DC motors.

- 6.5.1 Give the characteristics of PM DC motors.
- 6.5.2 Define the characteristics of PM DC motors.
- 6.5.3 Enlist the types of PM DC motors.
- 6.5.4 Compare the advantages of PM DC motor and a field wound motor.

6.6 Understand torque motor.

- 6.6.1 Describe the construction of a torque motor.
- 6.6.2 Enlist the application of a torque motor.

6.7 Understand brushless DC motors.

- 6.7.1 Describe the construction of brushless DC motor.
- 6.7.2 Describe the operation of brushless DC motor.]
- 6.7.3 Enlist the characteristics of a brushless DC motor.
- 6.7.4 List the application of brushless DC motor.

6.8 Understand stepper motor.

- 6.8.1 Explain the principle of operation of stepper motor.
- 6.8.2 Explain the concept of a digital motor.
- 6.8.3 Describe the working of various stepper motor such as variable reluctance, permanent magnet and Hybrid.
- 6.8.4 Define the terms such as step angle, stepping rate, step response, speed.
- 6.8.5 Describe the construction of a permanent magnet disc type stepper motor.
- 6.8.6 Explain the operation of a PM disc type stepper motor.
- 6.8.7 Describe the construction of variable reluctance stepper motor.

6.9 Understand synchronous motors (Fractional HP).

6.9.1 Describe the construction of a synchronous motor.

6.9.2 Give the operation of a fractional HP synchronous motor.

6.9.3 Enlist the types of synchronous motor such as Reluctance, Hysteresis and PM.

6.10 Understand Servo motors.

6.10.1 Describe the construction of a servo motor.

6.10.2 Explain the working of a servo motor.

6.10.3 Enlist the types of servo motors.

6.10.4 Describe transmitter & receiver servos.

Comp 232 MOTORS AND POWER SUPPLIES

LIST OF PRACTICALS.

1. Constructing a half wave rectifier.
2. Constructing a full wave rectifier.
3. Constructing a voltage doubler and tripler.
4. Constructing a filtered power supply.
5. Constructing a Zener diode regulated power supply
6. Constructing a single transistor regulated power supply.
7. Constructing an OP AMP regulated power supply.
8. Studying the working of error amplifier.
9. Constructing a switching - mode power supply.
10. Constructing power supply for computer circuits with different voltage output.
11. Generating square waves and timing pulses.
12. Studying the working of uninterruptible power supplies.
13. Demonstrating Faraday's Law of Induction.
14. Studying of DC motor/Generator.
15. Study of various methods of starting DC motors.
16. Studying the rotating magnetic field as applied to Polyphase Induction Motors.
17. Studying the construction of Induction motors.
18 Studying the construction and working od single-phase Motors (I) split-phase, (ii) Shaded pole, (iii) Universal.
19 Studying the Forwarded/Reverse, running of a fan-motor.
20 Studying Repulsion Motor, Construction starting.
21 Studying the construction of a synchronous motor.Studying the construction, starting, speed control, forward/reverse running and effect of torque on live current, speed and other parameters, in case of following Integral Horsepower motors.
22 Permanent - Magnet, DC Moving coil type.
23 Permanent - Magnet D.C. torque type.
24. Brushless D.C. motors, with synchronized IC triggered Armature and permanent magnet field.
25 Synchronous Motors - Permanent Magnet type.
26 Synchronous Motors - Reluctance type.
27 Synchronous Motors - Hysteresis type.
28. Studying the construction of stepper motors
    i) Variable reluctance type.
    ii) Permanent magnet type.
29 Studying Forward Reverse Movement; effect of signal-frequency on direction of rotation and speed of stepper motor.
30 Interfacing of stepper motor with a Micro-computer or a digital system.
31. Simple software development in BASIC, for on interfaced - stepper Motor and its verification.

Comp-243 DIGITAL ELECTRONICS AND MICROPROCESSOR

T	P	C
2	3	3

Total Contact Hours:

Theory: 64 Hours
Practical: 96 Hours

Pre-requisite: Comp-123, Electronic devices and circuits.

AIM This course has been designed to enable students to be familiar with:

1. Basic logic gates, number system.
2. Digital integrated circuit and flip flop.
3. Common combination and sequential circuits.
4. Various memory system.
5. Basic microprocessor and its interfacing.

COURSE CONTENTS:

1. BASIC LOGIC CIRCUITS.

1.1 AND, OR, NOT gates, their truth tables and symbols.
1.2 NAND, NOR, truth tables and symbols.
1.3 Use of NAND and NOR as universal gates.
1.4 SOP POS circuits.

2. NUMBER SYSTEMS AND BINARY CODES.

2.1 Binary, decimal, octal, hexadecimal systems.
2.2 Interconversion of number system in objection 2.1
2.3 BCD, Alpha numeric 8421, X3, Gray into Binary and vice versa.
2.4 Inter conversion of above codes into Binary and vice versa.
2.5 Subtraction of binary numbers by 1's and 2's complements.
2.6 Parity codes.

3. DIGITAL I.C.S.

3.1 SSI, MSI, LSI, VLSI.
3.2 Common terms used with gates.
3.3 Logic families.
3.4 Comparison of ITL, ECL, COMS.

4. FLIP FLOP CIRCUITS.

4.1 Common types of flip flops.
4.2 Schematic, symbols, out put form of S-R, T,D, J-K flop flops.
4.3 Applications of flip flops.

5. COMBINATIONAL LOGIC CIRCUITS.

5.1 Half Adder.
5.2 Full adder.
5.3 Subtractor.
5.4 Decoder.
5.5 Encoder.
5.6 Multiplexer.
5.7 Demuliplexer.
5.8 Code Convertor.

6. REGISTERS AND COUNTERS.

6.1 Registers their types and logic diagram.
6.2 Counters, their types and logic diagram.
6.3 Counter as frequency divider.

7. MEMORY SYSTEMS.

7.1 Common terminology.
7.2 Ferrite core memory.
7.3 RAM and ROM.
7.4 Use of RAM and ROM in computer.

8. INTRODUCTION TO MICROPROCESSOR.

8.1 Block diagram of computer.
8.2 ALU and control unit in microprocessor.
8.3 Block diagram of microprocessor.
8.4 Buses in up.
8.5 General characteristics of 6800 MPU.

9. INTERFACING AND PROGRAMMING.

9.1 General purpose bus, PIA, UUART.
9.2 Common languages for programming.
9.3 Instruction set for MC 6800 MPU.
9.4 Addressing modes in MC 6800.

TEXT BOOK:

Comp-243 DIGITAL ELECTRONICS AND MICROPROCESSOR

INSTRUCTIONAL OBJECTIVES.

1. UNDERSTAND LOGIC GATES.

1.1 Identify the three basic logic circuits by drawing the logic symbol for each.
1.2 Draw the truth table for the AND, OR, and NOT circuits.
1.3 Identify the two inverting gates circuits by draw the logic symbol for each.
1.4 Draw the truth table for the NAND and NOR gates.
1.5 Describe how an AND, OR NOT circuit can be obtained Nor gate.
1.6 Describe now an AND, OR or NOT circuit can ne obtained from a NAND gate.
1.7 State the Boolean expressions for the output of the and or circuits.
1.8 State the Boolean expression for the output of a sum-of-products circuit.
1.9 State the Boolean expression for a product-of-sums circuit.

2. UNDERSTAND VARIOUS SYSTEMS AND BINARY CODES.

2.1 Differentiate between analog and binary voltages.
2.2 Identify the number base for the binary, decimal, octal and hexadecimal numbering systems.
2.3 Add and subtract binary numbers.
2.4 Covert decimal numbers to binary numbers and vice versa.
2.5 Convert from octal numbers to decimal numbers and vice versa.
2.6 Convert from hexadecimal numbers to decimal and vice versa.
2.7 Convert from octal numbers to binary and vice versa.
2.8 Convert from hexadecimal numbers to binary numbers and vice versa.
2.9 Define the terms byte.
2.10 Determine the maximum decimal number which can be expressed by a given binary number.
2.11 Compute the number of different binary numbers which can be expressed by a given binary word length.
2.12 Convert from binary coded decimal (BCD) numbers to decimal numbers and vice versa.
2.13 Identify five codes which are used in various digital systems.
2.14 Describe the purpose of an alphanumeric code.
2.15 Subtract one binary number from another using one's complement.
2.16 Subtract one binary number from another using two's complement.
2.17 Explain X3 and gray code.
2.18 Convert from binary numbers to X3 and gray code and vice versa.
2.19 Define parity.
2.20 Explain importance of parity and parity codes.

3. UNDERSTAND DIGITAL INTEGRATED CIRCUITS.

3.1 Describe what is meant by the functional capacity of an integrated circuit.

3.2 Identify the approximate maximum number of gates associated with SSI, MSI, LSI and VLSI integrated circuit devices.

3.3 Define the terms propagation delay, operating speed, power dissipation, noise immunity, and rise and decay times.

3.4 Discuss the relationship between gate operating speed gate power consumption.

3.5 Identify five digital integrated circuit logic families.

3.6 Identify three TTL sub families, list the nomenclature used to identify each and compare the operating speed and power consumption for each with respect to standard TTL.

3.7 Discuss the purpose of three state TTL devices.

3.8 Identify the basic gates formed by the internal circuit of the TTL, ECL and CMOS integrated circuits.

3.9 Identify the binary logic levels for TTL, ECL and CMOS logic.

3.10 Identify the power supply voltage requirements and operating speed for standard TTL, ECL and CMOS, digital integrated circuits.

3.11 Identify the four ranges associated with operating speed and the types of integrated circuit logic families associated with each.

4. UNDERSTAND VARIOUS TYPES OF FLIP FLOPS.

4.1 List the three of multivibrator circuits and identify the type associated with the flip-flop.

4.2 Draw the logic diagram of an S-R flip-flop.

4.3 Identify four types of flip-flops.

4.4 Discuss what is meant by he set and reset states of a flip-flop and explain how the state of a flip-flop can be determined.

4.5 Describe the operation of the S-R, T,D and J-K flip-flops by discussing the normal input conditions and the input conditions which must exist for the flip-flop to change states.

4.6 Draw the schematic symbols for the S-R, T,D and J-K flip-flops and identify all inputs and outputs.

4.7 Draw the output waveforms of the S-R, T,D and J-K flip-flop for specified input conditions.

4.8 Discuss an application for the S-R, T,D and J-K flip-flops.

5. UNDERSTAND VARIOUS COMBINATIONAL LOGIC CIRCUITS.

5.1 Draw the logic diagram and schematic symbol for the EXCLUSIVE-OR gate and identify its output for various input level conditions.

5.2 Draw the logic diagrams and schematic symbols for the half-adder (HA) and full-adder (FA) circuits and identify their output levels for various input binary level conditions.

5.3 Draw the diagram of a parallel adder and describe how this circuits is able to add two binary numbers together.

5.4 Draw the diagram of a one's complement subtractor and describe how this circuit is able to subtract one binary number from another.

5.5 Discuss the purpose of a decoder, identify the gate associated with the circuit, and design a decoder circuit capable of decoding a binary word.
5.6 Discuss the function of an encoder circuit.
5.7 Describe the purpose of a multiplexer circuit.
5.8 Explain the purpose of a demultiplexer circuit.
5.9 Discuss the purpose of a code convertor circuit.

6. UNDERSTAND THE REGISTER AND COUNTER CIRCUITS.

6.1 Describe three applications for shift registers.
6.2 Identify the four types of registers with respect to the method in which data is placed into and taken from the register.
6.3 Draw the logic diagrams of the serial-in serial-out and parallel-out shift registers.
6.4 Describe, with the aid of diagrams, how data is shifted into and out of a serial-in serial-out shift register.
6.5 Describe the difference between an MOS static and dynamic register.
6.6 Draw the logic diagrams of the ripple up-counter, down-counter, and up-down counter, synchronous counter, and BCD counter.
6.7 Describe how a counter can be used as a frequency divider.
6.8 Calculate the output frequency of both a binary and BCD counter.

7. UNDERSTAND MEMORY SYSTEMS.

7.1 Define the terms read, write, and access time as they relate to digital memory.
7.2 Differentiate between volatile and nonvolatile memory.
7.3 Discuss the need for memory address.
7.4 Identify the three functional categories of memory systems.
7.5 Identify the kinds of mediums used in each of the memory categories listed in objective 7.4
7.6 Describe how a ferrite core is able to store a bit of binary data.
7.7 Differentiate between RAM and ROM semiconductor memory.
7.8 Discuss the organizational schemes used for storing binary information in RAM and ROM.
7.9 Describe how a binary bit is written into a BJT RAM.
7.10 Differentiate between ROMs, PROMs and EPROMs and describe how each is programmed.
7.11 Describe how RAMs and ROMs are typically used in a computer.

8. UNDERSTAND BASICS OF MICROPROCESSOR.

8.1 Draw a functional block diagram of a computer.
8.2 Describe a microprocessor in terms of the block diagram of a compute.
8.3 Identify the three computer application categories, describe two examples for each category, and identify the category in which the microprocessor is best utilized.
8.4 Discuss the function of the arithmetic logic unit (ALU) and control unit in a microprocessor.

8.5Draw block diagram of microprocessor.

8.6Identify major circuits associated with the arithmetic and logic unit and discuss the purpose of each.

8.7List major circuits associated with the arithmetic and logic unit and discuss the purpose of each.

8.8Identify the three buses used in microprocessors.

8.9Discuss the purpose of using an address word length which is twice as long as an information word.

8.10Discuss the general characteristics of the Motorola 6800MPU by describing its physical characteristics, DC voltage requirements, typical power dissipated, minimum clock frequency, and word length.

9. UNDERSTAND INTERFACING CIRCUITS AND PROGRAMMING TECHNIQUES.

9.1Identify three problems associated with concerning peripherals to a microprocessor.

9.2Discuss the purpose of the general-purpose interface bus (GPB), the peripheral interface adapter (PIA) the universal synchronous receiver transmitter (UART), CMOS, buffers, Analog to Digital (A/D) and digital to Analog (D/A) converters and three state buffers.

9.3Identify four types of languages used to program computers and discuss the difference between machine and assembly language.

9.4Describe what is meant by an instruction set.

9.5 Define the terms mnemonic, opcode, and operand.

9.6Describe how instructions are classified and identify the class of instructions used by the MC 6800 MPU.

9.7Discuss what is meant by address modes and identify the six addressing modes used by the MC 6800.

Comp-243DIGITAL ELECTRONICS AND MICROPROCESSOR

LIST OF PRACTICALS

1. Interconverting numbers of various systems.
2. Verifying truth tables of AND, OR, NAND, NOR, NOT, Exclusive OR Exclusive NOR.
3. Constructing combinational logic circuit.
4. Verifying De Morgan's theorem.
5. Simplifying logic circuitry by using K-maps.
6. Studying loading of TTl gates.
7. Constructing a simplified logic circuit MOS-ICS.
8. Constructing a flip-flop using discrete components.
9. Constructing a flip-flop using NAND, NOR logic gates.
10. Constructing Half adder/subtractor circuit using logic gates (use XOR gates, NAND gates and verify truth table).
11. Constructing full adder and full subtractor circuits using XOR and NAND gates (verify its truth tables).
12. Verifying truth table for any one universal shift register IC (E.G.7495, 74194, 74198 or MOS equivalent).
13. Constructing a binary counter wiring register.
14. Constructing a up/down counter.
15. Constructing a sequential logic circuit.
16. Studying the working of encode and decoder.
17. Studying the working of Multiplexer.
18. Studying the working of demultiplexer.
19. Studying the different types of memories.
20. Constructing a seven segment.
21. Writing simple programs using instruction for MC 6800.

Comp-253 MEASURING INSTRUMENT

T	P	C
2	3	3

Total contact hours:

Theory: 64 Hours
Practical: 96 Hours

Prerequisite: Electrical Essentials & Networks (Comp-114) and Mathematics (Math-113)

AIMS 1.To understand the working principle, types, and construction of different analog and digital instruments and their accessories.
2. To Manipulate skills of proper selection, use, handling, maintaining and repairing of various electrical and electronic instruments.

COURSE CONTENTS

1. Identify the different electrical meters.
2. Identify the various electronic instruments.
3. Describe the functions of each measuring instrument.
4. Use the most proper measuring instrument for a given job.
5. Perform measurements using test instruments.
6. Observe proper safety and care in using measuring instruments.
7. Calibrate measuring instruments.
8. Mend/repair defective measuring instruments.

1. MEASUREMENTS AND ERRORS. 2 Hours

1.1Precision of measurements.
1.2 Types of errors.
1.3 Accuracy rating of instruments.
1.4 Application of the concepts .

2. INDICATING INSTRUMENTS. 4 Hours

2.1 Introduction to meters.
2.2 D`Ansonval Meter movements
2.3 Ammeters, millimeters, micrometer and shunts.
2.4 Shunt calculations.
2.5 Voltmeter, multiplier and sensitivity.
2.6 Basic Ohmmeter (Conversion of ammeter into ohmmeter)
2.7AC meters (rectifier, moving iron-vane, electrodynamometer, thermocouple and clamp-on type)

3. VOLT-OHM MILLIAMMETER (VOM). 4 Hours

3.1 Basic requirements.

3.2 Ranges and Subfunctions.
3.3 Basic types of Volt-Ohm-Milliammeter.
3.4 Application.

4. TRANSISTOR VOLTMETER. 06 Hours

4.1 Advantages.
4.2 Basic TVM, FET, MOSFET Test Methods.
4.3 Tunnel Diode Test.
4.4 PIN diode test configuration.
4.5 Varactor diode test configuration.
4.6 Gunn diodes Test Methods.
4.7 Thyristors Test Methods.
4.8 Curve tracer.
4.9 Application.
4.10 Signal tracer C.R.T. Tester

5. BRIDGES AND BRIDGE-TYPE EQUIPMENT. 06 Hours

5.1 Introduction.
5.2 Whetstone bridge and Grounded whetstone bridge.
5.3 AC bridges (magnitude and phase balancing).
5.4 Maxwell bridge.
5.5 Hay Wien bridge
5.6 Scheming and Wien bridges.
5.7 Universal bridge.
5.8 Q-meter and LC meter.

6. SIGNAL GENERATORS. 08 Hours

6.1 Review of oscillator circuit operation.
6.2 AF generator.
6.3 RF generator.
6.4 AM generator.
6.5 FM generator.
6.6 Frequency synthesized signal generator.
6.7 Sweep/Marker generator.
6.8 Square and Pulse generator.
6.9 Function generator.
6.10 TV pattern generator.

7. OSCILLOSCOPES. 06 Hours

7.1 Theory and operation.
7.2 Single/dual trace (general purposes).
7.3 Triggered Sweep.
7.4 Storage.

7.5 Sampling
7.6 Vector scope
7.7 Curve tracer
7.8 Recorders

8. DIGITAL INSTRUMENTS.

8.1 Review of signal conversion (ADC and DAC)
8.2 Digital Voltmeter
8.3 Digital Multimeter
8.4 Frequency Counter
8.5 Digital LCR meter.
8.6 Digital I.C. tester.

9. ANALYZERS. 04 Hours

9.1 Wave Analyzer
9.2 Distortion Analyzer
9.3 Logic Analyzer
9.6 Signature Analyzer
9.7 Application

10. MISCELLANEOUS TEST INSTRUMENTS. 10 Hours

10.1 Wattmeter, power, dynamometer type
10.2 Energy meter, induction type
10.3 Watt meter, RF
10.4 Digital Volt meter
10.5 Digital Multimeter
10.6 Pulse counter
10.7 Frequency counter
10.8 Digital LCR meter.
10.9 Single tracer
10.10 X - Y recorder - X - T recorder
10.11 Digital IC Tester
10.12 Q-meter
10.13 Applications

11. PROBES 04 Hours

11.1 High Voltage probes
11.2 Oscilloscope probes
11.3 Logic probes
11.4 Logic pulser
11.5 Logic clip
11.6 Application

12. CALIBRATION OF INSTRUMENTS — 04 Hours

12.1 Standards of Calibration.
12.2 Techniques of Calibration.
12.3 Report of Calibration.

13. DEFECTS IN INSTRUMENTS. — 04 Hours

13.1 Common defects in Analog meter
13.2 Methods of repair of analog meter.
13.3 Common faults in curves tracer and their remedy
13.4 Major defects in A.C. bridges
13.5 Common faults in Oscilloscopes
13.6 Common faults in Signal generators
13.7 Common faults in Signal analyzer
13.8 Common faults in Digital Instruments.

TEXT & REFERENCE BOOKS.

1. Cycle N. Herrick Instruments & Measurement for Electronics.
2. Bernard Grob & Milton Kiver, Application of Electronics
3. Link G.D. Electronic Test Instruments;
   * Handbook of Meters - Theory and Applications.
   * Handbook of Oscilloscope - Theory and Applications.
4. Cooper William Electronic Instruments Techniques
5. Malvino, Electronic Instrumentation Fundamentals
6. Higgins O Patrik J, Basic Instrumentation - Industrial Measurements.
7. Jones & Chin, Electronics Instruments & Measurements
8. R.B. Gillies, Instrumentation & Measurements for Electronics Technicians

Comp-253 MEASURING INSTRUMENTS

INSTRUCTIONAL OBJECTIVES.

1.UNDERSTAND PURPOSE AND TERMINOLOGY OF MEASUREMENT.

1.1Define the terms: Instrument, Accuracy, Precision, Sensitivity, Resolution and Error.
1.2 Differentiate accuracy from precision.
1.3 List four sources of errors in instruments.
1.4 Describe the three general classes of errors in measurements.

2.TO UNDERSTAND THE CONSTRUCTION , WORKING AND USES OF DC AND AC METERS.

2.1 List the types of indicating instruments.
2.2Draw and label the constructional elements of permanent magnet moving coil (PMMC) mechanism.
2.3 Explain the working of PMMC (D'Arsonval) movement.
2.4Compare the external magnet construction with core magnet for PMMC mechanism.
2.5 Compare a taut band suspension with the jewel bearing mounting of moving coil
2.6 List the uses of each type of construction given under 2.1.4 and 2.1.5.
2.7 Identify the function of swamping resistor.
2.8 List the merits and demerits of PMMC mechanism.
2.9 Enlist the uses of PMMC mechanism.
2.10 Identify the constructional features and importance of zero-centered galvanometer movement.
2.11 Identify the function of PMMC galvanometer as dc micro-ammeter.
2.12Explain the function of shunt resistor to extend the range of micro-ammeter to milliammeter and ammeter.
2.13 Derive the formula to find the value of shunt resistor, Rs= Rm.Im / (I- Im).
2.14 Compute the value of shunt resistance for a desired extension in range.
2.15 Draw the circuit of a multi-range ammeter using universal or Ayrton shunt.
2.16 List three precautions to be observed in using a DC ammeter.
2.17 Enlist the uses of DC ammeter.
2.18 Identify the function of multiplier resistor.
2.19Drive the formula to find the value of multiplier resistance, Rm = (V- Im Rm)/ Im.
2.20 Compute the value of multiplier resistor for a desired f.s.d. of DC volts.
2.21 Draw a circuit arrangement of a multi-range voltmeter using multiplier resistors.
2.22 Explain the sensitivity and load effect of a voltmeter.
2.23 List the precautions in using DC voltmeter.
2.24 List the uses of Dc voltmeter.
2.25 List the method of measuring a resistance.
2.26 Explain the voltmeter-ammeter method of measuring resistance.
2.27 Draw the circuit of a basic Ohmmeter.
2.28 Explain the working of a basic Ohmmeter.

2.29 List the uses of Ohmmeter.
2.30 List the classes of AC meters.
2.31 Name the type of instrument mechanism used for each class of AC meter.
2.32 Draw the schematic diagram a rectifier type AC meter.
2.33 Explain the working of rectifier type AC meter.
2.34 Describe the working principle of a clamp-on AC meter.
2.35 Explain the working principal of moving iron-vane mechanism.
2.36 Draw the schematic diagram of an electrodynamometer movement.
2.37 Compare the rectifier, moving iron-vane and electrodynamometer type AC meter.
2.38 Draw the schematic diagram of a basic thermocouple instrument.
2.39 Explain the working of thermocouple instrument.
2.40 List the uses of above four type of AC meters.

3.UNDERSTAND THE IMPORTANCE, TYPES AND CONSTRUCTION OF VOLT-OHM-MILLIAMMETER.

3.1 Identify the importance of volt-ohm milliammeter (Multimeter)
3.2 Draw and label the block diagram showing three functions of multimeter (VOM).
3.3 List the types of volt-ohm-milliammeter
3.4 Describe the function of operating controls and scales of a typical VOM.
3.5 Identify the meter protection in an analog VOM.
3.6 Describe the use of VOM in making :
- a) Voltage measurements (AC, +/-, DC and decibel)
  - i) measuring AC in the presence of DC.
  - ii) measuring DC in the presence of AC.
- b) Current measurement
  - i) High current range
  - ii) Low current range.
- c) Decibel measurement

4.UNDERSTAND THE TYPES, CONSTRUCTION AND WORKING OF TVM, UNDERSTAND THE WORKING OF ELECTRONIC VOM.

4.1 Draw the schematic diagram of basic BJT input TVM.
4.2 Explain the working of BJT input TVM.
4.3 Draw the schematic diagram of basic FET input TVM.
4.4 Explain the working of FET input TVM.
4.5 Compare the FET input TVM with the BJT input TVM.
4.6 Draw the schematic diagram of BJT bridge TVM.
4.7 Explain the working of BJT bridge TVM.
4.8 Draw the schematic diagram of FET bridge TVM.
4.9 Explain the working of FET bridge TVM.
4.10 Compare the BJT bridge TVM with FET bridge TVM.
4.11 List the applications of TVM.
4.12 List important considerations in choosing a voltmeter.

4.13 List the major elements of an electronic VOM.

5.UNDERSTAND THE CONSTRUCTION AND WORKING OF BRIDGE -TYPE TEST INSTRUMENTS.

DC Bridges

5.1 Draw the circuit diagram of Whetstone bridge.
5.2 Explain the working of Whetstone bridge.
5.3 Identify the function of guard terminal in a guarded Whetstone bridge.
5.4 List the applications of Whetstone bridge

AC Bridges

5.5 List the electrical quantities measured by an AC bridge.
5.6 Draw the general diagram of an AC bridge.
5.7 State the balance (magnitude & phase) equation for a general AC bridge.
5.8 Draw the schematic diagram of Maxwell bridge .
5.9 Describe the procedure of balancing Maxwell bridge
5.10 Derive the balance equation of Maxwell bridge to find the unknown inductance.
5.11 Draw the schematic diagram of Hay bridge.
5.12 Derive the equation to find the unknown inductance.
5.13 Compare Maxwell bridge with Hay bridge.
5.14 Draw the schematic diagram of Scheming bridge.
5.15Derive the balance equation for Scheming bridge to find Cx, p.f, D and Q of series RC circuit.
5.16 Draw the schematic diagram of Wien bridge.
5.17 Describe the procedure of balancing Wien bridge to find the value of unknown frequency of a signal.
5.18 List the application of Wien bridge.

Q & LC meters and Universal Bridge

5.19 Draw the schematic diagram of basic Q-meter.
5.20 Explain the working of Q-meter.
5.21 Draw a block diagram of LC meter.
5.22 Identify the function of each block of LC meter.
5.23 Describe a universal bridge.
5.24 Enlist the controls and scales of universal bridge.
5.25 List he merits and demerits of bridge-type test instrument.

6. SIGNAL GENERATORS.

6.1 Understand the basics and need of a signal generators.

6.1.1 Describe the need and the basic requirements of a signal generator.
6.1.2List the major types of signal generators used for electronics testing and troubleshooting.

6.1.3 List the desired characteristics common to all the signal generators.

6.2 Understand the construction and working of AF generator.

6.2.1 Identify the similarities and differences between an audio oscillator and audio generator.

6.2.2 List the types of oscillators.

6.2.3 Identify the merits of RC oscillator.

6.2.4 Draw the schematic diagram of a RC Wien bridge oscillator.

6.2.5 Explain the working of Wien bridge oscillator.

6.2.6 Identify the function of controls and indicators of an AF generator.

6.2.7 List the applications of AF generator

6.3 Understand the construction and working of AM & FM generators.

6.3.1 Draw the basic circuit of a shop type RF generator.

6.3.2 Explain the working of the RF generator.

6.3.3 Identify the function of each control and indicator of RF generator.

6.3.4 List the applications of RF generator.

6.3.5 Draw the schematic diagram of a dip meter.

6.3.6 Describe the working of a dip meter circuit.

6.3.7 List the applications of dip meter.

6.4 Understand the construction and working of sweep, marker and pulse generators.

6.4.1 Draw the block diagram of an AM generator.

6.4.2 Identify the function of each block of an AM generator.

6.4.3 Describe the function of each control and indicator of AM generator.

6.4.4 List the applications of AM generator.

6.4.5 Draw the block diagram of FM generator.

6.4.6 Describe the function of each block of FM generator.

6.4.7 Identify the function of each control & indicator of FM generator.

6.4.8 List the applications of FM generator.

6.4.9 List the two methods of frequency syntheses.

6.4.10 Draw the block diagram of phase locked loop (PLL) or indirect method of frequency synthesis.

6.4.11 Identify the function of each block of PLL frequency synthesizer.

6.4.12 Draw the block diagram of the frequency divider type of signal generator.

6.4.13 Describe the function of each block of frequency divider type signal generator.

6.5 Understand the construction of TV pattern and special effects generators.

6.5.1 Draw the block diagram of sweep generator.

6.5.2 Describe the function of each block of sweep generator.

6.5.3 List the types of voltage sweep generations.

6.5.4 Enlist the applications of sweep generator.

6.5.5 Draw the block diagram of marker generator.

6.5.6 Describe the function of each block of the marker generator.

6.5.7 Identify the purpose of marker generator controls and indicators.

6.5.8 List the two basic methods for injection of marker signal into sweep generator.

6.5.9 Enlist the applications of marker generator.

6.5.10 List the methods of square wave generation.
6.5.11 Draw the block diagram of a square wave generator.
6.5.12 Explain the function of each block of the square wave generator.
6.5.13 Draw the block diagram of pulse generator using square wave generator and monostable multivibrator.
6.5.14 Explain the working of a pulse generator.
6.5.15 Identify the function of controls and indicators of a square wave and pulse generator.
6.5.16 List the applications of square wave and pulse generator.
6.5.17 Draw the schematic diagram of an OP-AMP Function generator.
6.5.18 Explain the working of the Function generator.
6.5.19 Draw the functional diagram of IC function generator.
6.5.20 Identify the function of each block of IC function generator.

6.6 TV Pattern and Special Effect Generators

6.6.1 Explain the need of TV pattern generator.
6.6.2 Describe the working of TV pattern generator using a block diagram.
6.6.3 Enlist special effect generator.
6.6.4 State uses of special effect generator.

7. OSCILLOSCOPE (CRO).

7.1 Understand the working principle, types and applications of oscilloscope and recorders.

7.1.1 List the four fundamental parameters that may be represented by an oscilloscope.
7.1.2 Sketch a cathode ray tube (CRT) and label the most important parts.
7.1.3 Describe the function of each part of a CRT.
7.1.4 Sketch the control circuit of a CRT.
7.1.5 Explain the purpose of each control of CRT.

7.2 General Purpose Oscilloscope

7.2.1 Draw the block diagram of general purpose oscilloscope.
7.2.2 Explain the function of each block of the oscilloscope.
7.2.3 Explain the function of each control of the oscilloscope.
7.2.4 Draw the block diagram of vertical section of an oscilloscope.
7.2.5 Explain the function of each block of vertical section of CRO.
7.2.6 Describe the purpose of delay line in the vertical section of a CRO.
7.2.7 Draw the block diagram of the horizontal section of a CRO.
7.2.8 Explain the function of each block of horizontal section of a CRO.
7.2.9 Define the terms: fluorescence, phosphorescence, persistence, luminance, graticules and deflection sensitivity.
7.2.10 Identify the function of a sweep generator in an oscilloscope.
7.2.11 List the types of sweep generator used in oscilloscopes.
7.2.12 Describe the function of differentiator circuit following a clipper in the sync section of a CRO.
7.2.13 Explain the action of Schmitt trigger circuit in a triggered oscilloscope.

7.2.14 List the application for which triggered sweep is superior to a recurrent type of sweep.

7.3 Dual Trace Oscilloscope

7.3.1 Describe the importance of dual trace oscilloscope.
7.3.2 Differentiate a dual beam CROP from a dual trace CROP.
7.3.3single trace into a dual trace display.
7.3.4 Explain the working of electronic switch circuit for a dual trace display.
7.3.5 List the controls and connectors of a shop oscilloscope.
7.3.6 Describe the function of each control and connector of a shop CRO.
7.3.7 List the applications of CRO.

7.4 Storage Oscilloscope

7.4.1 Identify the purpose of storage oscilloscope.
7.4.2 List the types of storage CRT.
7.4.3 Draw and label the simplified diagram of a storage CRO.
7.4.4 Explain he function of each part of a storage CRT.
7.4.5Identify the function of writing and flood guns in a storage oscilloscope.
7.4.6 Describe the method of erasing a target of a storage oscilloscope.
7.4.7Describe the function of controls and connectors of a storage oscilloscope
7.4.8 Enlist the advantages of storage oscilloscope.

7.5 Sampling Oscilloscope

7.5.1 Identify the importance of sampling oscilloscope.
7.5.2Sketch and label the block diagram of a random sampling oscilloscope.
7.5.3 Describe the function of each block of the above diagram.

7.6 Vectorscope

7.6.1Identify the function of vectorscope to check a colour TV receiver's response.
7.6.2Describe the use of the conventional oscilloscope as a vectorscope.

7.7 Curve Tracer

7.7.1 Identify the function of a modern curve tracer.
7.7.2 Draw the block diagram of a transistor curve tracer.

7.8 Recorders

7.8.1List the two basic types of recorders used as electronic test equipment.
7.8.2Draw the block diagram of a basic strip or roll chart recorder system.
7.8.3 Describe the working of strip chart recorder.
7.8.4 Draw the block diagram of a basic X-Y recorder or plotter system.
7.8.5 Describe the function of each block of x-y recorder.

8. DIGITAL INSTRUMENTS.

8.1 Understand the operation and applications of digital meters.

8.1.1 List the major types of digital test instruments.
8.1.2 Enlist the types of digital voltmeter (DVM).
8.1.3 Illustrate the voltage-to-time conversion principle of ramp-type DVM.
8.1.4 Draw the block diagram of ramp-type DVM.

8.1.4 Identify the function of each block of the ramp-type DVM.
8.1.5 Draw the block diagram of staircase ramp type DVM.
8.1.6 Identify the function of its each block.
8.1.7 Draw the block diagram of dual-slope type DVM.
8.1.8 Explain the function of its each block.
8.1.9 Compare the above three types of DVMs.
8.1.10 Draw the block diagram of dual-slope type digital multimeter.
8.1.11 Identify the function of its each block.
8.1.12 Draw the block diagram of digital LCR meter.
8.1.13 Identify the function of its each block.
8.1.14 Identify the function of each control of DVM and digital multimeter

8.2 Understand the working and uses of electronic counters.

8.2.1 Define the term "Electronic Counter"
8.2.2 Draw the block diagram of basic counter.
8.2.3 Identify the blocks of basic counter involved in frequency measurement operation.
8.2.4 Draw the basic counter block diagram for period measurement operation.
8.2.5 Explain the working of basic counter for frequency and period measurements.
8.2.6 Identify the function of panel controls and indicators of electronic counter.

9. WAVE AND LOGIC ANALYZERS.

9.1 Understand the function of wave and distortion analyzers.

9.1.1 Draw the block diagram of wave analyzer.
9.1.2 Explain the function of each block of wave analyzer.
9.1.3 Identify the function of the controls and indicators of the analyzer.
9.1.4 List the applications of wave analyzer.
9.1.5 Draw the block diagram of distortion analyzer.
9.1.6 Explain the operation of each block of distortion analyzer.
9.1.7 Identify the function of the controls & indicators of the analyzer.
9.1.8 List the applications of distortion analyzer.

9.2 Understand the working of logic and signature analyzers.

9.2.1 Draw the block diagram of logic analyzer
9.2.2 Explain the operation of each block of logic analyzer.
9.2.3 Identify the function of the controls & indicators of the analyzer.
9.2.4 List the application of logic analyzer
9.2.5 Draw the block diagram of signature analyzer.
9.2.6 Explain the function of each block of signature analyzer.
9.2.7 Identify the function of the controls & indicators of the analyzer.
9.2.8 List the application of signature analyzer

10. MISCELLANEOUS INSTRUMENTS.

10.1 Understand electrical power & energy meters.

10.1.1 Draw the schematic diagram of electrodynamometer type watt meter.

10.1.2 Explain the working of the watt meter.
10.1.3 Draw the circuit diagram of induction type energy meter.
10.1.4 Explain the working of energy meter.

10.2 Understand the working of RF power meter.

10.2.1 Draw the diagram of RF watt meter
10.2.2 Explain the operation of RF watt meter
10.2.3 List the uses of RF watt meter

10.3 Understand the function of level and field strength meters.

10.3.1 Draw the block diagram of VU meter.
10.3.2 Explain the operation of each block of VU Meter.
10.3.3 List the applications of VU Meter.
10.3.4 Draw the block diagram of sound level meter
10.3.5Explain the operation of each block of sound level meter
10.3.6 Explain the application of sound level meter
10.3.7 Draw the block diagram of field strength meter.
10.3.8 Explain the operation of each block of field strength meter.
10.3.3 List the applications of field strength meter.

10.4 Understand the working of signal tracer / injector.

10.4.1 Draw the block diagram of signal tracer.
10.4.2 Explain the operation of each block of signal tracer.
10.4.3 List the uses of signal tracer.

10.5 Understand the function of digital IC tester.

10.5.1 Draw the block diagram of digital IC tester.
10.5.2 Explain the operation of each block of digital IC tester.
10.5.3 Explain the application of digital IC tester.

10.6 Understand function of Q-meter.

10.6.1 Describe working of a Q-meter using a block diagram
10.6.2 List uses of Q-meter.

11. PROBES AND TRANSDUCER.

11.1 Understand the working of meter and scope probes.

11.1.1 List the major types of meter and scope probes.
11.1.2 Draw the circuit diagram of low capacitance probe.
11.1.3 Explain the function of low capacitance probe.
11.1.4Draw the circuit diagram of high voltage probe (resistance & capacitance types).
11.1.5 Explain the working of high voltage probe.
11.1.6 List the applications of high voltage probe
11.1.7 Draw the circuit diagram of RF probe .
11.1.8 Explain the function of RF probe.
11.1.9 Draw the block diagram of a basic logic probe. .
11.1.10 Explain the working of basic logic probe.
11.1.11 Draw the block diagram of a simple logic pulser.
11.1.12 Explain the working of logic pulser.

11.1.13 List the applications of logic probe and pulser.
11.1.14 Explain the working of logic clip.

11.2 Understand the function of three types of traducers.

11.2.1 List the three types of transducers.
11.2.2 Explain the principle of resistance-changing transducer.
11.2.3 Describe the working of self-generating transducer.
11.2.4 Identify the function of inductance- and capacitance-changing transducers.

12.UNDERSTAND THE NEED AND METHODS OF CALIBRATION OF MEASURING INSTRUMENTS.

12.1 Explain standard of calibration of measuring instruments.
12.2 Explain the techniques of calibration of measuring instruments.
12.3 Describe report of calibration of measuring instruments.

13.UNDERSTAND THE COMMON DEFECTS IN MEASURING INSTRUMENTS AND THE PROCESSES OF TROUBLESHOOTING.

13.1 Describe common faults in analog meters.
13.2 Explain the method of fault tracing in an analog meter.
13.3 Explain the method of repair of an analog meter.
13.4 List the common-faults in curve tracers with their symptoms, causes & remedies.
13.5 List major faults in AC bridges with their symptoms, causes & remedies.
13.6 List common faults in oscilloscopes with their symptoms, causes & remedies.
13.7 Explain the common faults in signal generators with their symptoms, causes & remedies.
13.8 Explain the common faults in signal analyzer with their symptoms, causes & remedies.
13.9 Explain the common faults in digital instruments with their symptoms, causes & remedies.

Comp-262 CONTROLS AND AUTOMATION.

T	P	C
1	3	2

Total Contact Hours:

Theory 32 Hours
Practical 96 Hours

Pre-requisites: Electronic devices, circuits I & II, digital electronics.

COURSE CONTENTS

1. INTRODUCTION TO PROCESS CONTROL. 03 Hours

- 1.1 Introduction.
- 1.2 Definition of Process Control.
- 1.3 Elements of Process Control.
  - 1.3.1 Identification of elements.
  - 1.3.2 Block diagram.
- 1.4 Evaluation of Process Control.
  - 1.4.1 System evaluation criteria.
  - 1.4.2 Dynamic response evaluation criteria.
- 1.5 Analog versus Digital processing.
  - 1.5.1 Analog processing.
  - 1.5.2 Digital processing.
- 1.6 Units, standards, and definitions.
  - 1.6.1 Units.
  - 1.6.2 Standard signals.
  - 1.6.3 Definitions.
  - 1.6.4 Process control drawing.
- 1.7 Time Response.
  - 1.7.1 Non-oscillating Response.
  - 1.7.2 Oscillating Response.

2. ANALOG SIGNAL CONDITIONING.

- 2.1 Introduction.
- 2.2 Principles of Analog signal conditioning.
  - 2.2.1 Signal level changes.
  - 2.2.2 Linearization.
  - 2.2.3 Conversions.
  - 2.2.4 Filtering and impedance matching.
- 2.3 Passive circuits.
  - 2.3.1 Divider circuit.
  - 2.3.2 Bridge circuits.
  - 2.3.3 RC filters.

2.4 Operational amplifiers.
- 2.4.1 Op Amp characteristics.
- 2.4.2 Op Amp specifications.

2.5 Op Amp circuits in instrumentation.
- 2.5.1 Voltage Follower.
- 2.5.2 Inverting Amplifier.
- 2.5.3 Non-inverting Amplifier.
- 2.5.4 Differential Amplifier.
- 2.5.5 Voltage to Current Converter.
- 2.5.6 Current to Voltage Converter.
- 2.5.7 Integrator.
- 2.5.8 Linearization.
- 2.5.9 Special Integrated Rectifier (ICS)

2.6 Industrial electronics.
- 2.6.1 Silicon Controlled Rectifier (SCR).
- 2.6.2 TRIAC

3. DIGITAL SIGNAL CONDITIONING. 03 Hours

3.1 Introduction.

3.2 Review of Digital fundamentals.
- 3.2.1 Digital information.
- 3.2.2 Digital logic circuits.
- 3.3.3 Programmable logic controllers.
- 3.3.4 Busses and Tri-State buffers.

3.3 Converters.
- 3.3.1 Comparators.
- 3.3.2 Digital to Analog converters (DACs).
- 3.3.3 Analog to Digital converters (ADCs).

3.4 Data Acquisition system.
- 3.4.1 Data Acquisition system (DAS).

4. THERMAL TRANSDUCERS. 02 Hours

4.1 Introduction.

4.2 Definition of Temperature.
- 4.2.1 Thermal energy.
- 4.2.2 Temperature.

4.3 Metal Resistance versus Temperature Devices.
- 4.3.1 Metal resistance versus Temperature.
- 4.3.2 Resistance versus Temperature approximations.
- 4.3.3 Resistance-Temperature detectors.

4.4 Thermistors.
- 4.4.1 Thermistors effects.

4.4.2 Thermistors.

4.5 Thermocouples.
- 4.5.1 Thermocouples effects.
- 4.5.2 Thermocouples.
- 4.5.3 Thermocouples transducers.

4.6 Other Thermal Transducers.
- 4.6.1 Bimetal strips.
- 4.6.2 Gas Thermometers.
- 4.6.3 Vapour Pressure Thermometers.
- 4.6.4 Liquid expansion Thermometers.

5. MECHANICAL TRANSDUCERS. 02 Hours

5.1 Introduction.

5.2 Displacement. location, or position transducers.
- 5.2.1 Potentiometric.
- 5.2.2 Capacitive and inductive.
- 5.2.3 Variable reluctance.
- 5.2.4 Level transducers.

5.3 Strain transducers.
- 5.3.1 Strain and stress.
- 5.3.2 Strain gage principles.
- 5.3.3 Metal stress gages (SGs).
- 5.3.4 Semiconductor strain gages (SGs).
- 5.3.5 Load cells.

5.4 Motion Transducers.
- 5.4.1 Types of motion.
- 5.4.2 Accelerometer principles.
- 5.4.3 Types of accelerometers.
- 5.4.4 Applications.

5.5 Pressure Transducers.
- 5.5.1 Pressure principles.
- 5.5.2 Pressure transducers (p>one atmosphere).
- 5.5.3 Pressure transducers (p<one atmosphere).

5.6 Flow Transducers.
- 5.6.1 Solid flow measurement.
- 5.6.2 Liquid flow.

6. OPTICAL TRANSDUCERS. 03 Hours

6.1 Introduction.

6.2 Fundamentals of EM Radiation.
- 6.2.1 Nature of EM Radiation.
- 6.2.2 Characteristics of light.

6.2.3 Luminous energy units and principles.

6.3 Photodetectors.

6.3.1 Photodetector characteristics.

6.3.2 Characteristics of light.

6.3.3 Photovoltaic detectors.

6.3.4 Photodiode detectors.

6.3.5 Photomissive detectors.

6.4 Pyrometry.

6.4.1 Thermal radiation.

6.4.2 Broadband pyrometers.

6.4.3 Narrowband pyrometers.

6.5 Optical Sources.

6.5.1 Conventional light sources.

6.5.2 Laser principles.

6.6 Applications.

6.6.1 Label inspection.

6.6.2 Turbidity.

6.6.3 Ranging.

7. CONTROL SYSTEM. 03 Hours

7.1 Introduction.

7.2 Final control operation.

7.2.1 Signal conversions.

7.2.2 Actuators.

7.2.3 Control element.

7.3 Signal Conversions.

7.3.1 Analog electrical signals.

7.3.2 Digital electrical signals.

7.3.3 Pneumatic signals.

7.4 Actuators.

7.4.1 Electrical actuators.

7.4.2 Pneumatic actuators.

7.4.3 Hydraulic actuators.

7.5 Control Elements.

7.5.1 Mechanical.

7.5.2 Electrical.

7.5.3 Fluid Valves.

8. DISCRETE-STATE PROCESS CONTROL. 03 Hours

8.1 Introduction.

8.2 Definition of Discrete state process control.

8.3 Characteristics of the system.

8.3.1 Discrete state variable.

8.3.2 Process specifications.
8.3.3 Event sequence description.

8.4 Ladder Diagram.
8.4.1 Background.
8.4.2 Ladder diagram elements.
8.4.3 Ladder diagram examples.

8.5 Programmable controllers.
8.5.1 Relay sequencers.
8.5.2 Programmable controller.
8.5.3 Programmable controller operation.
8.5.4 Programming.

9. CONTROLLER PRINCIPLES. 02 Hours

9.1 Introduction.

9.2 Process Characteristics.
9.2.1 Process equation.
9.2.2 Process load.
9.2.3 Process lag.
9.2.4 Self-regulation.

9.3 Control system parameters.
9.3.1 Error.
9.3.2 Variable range.
9.3.3 Control parameter range.
9.3.4 Control lag.
9.3.5 Dead time.
9.3.6 Cycling.
9.3.7 Controller modes.

9.4 Discontinuous Controller Modes.
9.4.1 Two position mode.
9.4.2 Multiposition mode.
9.4.3 Floating control mode.

9.5 Continuous Controller Modes.
9.5.1 Proportional control mode.
9.5.2 Integral control mode.
9.5.3 Derivative control mode.

9.6 Composite control Modes.
9.6.1 Proportional integral control (Pt).
9.6.2 Proportional derivative control mode (PD).
9.6.3 Three mode controller (PID).
9.6.4 special terminology.

10. ANALOG CONTROLLERS. 02 Hours

10.1 Introduction.
10.2 General features.
10.3 Electronics controllers.
10.3.1 Error detector.
10.3.2 single mode.
10.3.3 Composite controller modes.
10.4 Pneumatic Controllers.
10.4.1 General features.
10.4.2 Mode Implementation.

11. DIGITAL CONTROLLERS. 03 Hours

11.1 Digital electronics methods.
11.2 Digital electronics methods.
11.2.1 Simple alarms.
11.2.2 Two position control.
11.2.3 Multivariable alarms.
11.3 Computer in process control.
11.3.1 Programmable controllers.
11.3.2 Data logging.
11.3.3 Supervisory control.
11.3.4 Computer based controller.
11.4 Characteristics of digital data.
11.4.1 Digitized value.
11.4.2 Sampled data system.
11.5 Controller software.
11.5.1 Software format.
11.5.2 Input data operations.
11.5.3 Controller modes.
11.6 Computer controller examples.

12. CONTROL LOOP CHARACTERISTICS. 03 Hours

12.1 Introduction.
12.2 Control system configurations.
12.2.1 Single variable.
12.2.2 Cascade control.
12.3 Multivariable control systems.
12.3.1 Analog control.
12.3.2 Supervisory and direct digital control.
12.4 Control system quality.
12.4.1 Definition of quality.
12.4.2 Measure of quality.
12.5 Stability.
12.5.1 Why instability?

Comp-262 CONTROLS AND AUTOMATION.

INSTRUCTIONAL OBJECTIVES:

1. UNDERSTAND INTRODUCTION TO PROCESS CONTROL.

1.1 Draw a block diagram of a process control loop with a description of each element.
1.2 List three typical dynamic variables.
1.3 Describe three criteria used to evaluate the response of a process control loop.
1.4 Define analog signal processing.
1.5 Describe the two types of digital process control.
1.6 Define accuracy,hysteresis and sensitivity.
1.7 List the SI units of measures for length, time, mass and electric current.
1.8 Convert a physical quantity from SI to English units and vice versa.
1.9 Define the types of measurement and response.

2. UNDERSTAND ANALOG SIGNAL CONDITIONING.

2.1 Define the common types of analog signal conditioning.
2.2 Design a Wheatstone bridge for resistance measurement.
2.3 Draw a diagram of current balance bridge and describe its operation.
2.4 Design RC low-pass and high-pass-filters for specific applications.
2.5 Define the operation of a silicon controlled rectifier,
2.6 Design a high input impedance op amp dc amplifier for specific gain.
2.7 Analyze a simple opamp circuit for its transfer characteristics.
2.8 Explain the purpose of compensation leads in a bridge circuit.
2.9 Design a voltage-to-current converter for specified voltage input and current output.
2.10 Define the basic linearization procedure.

3. UNDERSTAND DIGITAL SIGNAL CONDITIONING.

3.1 Develop a Boolean equation for a simple process-control alarm problem.
3.2 Implement a process-control design of an alarm by digital circuits and components.
3.3 Define the representation of fractional binary and decimal numbers.
3.4 Design a basic DAC ad describe its operation.
3.5 Diagram a successive approximation ADC and describe its operation.
3.6 Define the conversion resolution of ADCs and DACs.
3.7 Explain a data acquisition system.

4. UNDERSTAND THERMAL TRANSDUCERS.

4.1 Define thermal energy,the relation of temperature scales to thermal energy, and temperature scales calibrations.
4.2 Transform a temperature reading between the Kelvin,Rankine, Celsius,and Fahrenheit temperature scales.
4.3 Design the application of an RTD temperature transducer to specific problems in temperature measurement.

4.4Design the application of a thermistor to specific temperature measurement problems.
4.5Design the application of a thermocouple to specific temperature measurements problems.
4.6Explain the operation of a bimetal strip for temperature measurement.
4.7Explain the operation of a gas thermometer and a vapor pressure thermometer.

5. UNDERSTAND MECHANICAL TRANSDUCERS.

5.1Define the relationship between acceleration, velocity, and position.
5.2Define the characteristics of vibration and shock.
5.3Draw and label a typical stress strain curve.
5.4Design the application of an LVDT to a displacement measurement problem.
5.5Describe the types of accelerometer and the characteristics of each.
5.6Design a system of strain movement using metal foil strain gages.
5.7Define two types of pressure measurement with electrical signal output.
5.8Diagram a system of flow measurement using differential pressure measurements.

6. UNDERSTAND OPTICAL TRANSDUCERS.

6.1Describe EM radiation in terms of frequency,wavelength, speed of propagation,and spectrum.
6.2Define the energy of EM radiation in terms of power, intensity and the effects of divergence.
6.3Describe the luminous energy description of EM radiation.
6.4Computer photoconductive, photovoltaic and photo emissive type photodetectors.
6.5Describe the principles and structure of both total radiation and optical pyrometers.
6.6Describe incandescent atomic and laser light sources by the characteristics of their light.
6.7Design the application of optical techniques to process-control measurement applications.

7. UNDERSTAND FINAL CONTROL

7.1 Define the three parts of final control operation.
7.2 Give two examples of electrical signal conversion.
7.3Make a diagram and describe the operating principles of the flap-per/nozzle pneumatic system.
7.4Describe the operating principles of ac,dc and stepping motors.
7.5Explain how a pneumatic positioning actuator functions in both the direct and reverse modes.
7.6Contrast quick-opening,linear and equal percentage control values in terms of the flow versus stem operation.
7.7Explain how control valve sizing techniques allow selection of the proper size of control valve.

8. UNDERSTAND DISCRETE-STATE PROCESS CONTROL.

8.1Define the nature of discrete-state process control systems.
8.2Give three examples of applications of discrete-state process control in industry.

8.3Explain how a discrete-state process can be described in terms of the objectives and hardware of the process.

8.4Contrast a table of ladder diagram symbols with an explanation of function of each symbol.

8.5Develop a ladder diagram from the narrative event sequence description of a discrete-state process control system.

8.6Describe the nature of a programmable controller and how it is used in discrete-state process control

8.7Develop a programmable controller program from the ladder diagram of a discrete-state process control application.

9. UNDERSTAND CONTROLLER PRINCIPLES.

9.1 Define process load, process lag and self-regulation.

9.2 Describe two-position and floating control mode

9.3 Define the proportional controller mode.

9.4Give an example and description of an integral-control mode.

9.5 Describe the derivative control mode.

9.6Contrast proportional integral and proportional derivative control modes.

9.7 Describe three modes controller.

9.8Provide a description of the controller output for a fixed error input of any of the controller modes.

10 UNDERSTAND ANALOG CONTROLLERS.

10.1 Recognize the essential elements of an analog controller.

10.2Diagram and describe the implementation of two position,proportional and integral control modes using op amps.

10.3Diagram and describe the implementation of proportional integral, proportional derivative and three mode controllers using op amps; diagram and describe the operation of a three mode pneumatic controller.

10.4Design the basic elements of a process-control loop using electronic analog techniques.

11 UNDERSTAND DIGITAL CONTROLLERS.

11.1Give examples of how single and multiple variable alarms are implemented in process control.

11.2Draw a diagram of typical data logging system for use in process control.

11.3Explain how computer supervisory process-control operation are used in an analog process-control loop.

11.4Draw a diagram of a direct digital control system identification of each element

11.5Explain the effect of ADC time and computer execution time on data sampling rate.

11.6Contrast microcomputers and mainframe computers as applied to process control.

11.7Define the effects of aliasing in data sampling systems.

11.8 Explain how controller modes are implemented in DDC.

11.9Determine the computer flow diagram for typical DDC application in process control.

12 UNDERSTAND CONTROL LOOP CHARACTERISTICS.

12.1 Explain the characteristics of single variable, compound, cascade and multivariable control.

12.2 Define three standard measures of quality in a control system.

12.3 Describe the control loop stability criteria with respect to a Bode plot.

12.4 Describe the open loop transient disturbance method of loop tuning.

12.5 Describe the Ziegier-Nichlos method process control tuning.

12.6 Define phase and gain margin.

12.7 Explain how the frequency response method can be used to tune a process-control loop.

Comp-262 CONTROLS AND AUTOMATION.

LIST OF PRACTICALS.

1.Plotting oscillatory and non-oscillatory time response of a control system.
2.Demonstrate the characteristics of impedance mateling & filter circuit.
3. Demonstrate the characteristics of an operational amplifier.
4. Demonstrate the working of a PLC.
5. Demonstrate the working of a digital to analog converter.
6. Demonstrate the working of a analog to digital converter.
7. Operate a Data Acquisition system DAS.
8. Draw the characteristics of a transducers.
9.Draw the characteristics of a strain gage.
10-12Draw response curves of
   i) Photo conductive detector.
   ii) Photo emissive detector.
   iii) Photo voltaic detector.
13. Manipulate the operation of a LASER.
14-16Operate electrical, pneumatic and hydraulic control systems.
17.Calculate control system parameters.
18. Construct a simple digital alarm.
19. Construct a multivariable alarm.
20. Use computer with a gain process.
21-32Operate a computer with a suitable software for controlling the parameters of a gain process.