Semester II
DSC A2: Electricity & Magnetism

Course Title: Electricity and Magnetism	Course Credits: 4
Total Contact Hours: 52	

Programme Outcomes

1. Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.
2. Problem solving: Execute a solution process using first principles of science to solve problems related to respective discipline.
3. Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
4. Ethics: Apply the professional ethics and norms in respective discipline.
5. Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.
6. Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs)	Program Outcomes (POs)					
	1	2	3	4	5	6
i. Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.	x	x				
ii. Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.	x					
iii. Apply Gauss's law of electrostatics to solve a variety of problems.	x	x			x	
iv. Describe the magnetic field produced by magnetic dipoles and electric currents.	x					
v. Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.	x					
vi. Describe how magnetism is produced and list examples where its effects are observed.	x				x	x
vii. Apply Kirchhoff's rules to analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.	x	x			x	x
viii. Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity,• Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines.	x	x			x	x

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

DSC A2: Electricity and Magnetism (credits 4+2)		52 Hrs
Unit 1		
Chapter 1	Electric charge and field, Coulomb's law, electric field strength, electric field lines, point charge in an electric field and electric dipole, work done by a charge (derivation of the expression for potential energy)	(13)
Chapter 2	Gauss's law and its applications (electric fields due to (i) charged infinite plane (ii) uniformly charged sphere (iii) uniformly charged infinite cylinder)	
Chapter 3	Electric potential, line integral, gradient of a scalar function, relation between field and potential. Potential due to point charge and distribution of charges (Examples: potential associated with a spherical charge distribution, infinite line charge distribution, infinite plane sheet of charges). Constant potential surfaces, Potential due to a dipole and electric quadrupole.	
Self study	Constant potential surfaces - for self learning Work out problems listed in the reference	
	Suggested Activities	
Activity 1	1. Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries. 2. A small project report on production of electricity as a source of energy: Different methods	
Activity 2	1. Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire. 2. Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures	
Unit 2		
Chapter 4	Conductors in electrostatic field, Conductors and insulators, conductors in electric field. Capacitance and capacitors, calculating capacitance in a parallel plate capacitor, parallel plate capacitor with dielectric, Energy stored in a capacitor, Dielectric and Guass's law for dielectrics.	(13)
Chapter 5	Electric currents and current density. Electrical conductivity and Ohm's law. Physics of electrical conduction, conduction in metals and semiconductors, circuits and circuit elements: Variable currents in capacitor circuits, Resistor, inductor and capacitor and their combination. force on a moving charge.	
Sself study	Currents and voltage in combination of R, L and C circuits	
	Suggested Activities	
Activity 3	1. Learn about electrical appliances which work with AC and DC electricity 2. Learn about types of resistors and their colour codes and types of capacitors(electrolytic and non-electrolytic)	

Activity 4	1. Learn about power transmission: 3-phase electricity, voltage and phase 2. Visit a nearby electrical power station. Interact with line men, Electrical engineers and managers. Discuss about power loss in transmission. How to reduce it? 3. Prepare a small project report on street lighting and types of electrical bulbs.	
Unit 3		
Chapter 6	Magnetism: Definition of magnetic field, Ampere's law and Biot-Savart law (magnetic force and magnetic flux), Magnetic force on a current carrying conductor, Hall effect. Electromagnetic induction, conducting rod moving in a magnetic field, Faraday's laws of induction, self inductance, mutual inductance and energy stored in a magnetic field.	(13)
Chapter 7	Alternating current circuits: Resonant circuit, alternating current, quality factor, RL, RC, LC, LCR circuits, admittance and impedance, power and energy in AC circuits.	
Self study	Hall Effect	
	Suggested Activities	
Activity 5	1. Prepare a small project report on street lighting and types of electrical bulbs. 2. Learn the measurement of electric current using tangent galvanometer.	
Activity 6	Build a small coil with insulated copper wire. Connect an ammeter micro/milli ammeter. Verify magnetic induction using a powerful bar magnet.	
Unit 4		
Chapter 8	Electromagnetic waves: Equation of continuity, Maxwell's equations, displacement current, electromagnetic wave, energy transported by electromagnetic waves. Electromagnetic waves in different frames of reference, Field of a current loop, magnetic moment, Electric current in atoms, electron spin and magnetic moment, magnetization and magnetic susceptibility.	(13)
Chapter 9	Types of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials. B-H hysteresis curves.	
Self study	B-H curves and its characteristics, Ferrites	
	Suggested Activities	
Activity 7	1. Prepare a small project report on production of magnetic field: Permanent magnets, electromagnets and superconducting magnets. 2. Learn the principle of working of a Gauss meter to measure magnetic field	
Activity 8	Model the earth's magnetic field with a diagram. Explain the effect of tilt of the earth's axis and reasons for the change in the tilt of the earth's axis over thousands of years.	

Note: 1. Activities have to be carried out compulsorily. In addition to the suggested activities, teacher has to encourage students to carry out many possible activities under every unit. 2. Enough number of numerical/analytical problems must be solved in every chapter.

References Books:

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics-Part-II,	David Halliday and Robert Resnick	Wiley Eastern Limited	2001
2	Berkeley Physics Course, Vol-2, Electricity and Magnetism, Special Edition	Edward M Purcell	Tata Mc Graw-Hill Publishing Company Ltd, New Delhi	2008
3	Electricity and magnetism.	D. Chattopadhyay, P.C Rakshit	New Central Book Agency (P) Ltd.	2004
4	Electricity and magnetism	K.K Tewari	S Chand and Company	2007
5	A Text Book of Electrical Technology Volume- I & II	B.L Theraja, A.K Theraja.	S Chand and Company	2014

DSC A2: Practical II

List of Experiments to be performed

1.	Experiments on tracing of electric and magnetic flux lines for standard configuration.
2.	Determination of components of earth's magnetic field using a Ballistic galvanometer.
3.	Determination of capacitance of a condenser using B.G.
4.	Determination of high resistance by leakage using B.G.
5.	Determination of mutual inductance using BG.
6.	Charging and discharging of a capacitor(energy dissipated during charging and time constant measurements.
7.	Series and parallel resonance circuits (LCR circuits).
8.	Impedance of series RC circuits- determination of frequency of AC.
9.	Study the characteristics of a series RC and RL Circuit.
10.	Determination of self inductance of a coil.
11.	Verification of laws of combination of capacitances and determination of unknown capacitance using de - Sauty bridge.
12.	Determination of B_H using Helmholtz double coil galvanometer and potentiometer.

Note: Minimum EIGHT experiments have to be carried out.

Open Elective theory course for Semester II
(OE-II: Astronomy)

Programme Outcome

1. Students will learn about ancient, Indian and modern Astronomy
2. Students will learn about optical instruments used for study of Astronomical objects.
3. Students will about Sun and Moon their dynamics.
4. Students will learn about outer planets such as Mars, Jupiter and Saturn.
5. Students learn and appreciate the seasonal changes and their relation to Astronomy.

OE-II: Astronomy (3 credits)		**39 Hrs**
Unit 1 : History and Introduction		
Chapter 1	Ancient Astronomy : Greek Observations, Sumerian Observations,Mayan Observations, Arabic Observations ,Chinese Observations	(13)
Chapter 2	Indian Astronomy: Vedic Astronomy, Ancient Astronomy–Aryabhata, Varahamihira,Bhaskara Astronomy in Indian Scriptures, Precession of the Equinox, Celebrations of Equinox	
Chapter 3	Medieval & Modern Astronomy Invention of Telescopes, Models of the Solar System & Universe, Observations by Tycho Brahe, Kepler, Galileo, Herschel and other,modern Astronomy	
Chapter 4	Optical tools for Astronomy: Pin Hole, Binoculars, Telescopes & Imaging.	
Chapter 5	Mathematical Methods of Observations Angular Measurement, Trigonometric functions, Stellar Parallax	
Chapter 6	Observational Terminologies Cardinal Directions, Azimuth, Altitude, Measurements using Compass and Hand. Equatorial Co-ordinates, Light years, Magnitude, Colors etc.	
Unit 2: Observations of the Solar System		
Chapter 7.	The Sun : Ecliptic and the Orientation of the Earth, Seasons - Solstices and Equinox, Observations of the Sun from Earth during seasons. Eclipses, Zero-shadow day, Sunspots	(13)
Chapter 8	The Moon, Earth-Moon system – Phases, Lunar Eclipses, Ecliptic and Lunar Orbital Plane – Nodes, Lunar Month, Full Moon Names	
Chapter 9.	Inner Planets: Mercury & Venus, Observational History, Observational Windows, Appearance, Apparitions, Elongations, Superior Conjunctions, Inferior Conjunctions, Transits.	
Chapter 10	Outer Planets: Mars, Jupiter & Saturn Observational History. Observational Windows, Appearance, Frequency of oppositions, Conjunctions, Moons Eclipses. Galilean Moons, Saturn's Rings	

Unit 3: Major Astronomy Observations 3: Observations across a Year		
Chapter 11	March to June Prominent Stars and Constellations Visible during this period, Methods of Spotting.	(13)
Chapter 12	June to September Prominent Stars and Constellations Visible during this period, Methods of Spotting.	
Chapter 13	September to December Prominent Stars and Constellations Visible during this period, Methods of Spotting.	
Chapter 14	December to March **Pr**ominent Stars and Constellations Visible during this period, Methods of Spotting.	

Activities

1. Measuring Seasons using Sun's Position.
2. Measuring Distance using Parallax.
3. Estimation of the Stellar Diameter using Pin Hole
4. Measuring Height of an Object Using Clinometer.
5. Star spotting using constellation maps
6. Constellation spotting using Skymaps
7. Estimation of 'Suitable Periods' to observe deep sky objects using Planisphere.
8. Estimation of the Size of the Solar System in using Light Years.
9. Identification of Lunar Phases across a year.
10. Measuring Constellation of the Sun using Night Skymaps or Planispheres.

Reference Books:

1. The Stargazer's Guide - How to Read Our Night Sky by Emily Winterburn
2. A guide to the Night Sky – Beginner's handbook by P.N. Shankar
3. The Complete Idiot's guide to Astronomy by Christopher De Pree and Alan Axelrod

Text Books

1. P. N. SHANKAR A GUIDE TO THE NIGHT SKY
   https://www.arvindguptatoys.com/arvindgupta/nightskyshankar.pdf
2. BimanBasu , Joy of Star Watching , National Book Trust of India 2013

References Books

Christopher De Pree :The Complete Idiot's Guide to Astronomy, Penguin USA, 2008

Emily Winterburn ,The Stargazer's Guide: How to Read Our Night Sky, Constable and Robinson, 2008

Note: Activities have to be carried out compulsorily. In addition to the suggested activities, teacher has to encourage students to carry out many possible activities under every unit.

DEAN
Faculty of Science & Technology
Gulbarga University, Kalaburagi-585 106.

PROFESSOR & CHAIRMAN
Department of Physics
Gulbarga University
KALABURAGI - 585 106