Subject Code	EX002
Subject Title	Engineering Science

Objectives

This unit aims to assess the students' knowledge of the Engineering science. Engineering is a discipline that uses scientific theory to design, develop or maintain systems.

Syllabus

1. **Mechanics of deformable bodies (Concept of Stress and strain)**
   Elastic constants, Hooke's law, Axially loaded bars, Variation of Shearing loads and bending moments in beams, Introduction to 2D stress, Poisson's ratio.
2. **Heat**
   Temperature Measurement, thermal expansion, behavior of gases, kinetic theory of gases, heat exchange, vapour and humidity, laws of thermodynamics, and transfer of heat.
3. **Optics**
   Wave optics, ray optics, reflection, refraction, optical instruments
4. **Principles of gravitation**
   Gravitational force and Newton's Law, Earth's gravitational field
5. **Electrostatics**
   Coulomb's Law, Electric field intensity, Electric flux density and electric potential, Gauss's Law, equipotential surfaces, dielectric breakdown, corona discharges, Capacitance, effect of earth on capacitance, Energy stored in electric field; forces due to different distribution of charges
6. **Magnetics**
   Magnetic field intensity and flux density, Biot Savart's Law, Ampere's Law, motion of a charged particle in a magnetic field, Magnetic circuits, Ampere's Circuital Law, Inductance of coils, cables and parallel lines, effects of earth on inductance; mutual inductance, Magnetic actuators, magnetic force, Electromagnetic induction; Faraday's Law and Lenz's Law, principle of transformer action
7. **Electrical circuits**
   Basic circuit Laws; calculation R, RC and RL circuits with DC inputs, Periodic waveforms and waveform parameters, linear circuits with AC inputs; use of complex phasors and phasor diagrams; real, reactive and complex power, resonant circuits
8. **Basic electronics**
   Diode rectifiers; smoothing circuits; Zener regulators; LED and photo diodes, Amplifier circuits using BJTs and FETs; biasing calculations and small signal calculations, Operational amplifiers, Basic digital electronics, use of logic gates for implementing Boolean functions; latches, flip-flops and applications
9. **Mechanical properties of matter**
   Elasticity of solids, Viscosity, Surface tension, Osmosis.
10. **Matter and Radiation**
    Quantum nature of radiation, Photoelectric effect, wave particle duality, X – rays, Radioactivity, nuclear energy
11. **Engineering Chemistry**
    Mass and component balance of a system, Mass balance with chemical reaction, Reaction rates and its implications, Heat balance of chemical systems with or without reactions

Assessments	Exam Duration: 3 hours
	Nature of questions:
	Application of fundamentals in science to solve engineering problems with particular reference to fundamentals learned in GCE A/L
	Two sections
	    o Section 1 - compulsory 3 main questions
	    o Section 2 – 3 out of 6 field specific questions
	Mark allocation – 100 marks for each question
	Pass mark is 50 out of 100

References

1. Higher Engineering Science, By W Bolton
2. Higher National Engineering, 2nd ed, by Mike Tooley
3. Physics for Scientists and Engineers, by Randall D. Knight