Department of Physics
Govt. Degree College (Boys) Baramulla

SEMESTER 2nd MAJOR / MINOR
COURSE: PHYSICS (ELECTRICITY AND MAGNETISM) CODE: PHY222M
CREDITS: 04 (Theory) + 02 (Prac)

Unit – I: Vector Analysis: Review of vector algebra, Scalar and Vector product, total and partial differentiation of a vector, gradient, divergence, Curl and their physical significance, Scalar and vector field. Vector Integration: Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem (statement only). Differential equations of first and second order of degree one and their solutions: Linear differential equations.

Unit – II: Electrostatics: Electrostatic Field **(E)**, Path of charged particle in an electric field, electric flux, Gauss's theorem of electrostatics, Differential form of Gauss Law, Applications of Gauss theorem: Electric field due to point charge, uniformly charged spherical shell and solid sphere, electric field due to uniform infinite cylindrical charge. Electric field as negative gradient of electric potential, Electric potential due to electric dipole, uniformly charged spherical shell and solid sphere.

Unit – III: Parallel plate capacitor filled with dielectric; polarization of dielectric and Polarization vector (P); Displacement vector (D). Relation between **E**, **P** and **D**. Molecular Polarizability, electric susceptibility and Dielectric constant, Relation between dielectric constant and susceptibility. Gauss's law in dielectrics, energy stored in electric field in presence of dielectric; Boundary conditions on **E** and **D**. Steady current and current density; equation of continuity; vector form of Ohm's law; Biot-Savart's law; **B** due to a current carrying straight wire; Ampere's circuital law; Differential form of Ampere's law; Magnetic flux; Gauss's law of Magnetostatics; Intensity of magnetisation, relative permeability and magnetic susceptibility; Relation between relative permeability and magnetic susceptibility; Boundary conditions on **B** and **H**. Brief introduction of dia. para, and ferro-magnetic materials.

Unit – IV: Electromagnetic induction: Faraday's laws of electromagnetic induction, Faraday's law in universal form, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field, Displacement current, Maxwell's equations of electromagnetism in differential and integral form, Poynting vector, Energy density in electromagnetic field, Wave equation, Electromagnetic wave propagation through vacuum and isotropic dielectric medium. Properties of EM waves.

Books Recommended:

1. Berkeley Physics Course Vol.2; Electricity and Magnetism; E.M. Purcell (McGraw Hill)
2. Halliday and Resnick; "Physics"; Vo.2
3. D.J.Griffiths; "Introduction to Electrodynamics" (Prentice Hall of India).
4. Reitz and Milford; "Electricity and Magnetism" (Addison Wesley).
5. A.S. Mahajan and A.S.Rangwala; "Electricy and Magnetism" (Tata McGraw Hill.
6. A.M.Portis; "Electromagnetism Fields"
7. Pugh and Pugh; "Principels of electricity and Magnetism" Addison Wesley.
8. Panofsky and Phiullips; "Classicial Electricity and Magnetism" India Book House
9. S.Atwood; "Electricity and Magnetism"; Dover.
10. Satya Praash, "Electricity and Magnetism" (PPM)

Semester II **Skill Course** **Course Title: Solar PV Installer**
Course Code: BPH22S202 **Q P Name: SGJ/Q0101, V1.0** **Credits: 2(Th.)+2(Pr.) = 04** **NSQF Level: 04**

Learning Outcomes:
After completing this programme, participants will be able to:

. Understand concepts of Physics, Energy and Electronics applied in the working of Solar Energy Devices.
. Carry out the site survey for installation of Solar PV system
. Assess the customer's Solar PV requirement
. Procure the Solar PV system components
. Identify and Use the Tools & tackles used for Solar PV system installation
. Install the Civil/Mechanical and Electrical components of a Solar PV system
. Test and Commission Solar PV system
. Maintain Solar PV system
. Maintain personal Health & Safety at project site
0. Troubleshooting of equipments installed.

Unit I: Basics of Electricity and Solar Energy-II:

- Work, Mechanical Power, Energy, Units of Energy, Heating Effect of electric current, Wattage of household items, Horse Power.
- Magnetism, Current & Magnetic field, Ampere's Law, Solenoid, Self & Mutual Inductance, Transformer.
- Alternating Current, Frequency of AC, AC Voltage and Current, Sine wave, Average Value, RMS value, Simple AC Circuit, Resistance in AC Circuit, Inductance in AC Circuit, Capacitor in AC Circuit, Power in AC Circuit, Power Factor, Reactance of an AC Circuit, Impedance, AC Generator, Single Phase, 3 Phase.
- Types of wires and cables, Insulating Materials, Standard wire gauge, Specifications of wires and cables.

Unit II: Solar Photovoltaic Systems – II:

- Basic terminologies of a PV cell (I-V Curve, efficiency, FF), Solar Cells to Module, Module name plate specifications, Basic Structure of PV module, Module to Array, Classification of PV Modules based upon technology, PV Cell/Module manufacturing process (Brief idea), Applications of PV, Different configurations of PV power system: Stand alone, Grid connected, hybrid system etc.
- Introduction to Batteries, types of batteries, operation and structure, Basic Terminologies of a Battery, Charging & Discharging Characteristics, Factors affecting Battery operation and Selection Criteria.
- Introduction to Inverter, types of Inverters, operation, make and specifications, Basic Terminologies of an Inverter and Characteristics, Factors affecting inverter operation and Selection Criteria.
- Introduction to Charge Controllers, Basics of Charge controllers, operation and specifications, DC-DC converters, Types of charge controllers and selection criteria,

Practicals:

Study of a Sine wave using CRO.
Determination of Frequency of AC.
Study of an AC Circuit with a capacitor in it
Study of an AC Circuit with inductor in it
Study of Reactance and Impedance of an AC Circuit.
Study of a Transformer
To demonstrate the working of diode as Bypass diode and blocking diode.
To draw the charging and discharging characteristics of battery.
Observe the output waveform of the inverter in auto mode.
. To understand Electrical parameters associated with batteries charging/discharging curves and of a Battery management system.
. Study of Solar Devices like Solar Cooker etc.
. Field trip to nearby hydroelectric stations/ solar power installation

Books Recommended:

Non-Conventional Energy Resources, B.H.Khan
Non-Conventional Energy Resources, D.S.Chauhan and S.K.Srivastava
Solar Energy, S.P. Sukhatme and J. K. Nayak
Solar Energy – M.P Agarwal – S.Chand and Co. Ltd.
Solar Energy – Suhas P Sukhative Tata McGraw Hill Publishing Compant Ltd.
Handbook of Batteries: Thomas Reddy
Solar Photovoltaic Technology and Systems by C S Solanki, PHI Learning Publications
Modern Battery Engineering: K P Birke
Power Electronics: P S Bimbhra
. Smart Solar PV Inverters with Advanced Grid Support: R K Varma

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Semester 1st Multidisciplinary

Subject: Physics

Course title: Energy Sources Course Code: **PHY022I**
Credits: 2+1

Unit I

Physics as a fundamental science, physics and society, relation of physics with other sciences, Energy crisis as a major challenge of the century; Energy concept and sources in general, its significance & necessity, Classification of energy sources: Primary and Secondary energy sources. Commercial and Non-commercial energy sources, Renewable and Non-renewable energy, Conventional and Non-conventional energy. Importance of Non-commercial energy resources Conventional energy sources: Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations, Impact on environment and their issues & challenges. Overview of Indian & world energy scenario with latest statistics–consumption & necessity. Need of eco-friendly & green energy & their related technology, Environmental issues and Renewable sources of energy, Sustainability.

Unit II

Solar energy: Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar cooker, solar green houses, solar cell. Need and characteristics of photovoltaic (PV) systems, PV modules, and sun tracking systems.

Wind and Tidal Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different types of wind turbines, An overview of developments in Offshore Wind Energy,
Tidal Energy, Tide Energy Technologies, Wave energy systems, Ocean Thermal Energy Conversion.
B**iomass**, biochemical conversion, biogas generation, geothermal energy, Small Hydroelectricity.

Practicals:

1. Demonstration of training modules on solar energy, wind energy etc
2. Conversion of thermal energy into voltage using thermoelectric modules
3. VI characteristics of solar cell/modules
4. Field trip to nearby hydroelectric stations/ solar power installation
5. Project report on solar, hydro energy scenario in India.
6. Visit to site of Geothermal energy
7. Visit to wind farm
8. Project report on energy crisis in the world
9. Project report on potential of solar energy in the world and in India
10. Study of rural electrification plants of Govt. of India.

Reference Books:

1. Non-conventional energy sources – G.D Rai – Khanna Publishers, New Selhi
2. Solar Energy – M.P Agarwal – S.Chand and Co. Ltd.
3. Solar Energy – Suhas P Sukhative Tata McGraw Hill Publishing Compant Ltd.
4. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
5. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA)
6. Solar Energy: Fundamentals, Design, Modelling and Applications by G. N. Tiwari, Narosa Publications
7. Non-Conventional Energy Resources by B H Khan, McGraw Hill
8. Solar Photovoltaic Technology and Systems by C S Solanki, PHI Learning Publications