Kingdom of Saudi Arabia
Al-Imam Muhammad Ibn Saud Islamic University
Faculty of Sciences
Department of Physics

PHY 324 – Electronics

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
PHY	324	Electronics	3	3	0	1	PHY 220

Learning Objectives

By the end of the course, students will:

- Develop and enhance their knowledge and understanding of the concepts of electronics.
- Appreciate the semiconductor technologies and their use in basic circuits.
- Get a lot of practical experience in building all kinds of electronic circuits
- Learn the essentials of direct-current circuits and alternating-current circuits using complex phasor techniques where applicable
- Be able to solve problems in electronics and to deal with electronic devices in daily life use.
- Understand the basic principles of digital circuits and have an appreciation of the role of digital signal processing in contemporary systems.

Syllabus (56 Hours)

AC Fundamentals (08 H): The Sine wave –Average and RMS values–The J operator – Polar and rectangular forms of complex numbers – Phasor diagram – Complex impedance and admittance- Concept of voltage and current sources – KVL and KCL- Application to AC circuits R,C,L, RL,RC, RLC - Resonance: Series resonance and parallel resonance RLC circuits .

Introduction to Semiconductor (06 H): Atomic structure, semiconductors, conductor, Insulators, conduction in semiconductor, Pure semiconductor, recombination of electrons and holes Intrinsic and extrinsic semiconductors, N and P- type semiconductors, Mobility, Drift Velocity, Energy band gap. The potential barrier, Work function, Different type of electron emission, Applications of continuity equation for the study of junction behaviour – Avalanche and zener breakdown .

PN Junction (04 H) : Depletion region – Junction capacitance – Diode equation (no derivation) – Effect of temperature on reverse saturation current – construction, working, V-I characteristics and simple applications of :Junction diode, Zener diode, Tunnel diode and Varactor diode. Filter considerations .

Rectifiers (04 H): Half wave and full wave and bridge rectifiers - power, efficiency and ripple factor for half wave and full wave rectifiers , Regulation – Harmonic components in rectified output

Silicon Controlled Rectifier (SCR) (04 H): Structure and working of SCR. Two transistor representation, Characteristics of SCR. Application of SCR for power control.

Bipolar Junction Transistor (BJT) (08 H): PNP and NPN transistors–current components in BJT – BJT static characteristics (Input and Output) – Early effect- CB, CC,CE configurations (cut off, active, and saturation regions) CE configuration as two port network – Alpha and Beta of a transistor ,Biasing and load line analysis – Fixed bias and self bias arrangement. Transistor action, Transistor as an amplifier, Operating point, Load line, expressions for current gain, voltage gain, input impedance, output impedance and power gain. Power amplifier - power BJT - Thermal resistance - Maximum power- Class A, Class B, Class AB and Class C amplifiers -Basic operational amplifier- Differential amplifier.

Operational Amplifier fundamentals (04 H): Characteristics - OpAmp parameters - inverting amplifier-non-inverting amplifier - unity follower - summing amplifier-difference amplifier. Differentiator, integrator, comparator using OP-Amps

Field Effect Transistor (FET) (06 H): Field-Effect Transistors (FET): Construction and classification, Principle of operation, Characteristic curves, Characteristic parameters of the FET, Effect of temperature on FET, Common source amplifier, Common drain amplifier, Classification of MOSFET & UJT. Application of FET as voltage variable resistor and MOSFET as a switch – Advantages of FET over transistor.

Uni Junction Transistor (UJT) (04 H): Structure and working of UJT-Characteristics. Application of UJT as a relaxation oscillator.

Optoelectronic Devices (04 H): Structure and operation of PN photodiode, Phototransistor, Solar cell, Photoconductive cell, Photovoltaic, Sensors, LED, LCD, Alphanumeric display

Digital Electronics (04 H): Introduction to number systems, Logic gates OR, AND, NOT, X-OR, NAND, NOR gates - Truth tables – Positive and negative logic – Logic families and their characteristics – RTL, DTL, ECL, TTL and CMOS.– Universal building blocks NAND and NOR gates.

Reference Books:

1- "The Art of Electronics "by Paul Horowitz and Winfield Hill, Cambridge University Press, 2nd edition (July 28, 1989)

2- "Electronic Devices and Circuit Theory"- by R.L.Boylestad and L.Nashelsky- Pearson Education.
3- "Electronics Fundamentals and Applications for Engineers and Scientists" – by Millman and Halkias - McGraw Hill
4- "Electronics, 2nd Edition", by Allan R, Hambley, Prentice-Hall, 2000.
5- "Electronic Engineering Materials and Devices", by J. Allison, 2nd ed., McGraw-Hill, 1993.
6- "Semiconductor Physics and Devices" ,by D. A. Neamen, 3rd ed., McGraw-Hill, 2003.