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Total 17 5 14 500 100 100 250 50 1000 30
Any electronic trade has its basis on a certain number of components and some basic standard circuits. These common circuits are applied in all sections of electronic technology.

Emphasis has been given on the statics and applications of semiconductor devices/components. The focus has been made on the interaction of active and passive components and overall performance according to stated requirements.

The laboratory course fundamentally aims to familiarize the student with various devices and components and their applications.

### COURSE CONTENTS

1. **SEMICONDUCTORS**
   - Energy Band Theory
   - Classification as Insulators, Conductors & Semiconductors
   - Types Of Semiconductors
Intrinsic & Extrinsic Semiconductors
Concept of Hole & Electron
Mobility of Hole & Electron
P-Type & N-Type Semiconductor
Majority Carrier in P-Type & N-Type Semiconductor
Drift Current, Diffusion & Recombination

Properties Of Ge, Si
Group-III & Group-V Alloys and their properties

2. pn - JUNCTION

Construction of p-n Junction
Depletion layer
Junction or Barrier Voltage
Forward & Reverse Biased PN Junction
Barrier Width & Diffusion
V-I Characteristic of PN Junction

pn Junction Diode
Working
VI Characteristics
Parameters of pn-Junction Diode
Static & Dynamic Resistance, Bulk Resistance,
Cut In Potential
Reverse Saturation Current,
Reverse Breakdown

Zener Diode
VARACTER Diode
Light Emitting Diode (LED),
Photo-Diode
Applications of Various Types of Diodes.

3. RECTIFIER & DC POWER SUPPLIES

SINGLE PHASE
Half Wave Rectifier
Full Wave Rectifier
Bridge Rectifier
Centre-Tapped FW-Rectifier
Calculation of Instantaneous, Average & rms values
Efficiency, Ripple factor
PIV & TUF.
Filters
L,C & LC
Voltage Regulation
Zener & Shunt Regulator
4. BIPOLAR JUNCTION TRANNISTOR

?? Construction of BJT
?? NPN & PNP transistor
   Current components
   alpha & Beta a of Transistor
?? Transistor Biasing
   Fixed Bias
   Self Bias
   Collector-Base biasing circuit configuration

?? Static characteristic of CB, CE & CC configuration
?? Significance & utility of h-parameter
?? Thermal Runaway, Heat dissipation, Heat Sink
?? Transistor as an Amplifiers
?? Classification of Amplifiers
   Class A, B, C & AB
   Frequency response of
   CB, CE & CC Amplifier
   Performance & Comparisons of CB, CE & CC
?? Amplifier Parameters
   A_i, A_v, Rin, R_o, A_p
   Distortion In Amplifier - Nonlinear, Frequency & Phase.

?? Multistage Amplifier
   Coupling & Cascading

5. FEEDBACK AMPLIFIER & OSCILLATOR.

?? General Concept Of Feedback
?? Positive & Negative Feed Back
   Voltage Shunt & Voltage Series Feedback
   Current Shunt & Current Series Feedback
?? Effect Of Negative Feedback,
?? Barkhausen Criterion For Oscillation
?? Type Of Oscillator
   Weinbridge Oscillator
   Hartley Oscillator
   Colpits Oscillator
   Clapp's Oscillator
   Crystal Controlled Oscillator.

6. MULTIVIBRATOR
?? BJT as Switch
?? Inverter
?? Concept of Multivibrator
   Bistable
   Monostable
   Astable Multivibrator
   Schmitt Trigger

**Course: Basic Electronics & Devices, Lab**

**CODE : 234321 (28)**

**Hours: 32**

**LIST OF EXPERIMENTS**

1. Plot Forward & Reverse Characteristic of PN Junction Diode.
2. Plot Vi Characteristic Of Zener Diode.
5. Plotting Input & Output Wave Form Full Wave Rectifier With & Without Filter Circuit & verify the plot, using CRO Display.
7. Study Astable, Monostable & Bistable Multivibrator and plot the Output waveform.

**RECOMMENDED BOOK**

1. Eletronoc Principle -- by Malvino
4. Basic Electronics -- by G. M. Mottershed ( PHI )
CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BILHAI

(A) SEMESTER : III
(B) SUBJECT TITLE : ELECTRICAL & ELECTRONIC MEASUREMENTS
(C) CODE : 200313 (28)
(D) BRANCH / DISCIPLINE : INSTRUMENTATION ENGINEERING

E) RATIONALE : This measurement subject enables the student to understand the very basic facts, Concepts and principles of measurement and will be able to apply the same for solving simple test procedures. This subject also enables the student to understand various skills in measuring devices and in display and recording systems.

F) TEACHING AND EXMINATION SCHEME:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Periods/Week (In Hours)</th>
<th>Scheme of Examination</th>
<th>Credit [L+(T+P)]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
<td>T</td>
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</tbody>
</table>

L : Lecture hours : T : Tutorial hours, P : Practical hours
ESE – End of Semester Exam.; CT – Class Test; TA- Teacher’s Assessment

G) DISTRIBUTION OF MARKS AND HOURS:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Chapter No.</th>
<th>Chapter Name</th>
<th>Hours</th>
<th>Marks</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Measurement Systems</td>
<td>10</td>
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<tr>
<td>2</td>
<td>2</td>
<td>Measurement of Circuit Component (R, L&amp;C)</td>
<td>15</td>
<td>20</td>
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<tr>
<td>3</td>
<td>3</td>
<td>Instrument Transformer</td>
<td>10</td>
<td>20</td>
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<tr>
<td>4</td>
<td>4</td>
<td>Cathode Ray Oscilloscope</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Displays and Recorders</td>
<td>14</td>
<td>25</td>
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<td></td>
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</tbody>
</table>
H)  DETAILED COURSE CONTENTS:

Chapter – 1 : Measurement Systems
« Basic arrangements of Measurement System;
  - Sensing Element.
  - Signal conditioning element.
  - Output element.
« Basic parameters of Measuring Devices.
  - Accuracy and Precision.
  - Error (Gross, Systematic and Random).
  - Linearity, Hysteresis, Resolution, Threshold.
  - Repeatability, Reliability and Maintainability.
  - Span.
  - Calibration.
« Standards and Units of Measurement;
« Electrical Standards.

Chapter – 2 : Measurement of Circuit Components (R,L and C)
« Inductance Measurement.
« Self-Inductance Measurement.
  - Ammeter and Voltmeter method.
  - Three Voltmeter Methods.
  - Three Ammeter Method.
  - General Four arms bridge network method.
  - Maxwells’ bridge method, and other bridges used for Self-Inductance measurement & their application.
« Mutual Inductance Measurement.
  - Felici’s Method.
« Capacitance Measurement –
  - Wein bridge method, and other bridges used for capacitance measurement and their specific applications.
« Resistance Measurement:
  - Ammeter voltmeter method, Potentiometer method, Kelvin’s double bridge method, Wheatstone bridge method, Loss of charge method.

Chapter – 3 : Instrument Transformer
« Need of Instrument Transformer.
« Range Extension of Ammeter.
« Range Extension of Voltmeter.
« Advantages of Instrument Transformer.
« Current Transformer and Potential Transformer, phase error, ratio error and burden.
Use of Current Transformer and potential transformer for range extension in high voltage and current circuits.

Chapter – 4 : Cathode Ray Oscilloscope
- Need of C.R.O. in electronic measurements.
- Block diagram of a general-purpose cathode ray oscilloscope.
- Time base generator – necessity of time base signal.
- Basic C.R.O. Circuits:
  - Vertical (y) deflection system, Horizontal (x) deflection system, synchronization, Blanking Circuit, Intensity Modulation, Positioning Control, Focus Control, Intensity control, Calibration Circuit Astigmatism.
- Application of CRO: Measurement of Voltage, Current, Frequency, Phase difference.
- Special Purpose C.R.O.
  - Multiple beam oscilloscopes.
  - Multiple trace Oscilloscope.
  - Storage type oscilloscope.

Chapter – 5 : Displays and Recorders
- Displays:
  - Analog indicators/displays
  - Digital indicators/displays
    i. Cold cathode displays
    ii. Fluorescent displays
    iii. Light emitting diodes
    iv. Liquid crystal diodes
    v. Alpha-numeric display
    vi. Dot matrix display
    vii. Seven segment display
- Recorders:
  - Analog Recorder, Graphic Recorder, Optical oscillograph, Strip Chart Recorder (Null & Galvanometer).
  - X-Y Recorder, Ultraviolet Recorder, Magnetic Tap Recorder.

I) SUGGESTED INSTRUCTIONAL STRATEGIES:
A good practice and exercise is required to enable students to have complete knowledge on the subject and various measurement techniques.

J) SUGGESTED LEARNING RESOURCES.

(a) Reference Books:
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Title</th>
<th>Author, Publisher, Edition &amp; Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Electronic Instrumentation &amp; Measurement Techniques</td>
<td>Cooper W.D. &amp; Helfride A.D., Prentice Hall of India, New Delhi.</td>
</tr>
<tr>
<td>5</td>
<td>Electrical Measurement &amp; Measuring Instruments</td>
<td>Golding &amp; Widdis.</td>
</tr>
<tr>
<td>6</td>
<td>A Course in Electrical and Electronics &amp; Instrumentation</td>
<td>Rambhadran S., Khanna Publishers, Delhi.</td>
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(b) Others:
- VCDs.
- Learning Packages.
- Lab Manuals.
- Charts.

Course: Electrical & Electronic Measurements, Lab

CODE : 200323 (28)
Hours: 32

LIST OF PRACTICALS / TUTORIALS:

1. Self-inductance measurements:
   - Ammeter and Voltmeter method.
   - Voltmeter method.
   - Ammeter method.


3. Self-inductance Measurement by –
   Maxwell’s Bridges method.

6. Low-resistance Measurement by –
   - Ammeter Voltmeter method.
   - Potentiometer method.
   - Kelvin’s double bridge method.
8. Ammeter range extension using shunts.
10. Study and use of C.T. & P.T.
11. Study of C.R.O.
12. Voltage measurement on C.R.O.
13. Current measurement on C.R.O.
14. Frequency measurement on C.R.O.
15. Phase difference measurement on C.R.O.
16. Study of Displays – Cold cathode displays, Fluorescent displays, Light emitting diodes, Liquid crystal
diodes, Alpha-numeric display
   Recorders –
17. Digital Instruments –
    Digital Voltmeter, Digital Frequency Meter, Digital Panel Meter, Digital Storage Oscilloscope.
E) RATIONALE : The aim of this course is to develop some level of specialization in students of electronics & telecommunication engineering. It is often expected from the passouts of electronics and telecommunication engineering diploma programme to troubleshoot the common faults in computers that usually occur. Today large numbers of computers are being procured for different purposes. However, there are only few trained personnel in the market who are capable of maintaining computer systems similar to the way TV sets are repaired. Keeping this scenario in mind, if the size of the industry where the polytechnic passouts get employed is small or if he/she is a self entrepreneur who has just started a business, then there is a high potential of using the training in this course for employment as well as for supporting his/her own business.

This course is intended to make the student to be aware of the different parts of computer system, their functions, common faults in computers and develop troubleshooting skills of a typical computer systems.

F) TEACHING AND EXMINATION SCHEME:

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<td>Basic Concept of Computer Hardware</td>
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H) DETAILED COURSE CONTENTS:

Chapter – 1 : Basic Concept of Computer Hardware
- System Blocks of a Computer
- Basic Architecture
- Detailed Specification of a Computer

Chapter – 2 : Motherboard & Processor
- MOTHER-BOARD
  - Specification of Mother-Board
  - Commercially Available Various Type of Motherboards
  - Chipset & its importance
  - Mother-Board Jumpers / Jumper Setting and its utility
  - Panel Connections and indications

- PROCESSOR
  - Popular Processors
  - Features of a processor
  - Processor Sockets
  - Cooling of Processor
  - Socket Compatibility
  - Precautions for handling a Processor

- ADD ON CARDS
  - AGP / XGP
  - Sound-Blaster
  - TV-Tuner
  - FAX-MODEM
- Special Purpose Cards

**INSERTION SLOTS & PORTS**
- ISA / EISA Slot
- PCI / PCIMCA Slot
- AGP / XGP Slot
- IDE Slot
- RAM & External Cache Slot
- Serial / Parallel Ports
- Game / Joystick Port
- Display / VGA Connecting Port
- USB Port
- IR Port (Infra Red)

**Chapter – 3 : Input Devices**

**BASICS OF INPUT DEVICES**

**TYPES OF INPUT DEVICES**
- Key-Board
- Mouse
- Scanner (Flat Bed / Vertical Roller etc.)
- Light Pen
- Card Reader
- Camera (Web / Still / Video)

**Chapter – 4 : Output Devices**

**BASICS OF OUTPUT DEVICES**

**TYPES OF OUTPUT DEVICES**
- Printers
- Dot Matrix Printer (DMP)
- Heavy Duty Printer (HDP)
- Line Printer (LP)
- LASER Printer
- Inkjet / Desk-jet Printer
- Thermal Printer

**MULTIFUNCTION PRINTERS**
- 3-in-1 Printer
- 5-in-1 Printer

**PLOTTERS**
- Flat-Bed & Vertical Roller Plotter
- Inkjet Plotter
- Pen Plotter
- Laser Plotter

**Chapter – 5 : Display Devices**

**ADAPTERS**
- Type of Display Adapter
- CGA / VGA / SVGA / XGA / WXGA
**TYPES OF DISPLAYS**
- Display active Area
- CRT Display
- Active Matrix
- LCD / TFT Display

**Chapter – 6 : Storage Devices**

- **TYPE OF STORAGE**
  - Primary Storage Devices
  - Secondary Storage System
  - Standard Features of Storage Devices

- **HARD DISK DRIVE**
  - Features & Construction of HDD
  - Parallel IDE / ATA Drive & specifications
  - Serial IDE / ATA Drive & Specifications
  - SCSI Drive
  - Hard Disk Stacks

- **FLOPPY DISK DRIVE**
  - Features & Construction of FDD
  - Types Floppy & Floppy Drives

- **CD / DVD - DRIVE**
  - Basic Features of CD
  - Basic Features of DVD
  - CD-Drive
  - Read / Read-Write CD
  - CD / DVD Burning Process
  - Read / Read-Write CD-Drive
  - Concept of Combo Drive
  - Read / Read-Write DVD
  - Read / Read-Write DVD-Drive

- **RAM / CACHE MEMORY**
  - Fundamental of RAM
  - Various types of RAM
  - RAM Organization & its functioning
  - SIMM / DIMM
  - SRAM / DRAM
  - SDRAM / DDRAM
  - Cache Memory
  - Various types of Cache Memory
  - Working Concept & Need of Cache

**Chapter – 7 : Installation**

- **INSTALLATION OF A SYSTEM**
  - Basic idea about any type of Installation
  - BIOS Setup / POST
- Manual Configuration of BIOS
- Setting up USER / SUPERVISOR Password
- Disabling Password
- APCM

**HDD PREPARATION**
- SCANDISK
- FDISK & Partitioning of HDD
- FORMATTING of HDD

**OPERATING SYSTEMS**
- Selection Criteria of O/S
- O/S Installation
- Booting Process of the system
- Hard-Boot / Soft-Boot

**APPLICATION S/W INSTALLATION**
- SCANDISK
- FDISK & Partitioning of HDD
- FORMATTING of HDD

**MULTIMEDIA CONFIGURATION**
- Sound-Blaster Card & Software Installation
- AGP / XGP Card & Software Installation
- TV-Tuner Card & Software Installation

**FAX-MODEM ( CARD ) & SOFTWARE INSTALLATION**

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**Chapter – 8 : Virus – Antivirus & Fireballs**
- Concept and Various features of Viruses
- Types of Virus
- Antidote or Antivirus S/W
- Quarantine (For Infected File/s)
- Scanning & Virus Removal (From Infected Files)

**FIREBALL PROTECTION**
- Concept and features
- Security Features
- Security Level
- Need of Activation & Deactivation

---

**Chapter – 9 : Maintenance & Trouble-Shooting**
- Common Faults In A Computer System & Symptoms
- Normal Precautions & Preventive Maintenance
- Diagnostic S/W & Tools
- Routine Check-Up & Minor Maintenance.

---

**Chapter – 10 : Other Peripherals & Interface Devices**
- DIGITAL PAD / INTERACTIVE BOARD
- Mass Storage Devices
- Raid Controllers & Utility
- Usb Devices & Its Utility
- Wireless Lan Card & Network
- Bluetooth / Buffelo Devices
I) SUGGESTED INSTRUCTIONAL STRATEGIES:

a) The students should be demonstrated the possible faults that are encountered and he/she should be explained the process of rectification.
b) More troubleshooting exercises should be given.
c) Lecture session could be conducted directly in the computer laboratory for enhanced understanding.
d) The course should be taught by taking help of various audio visual aids.
e) Moreover, when teaching this course, the actual devices need to be brought to the class and demonstrated to the students.

J) SUGGESTED LEARNING RESOURCES:

(c) Reference Books:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Title</th>
<th>Author, Publisher, Edition &amp; Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Troubleshooting, Maintaining &amp; repairing PCs</td>
<td>Bigelow, Stephen J.; Tata McGraw-Hill, Ltd. New Delhi, 2nd, 1999</td>
</tr>
<tr>
<td>2</td>
<td>How multimedia computer works</td>
<td>BPB Publication; New Delhi 7th, 1998</td>
</tr>
<tr>
<td>4</td>
<td>Assemble Your Own Computer</td>
<td>G.K. Gupta; G.T. Publication, Jaipur, 1st, 1996</td>
</tr>
<tr>
<td>5</td>
<td>The Complete PC upgrade &amp; Maintenance guide</td>
<td>Jain, Manish; BPB; New Delhi, 7th, 1997</td>
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<tr>
<td>6</td>
<td>Modern - All About Monitors</td>
<td>Lotia, Nair; BPB Publication; New Delhi 2nd, 1999</td>
</tr>
<tr>
<td>7</td>
<td>All about Keyboard and mouse</td>
<td>Lotia; BPB Publication; New Delhi. 2nd, 1992</td>
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<tr>
<td>8</td>
<td>Complete PC upgrade &amp; Maintenance guide</td>
<td>Minasi Mark; BPB Publication; New Delhi, 7th, 1997</td>
</tr>
<tr>
<td>9</td>
<td>Upgrading and repairing PCs</td>
<td>Mueller, Scott; Prentice-Hall of India, New Delhi 8th, 1998</td>
</tr>
<tr>
<td>10</td>
<td>A Complete Guide to SMPS for PC</td>
<td>Upadhyay; BPB Publication; New Delhi, 1st, 1996</td>
</tr>
</tbody>
</table>

(d) Others:

- VCDs
- Learning Packages
- Lab Manuals
- Charts
LIST OF PRACTICALS / TUTORIALS:

a) Identify different elements of computer system.
b) Identify different beep codes and error codes.
c) Identification of different motherboards & CPU’s.
d) Configuration of slot 1 motherboard for setting up of a Pentium III processor.
e) Troubleshooting symptom failures in motherboard.
f) Troubleshooting symptom failures in FDD.
g) Installation of memory modules (SIMMs, DIMMs); CMOS battery and-on cards.
h) Installation & configuration of a display card (PCI –SVGA).
i) Installation & configuration of Video Accelerator card (2D ; 3D) in AGP slot.
j) Installation & configuration of a sound blaster card, sound and video mixing.
k) Installation of Input devices.
l) Installation of Deskjet., laser printer & printer consumables.
m) Installation of Video Display Unit (VDU).
n) Installation of Scanners.
o) Portioning and formatting a hard disk using FDISK ; Disk manager.
p) Installation and configuration of a IDE: SCSI  CD-ROM drive.
q) Installation and configuration of a DVD drive.
r) Installation and configuration of a CD-writer, creating an audio CD using CD-writer and download MP-III songs from the Internet.
s) Importing & exporting from different video formats like GIF, JPEG, TIF, PGA, CDR, PHV etc.
t) Assembly, installation and configuration and troubleshooting of complete computer system along with input output devices and UPS.
u) Installation of operating system.
v) Installation of application softwares like MS-Office 2000 and Star Office.
w) Installation of Diagnostic softwares.
x) Installation of antivirus softwares.
y) Preventive maintenance of computer system.
z) Debugging computer system.
Electricity plays a very important role in day-to-day life of every one. It also forms the very first basis for any Electronics technician course, since the fundamentals of Electrical Engg. are used in the Electronics circuits, T.V., Instrumentation-Circuit and control-Circuits.

As a technician, one is expected to know the fundamentals and utilization aspects of electrical engineering, practice the safety rules and prevent the mishaps and hazards.

The course of fundamentals of Electrical Engg. aims to impart the knowledge and practice in DC and AC circuits, machines, measuring instruments and electrical safety, which is essential in developing a solid foundation for any Electronics Engg student to become a competent technician.

The course is designed so that more emphasis on practice through laboratory work is given to reinforce fundamental concepts and develop basic skills of handling of instruments and machines.

(F) TEACHING & EXAMINATION SCHEME

<table>
<thead>
<tr>
<th>Subject</th>
<th>Period per week</th>
<th>Scheme of Examination</th>
<th>Total Marks</th>
<th>Credit</th>
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<td>234324 (24)</td>
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Distribution of Marks and Hours:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Topic</th>
<th>Hours</th>
<th>Marks</th>
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<tbody>
<tr>
<td>1</td>
<td>Basic concepts</td>
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<tr>
<td>2</td>
<td>Electromagnetism</td>
<td>06</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>A.C. Circuit</td>
<td>08</td>
<td>12</td>
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<tr>
<td>4</td>
<td>Polyphase Circuits</td>
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<td>08</td>
</tr>
<tr>
<td>5</td>
<td>Transformers</td>
<td>08</td>
<td>10</td>
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<tr>
<td>6</td>
<td>D.C. Machines</td>
<td>08</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>A.C. Motors</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>Single Phase Induction Motor</td>
<td>10</td>
<td>10</td>
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<tr>
<td>9</td>
<td>Electrical &amp; Electronic</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Measurement</td>
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<td></td>
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</tbody>
</table>
Detailed Course Contents:

1. **BASIC CONCEPTS**
   - Concept of unit of Electric Current and Voltage
   - Ohm’s Law
   - Concept of Resistance, Inductance
   - Resistivity and Conductivity, units and dependence on temperature.
   - Power & energy heating effect of electric current and conversion of units (Mechanical to Electrical).
     - Series and parallel combination of resistance and wattage considerations. Simple numerical problems.

2. **ELECTROMAGNETISM**
   - Concept of magnetic field production by flow of current
   - Concept of e.m.f.
     - Magnetic Flux
     - Reluctance
     - permeability
   - Analogy between electric & magnetic circuit.
   - Faraday’s Laws of electromagnetic Induction
     - Self and mutually induced e.m.f.,
     - Simple numerical problems.

3. **A.C. CIRCUIT**
   - Concept of alternating voltage and current, difference between A.C. and D.C.
   - Concept of Cycle, Frequency, Period, Amplitude
     - Instantaneous Value,
     - Average Value,
     - r.m.s. value
     - Peak value
     - Form factor (definitions only).
   - Concept of impedance & phase angle,
   - RL, RC & RLC Series & parallel circuits & Numerical problems

4. **POLY PHASE CIRCUITS**
   - Three phase A.C. waveform
Phase displacement, equations of each phase,
Values in each phase at any instant of time, Numerical problems.
Three phase A.C. circuit with balanced load.

5. TRANSFORMERS

- Principle of Transformer
- E.M.F. equation
- Transformation ratio
- Losses in Transformers
  - Copper loss, Core loss,
  - Efficiency, Numerical problems
- Auto Transformer
- Applications of Transformer and Auto Transformer.

6 D.C. MACHINES

- Working principle of D.C. Machines
- Constructional Features
- Classification and applications, numerical problems.

7 A.C. MOTORS

- Introduction of A.C. Motor
- Classification of A.C. Motors
- Construction of 3-? Induction motors
- Working principle of 3-? Induction Motors
- Application of 3-? Induction Motors.
- Introduction of Synchronous Motor

8 SINGLE PHASE INDUCTION MOTOR

- Types of Single Phase Induction Motor
- Capacitor start
- Capacitor start and Capacitor run
- Shaded Pole type, Universal Motor.

9 ELECTRICAL & ELECTRONIC MEASUREMENT

- General description of PMMC
  - Moving iron type instruments.
  - Dynamometers type instruments.
- Working principle and construction of Ammeters and Voltmeters, extension of range and simple numerical problems.
- Principle and working of Wattmeter (dynamometer type) and Energy meter (Induction type).
- Digital measuring instruments
Seven-segment display and its applications.
Basic concepts of CRO.

10 ELECTRICAL SAFETY

Safety Precaution.
Effect of Electric Current on Human Body.
Artificial Respiration.
Circuit Protection: Fuses, Switches, Relays of circuit, MCB, MCCB.
Earthing.

Course: Fundamental Of Electrical Engg. Lab

CODE : 234324 (24)
Hours: 48

LIST OF PRACTICAL:

1. Verify Ohm’s Law.
2. Verify KCL & KVL.
4. Measure voltage & current in RLC parallel circuit. Also calculate impedance, power factor, and Draw vector diagram.
5. Use rheostat as Regulator and Potential divider.
6. Identify the different parts of a dismantled motor.
7. Identify the different parts of 3-point starter and use it for starting single-phase induction motor.
10. Calculate transformation ratio of single phase transformer.
11. Identify various types of induction motor looking at the constructional details.
12. Measure current & voltage in balanced star connection. Also verify the relation of phase and line value of voltage and current.
13. Measure current & voltage in balanced Delta connection. Also verify the relation of phase and line value of voltage and current.
14. Measure the electrical power and energy in a given circuit.
15. Measure active & reactive power in 3-phase balance load circuit by one wattmeter method.
16. Use analog and digital multimeter for testing voltage, current and resistance.
18. Calculate fusing current of a fuse wire.
19. Observe different waveform on C.R.O. to calculate time period, maximum value, cycle, frequency etc. of A.C. waveform.
20. Calibrate given voltmeter/ammeter.
21. Calibrate energy meter at various P.F. by Standard energy meter

SUGGESTED INSTRUCTIONAL STRATEGIES:

The implementation strategy to teach this course should be a good mix of the various teaching methods like lecture, question answer, assignment and lab. work. More drill and practice to solve numerical problems, home and classroom assignments would prove more useful to develop the analytical skills. As this will be the first exposure to an electrical laboratory, the procedure of lab practices should be in more detail including the safe practices to be followed.

SUGGESTED LEARNING RESOURCES.

REFERENCE BOOKS:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Title</th>
<th>Author, Publisher, Edition &amp; Year</th>
</tr>
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<tbody>
<tr>
<td>5.</td>
<td>Electrical Technology</td>
<td>Hughes, Edward, Longman, 1st, 1990</td>
</tr>
<tr>
<td>12.</td>
<td>Electromagnetism: Theory and Applications</td>
<td>Pramanik, Prentice-hall, New- Delhi,</td>
</tr>
<tr>
<td>13.</td>
<td>Basic Electrical Engineering</td>
<td>R.K. Rajput</td>
</tr>
<tr>
<td>14.</td>
<td>Basic Electrical Engineering</td>
<td>Jain &amp; Jain</td>
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<tr>
<td>15.</td>
<td>Basic Electrical Engineering</td>
<td>Anjali Chakraborty</td>
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</tbody>
</table>

OTHERS

VCDs.

Learning Packages.

Lab Manuals.

Charts.
(A) SEMESTER : III
(B) SUBJECT TITLE : DIGITAL ELECTRONICS
(C) CODE : 200312(28)
(D) BRANCH / DISCIPLINE : INSTRUMENTATION ENGINEERING

E) RATIONALE : This course is classified under basic technology group is intended to enable the students to understand the facts, concepts, principles & procedures of digital techniques and their application used in digital circuits & systems. This subject concept will help in developing skills regarding small circuit implementation. It will also help students acquire investigation skill required for prototype testing.

F) TEACHING AND EXMINATION SCHEME:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Periods/Week (In Hours) (Teaching Scheme)</th>
<th>Scheme of Examination</th>
<th>Credit L+(T+P)/2</th>
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</table>

L : Lecture hours, : T : Tutorial hours, P : Practical hours;
ESE – End of Semester Exam.; CT – Class Test; TA – Teacher’s Assessment

G) DISTRIBUTION OF MARKS AND HOURS:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Chapter No.</th>
<th>Chapter Name</th>
<th>Hours</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Number System &amp; Codes</td>
<td>10</td>
<td>15</td>
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<tr>
<td>2</td>
<td>2</td>
<td>Boolean Algebra &amp; Logic Gates</td>
<td>12</td>
<td>25</td>
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<tr>
<td>3</td>
<td>3</td>
<td>Combinational Circuits</td>
<td>09</td>
<td>15</td>
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<tr>
<td>4</td>
<td>4</td>
<td>Sequential Circuits</td>
<td>10</td>
<td>13</td>
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<tr>
<td>5</td>
<td>5</td>
<td>D/A and A/D Converters</td>
<td>08</td>
<td>12</td>
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<tr>
<td>6</td>
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<td>Logic Families</td>
<td>07</td>
<td>10</td>
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<td>7</td>
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<td>Memories</td>
<td>08</td>
<td>10</td>
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<tr>
<td></td>
<td></td>
<td>Total</td>
<td>64</td>
<td>100</td>
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</tbody>
</table>
H) DETAILED COURSE CONTENTS:

Chapter – 1: Number System & Codes
- Number systems, Conversion between different number systems, complement of numbers i.e. 1’s, 2’s, 9’s, 10’s
- Binary Codes: Weighted & Unweighted codes, Excess-3 Code, Gray Code, Ring code, Error Detection & Correction Codes, BCD Code
- Binary Operations - Addition, Subtraction, Multiplication, Division

Chapter – 2: Logic Gates & Boolean Algebra
- Logic Gates- AND, OR, NOT, EX-OR, EX-NOR, Universal Gates, Switching circuits
- Basic Boolean Functions, Boolean theorems, De Morgan’s Theorems, function of duality, Max-term, Min-term, SOP & POS,
- Simplification of Boolean Functions with Boolean algebra. Simplification with K-map up to 5 variables.

Chapter – 3: Combinational Circuits
- Half Adder, Full Adder, Half Subtractor, Full Subtractor, 3 bit binary adder, 3 bit binary Subtractor. BCD adder, Magnitude comparator.
- Encoder, Decoder, Multiplexer, Demultiplexer.
- BCD to binary & binary to BCD decoder, BCD to Seven Segment decoder.

Chapter – 4: Sequential Circuits
- Flip-Flop – Introduction to Flip Flop- RS F/F, JK F/F, D F/F, T F/F, Clock, Set, and Reset input of F/F
- clock triggering-positive & negative clock, Edge triggering, level triggering.
- Race around condition, Master Slave F/F (unclocked & clocked input), Counters – Introduction, Synchronous & Asynchronous counter, Ripple Counter, Up-down binary counter, Decade counter, BCD counter, Ring counter, Johnson counter. Designing of counters.
- Register – Introduction, Series in-parallel out, Series in-series out, Parallel in-parallel out register, shift register, Designing of register

Chapter – 5: D/A and A/D Converters
- Binary – weighted digital to analog converters
- Counter ramp analog to digital converter
- Successive approximation analog to digital converter.

Chapter – 6: Logic Families
- Introduction to Logic IC Families- like 74 Series IC, 54 Series IC, 40 Series.
- Concept of TTL, RTL, DTL, ETL, C-MOS and comparison.

Chapter – 7: Memories
- Introduction to Memories: Magnetic memory, Semi conductor memory, Static/Dynamic memories, RAM/ROM. Programmable ROM/EPROM/EE ROM/EAROM.
I) INSTRUCTIONAL STRATEGIES:
The implementation strategy to teach this course should be a good mix of the various teaching methods like lecture, question answer, assignment and lab. work. More drill and practice of numericals will be useful. Home and classroom assignments would prove more useful to develop the analytical skills.

J) LEARNING RESOURCES.

(e) Reference Books:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Title</th>
<th>Author, Publisher, Edition &amp; Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Digital circuits and logic design</td>
<td>Lee, Prentice-Hall, 2004</td>
</tr>
<tr>
<td>2</td>
<td>Digital Electronics: An Introduction to theory and practice</td>
<td>Gothmann, Prentice-Hall, 2004</td>
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<td>3</td>
<td>Digital Electronics</td>
<td>Morris Mano</td>
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<td>4</td>
<td>Digital Fundamentals</td>
<td>T.L. Floyd</td>
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<td>5</td>
<td>Digital Electronics</td>
<td>Malvino</td>
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<td>Digital Electronics</td>
<td>R.P. Jain</td>
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<td>7</td>
<td>Digital Principles and Applications</td>
<td>Malvino, Leach</td>
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<td>8</td>
<td>Digital electronics</td>
<td>R.K. Gaur</td>
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<td>9</td>
<td>Digital Electronics (A practical approach)</td>
<td>William Kleltz</td>
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<tr>
<td>10</td>
<td>Pulse &amp; Digital Circuits And Applications</td>
<td>R. Venkatraman, Dhanpatrai &amp; sons</td>
</tr>
</tbody>
</table>

(f) Others:

- VCDs.
- Learning Packages.
- Lab Manuals.
- Charts.

*****
LIST OF PRACTICALS / TUTORIALS:

1. Verify Truth Table of Logic Gates (AND, OR, NOT, NAND & NOR Gates).
4. Verify Demorgan’s theorem.
6. Design full Adder.
7. Design Half subtractor.
8. Design full subtractor.
9. Verify the operation of magnitude comparator (7485 IC).
10. Verify the Truth Table of RS Flipflop, JK F/F, D F/F & T type F/F.
13. Design a counter for given event counting.
15. Design shift Register & verify truth table.
16. Design a register such that it can be used as a serial/parallel shift register.