MANGALORE UNIVERSITY

Department of Materials Science

MSc Materials Science

MSH 402: **ELECTROMAGNETIC THEORY AND ELECTRONICS** (4 Credits**)**

Objectives: The course aims to impart fundamentals of electromagnetic theory necessary to understand the optical properties of materials. The basics of electronics are required to understand the semiconductor devices and also to understand the functioning of electronic devices/equipment for the effective use of the instruments.

Expected course outcomes: At the end of the course students will be familiar with the optical phenomena and interaction of light with materials which will be helpful in interpreting the data obtained during their future engagements. Understanding the electronics part may help the students in troubleshooting any possible minor/major faults in electronic equipment that occur.

Unit I

Electromagnetic Theory: Maxwell's equations and material equations - the wave equations and velocity of light - Boundary conditions at a surface of discontinuity - Fresnel's laws of reflection and refractions - Fresnel's rhomb. Standing waves- Wiener's experiments - Lippman's colour photography.

Propagation of light in a medium: Dispersion in dielectric – Sellmeir's formula - propagation in metal - Hagen formula. Propagation in crystals - wave vector surface - ray theory - ray velocity - double refraction - optical activity - Faraday rotation.

18 hours

Unit II

Electronics: Active and passive components - Diodes, transistors, SCR, FET. Resistors - carbon resistors, wire wound resistors, IC resistors - thick and thin film resistors. Capacitors - Tantalum, electrolytic, oxide capacitors, junction capacitors, IC capacitors - thick and thin film capacitors. Inductors. Power supplies - Rectification and filter action - Types of voltage regulators, shunt and series regulators using transistors. Applications - SMPS, 3 pin IC regulators, voltage stabilizers (servo, CVT). Amplifiers: Types of transistor amplifiers - small signal amplifiers-design calculation, power amplifiers. Oscillators: Feed back concepts - negative and positive. Phase shift oscillators, crystal oscillators, LC oscillators - Hartly and Colpitt's oscillators. 18 hours

Unit III

Wave shaping circuits: Different types of waveforms. Integrating and differentiating circuits. Clipping circuits - diode clipper- positive and negative clippers, biased clippers - double diode clipper. Clamping circuits - positive and negative clamping, partial clamping. Multivibrators: Astable, bistable, and monostable multivibrators. Schmitt trigger.

Operational Amplifiers: Introduction - Characteristics. Applications - inverting, non-inverting, difference, and summing amplifier. Differentiation and integration circuits using opamp.

18 hours

References

1. Introduction to Modern Optics – G R Fowles (Rinehart & Winstar Inc., 1968)
2. Optics – A N Mateev (MIR, 1988)
3. Optics – Ajoy Ghatak (Tata McGraw-Hill, 1995)
4. Electromagnetics – J D Krans (McGraw Hill, 1987)
5. Semiconductor Devices – J Brophy (George Allen, 1964)
6. Solid State Electronic Devices – Ben G Streetman (Prentice-Hall, 1995)
7. Electronic Devices and Circuits – A Mottershead (Prentice-Hall, 1991)
8. Integrated Electronics – Millman and Halkias (McGraw Hill, 1995)
9. Digital Principles and Applications – A P Malvino and Lach (McGraw-Hill, 1986)
10. Microprocessors: Principles and applications –C M Gilmore (McGraw-Hill, 1995)
11. Introduction to microprocessors – A P Mathur (Tata McGraw-Hill, 1995)