FYUGP-CBCS

NOWGONG COLLEGE
(Autonomous)

SYLLABUS

Department of Physics

Learning Outcome-based Curriculum Framework (LOCF) of
Four Year Undergraduate Programme
Choice-based Credit System with flexibility

Effective from Academic Year 2023-24

Syllabus is approved in Academic Council, Nowgong College (Autonomous)
Dated: 30th June, 2023

SYLLABUS FOR UG PROGRAMME IN PHYSICS
Course and Credit Structure

Semester	Major (Maj)	Minor (Min)	Inter-Disciplinary	AEC	SEC	VAC (Any Two)	Summer Internship	Research Project/Dissertation	Total Credit
1st	PHYS-MAJ-1014 (Mechanics)	PHYS-MIN-1014 (Mechanics)	PHYS-IDC-1014 (Physics for Everyone)	ASSA/HIND/BENG-AEC-1012 Jugajogmulok Axomiya/ Vyakaran Evam Vyavaharik Hindi/Byowoharic Bangla – I	PHYS-SEC-1014 (Physics Workshop Skill)	UNIN-VAC-1012 (Understanding India) ENSC-VAC-1012 (Environmental Science) NASS-VAC-1012 (National Service Scheme) NASS-VAC-1012 (National Service Scheme)	---	---	22
2nd	PHYS-MAJ-2014 (Electricity and Magnetism)	PHYS-MIN-2014 (Electricity and Magnetism)	PHYS-IDC-2014 (Basic	ASSA/HIND/BENG -AEC-	PHYS-SEC-2014 (Electric	DITS-VAC-2012 (Digital Technologi	---	---	22

			Astronomy)	2012 Byowoharic Axomiya/ Karyalayi Hindi /Byowoharic Bangla – II	Circuit & Network Skills)	cal Solutions) YOMH-VAC-2012 (Yoga and Mental Health) NACC-VAC-2012 (National Cadet Corps)			
Certificate after 1 Year									
3rd	PHYS-MAJ-3014 (Mathematical Physics-I) PHYS-MAJ-3024 (Waves and Optics)	PHYS-MIN-3014 (Mathematical Physics-I)	PHYS-IDC-3014 (Renewable Energy and Energy Sources)	ENGL-AEC-3012 (English and Mass Communication)	PHYS-SEC-3014 (Weather Forecasting)	---	---	---	22
4th	PHYS-MAJ-4014 (Mathematical Physics-II) PHYS-MAJ-4024 (Analog Systems and Applications) PHYS-MAJ-4034 (Thermal Physics) PHYS-MAJ-4044 (Elements of Modern Physics)	PHYS-MIN-4014 (Thermal Physics)	---	ENGL-AEC-4012 (Academic Writing)	---	---	---	---	22

Diploma after 2 Years									
5th	PHYS-MAJ-5014 (Mathematical Physics-III) PHYS-MAJ-5024 (Digital Systems and Applications) PHYS-MAJ-5034 (Quantum Mechanics and Applications) PHYS-MAJ-5044 (Solid State Physics)	PHYS-MIN-5014 (Digital Systems and Applications)	---------	-------	---------	---------	PHYS-INTE-5012 (Internship) Laboratory Skill	---------	22
6th	PHYS-MAJ-6014 (Electromagnetic Theory) PHYS-MAJ-6024 (Statistical Mechanics) PHYS-MAJ-6034 (Nuclear and Particle Physics) PHYS-MAJ-6044 (Advanced Mathematical Physics) PHYS-MAJ-6052 (Project/ Dissertation)	PHYS-MIN-6014 (Nuclear and Particle Physics)	---------	---------	----------	----------	--------	----------	22

Degree after 3 years (With Major/Minor)									
7th	PHYS-MAJ-7014 (Classical Mechanics) PHYS-MAJ-7024 (Electrodynamics) PHYS-MAJ-7034 (Quantum Mechanics)	PHYS-MIN-7014 (Classical Mechanics)	--------	--------	----------	REET-VAC-7012 (Research Ethics)	--------	REME-MAJ-7044 (Research Methodology)	22
8th	PHYS-MAJ-8014 (Atomic and Molecular Spectroscopy)	PHYS-MIN-8014 (Atomic and Molecular Spectroscopy)	----------	--------	--------	INPR-VAC-8012 (Intellectual Property Rights)	--------	PHYS-DISS-80112 (Dissertation) (Those who are undertaking Research Project or Dissertation) OR PHYS-MAJ-8024 (Advanced Nuclear Physics) PHYS-MAJ-8034 (Condensed Matter Physics) PHYS-MAJ-8044 (Electronics) (Those who are not undertaking	22

								Research Project or Dissertation)	
Degree after 4 years (With Honours/by Research)									176

N.B.: 1. 4 credit papers = 100 marks (60T+20IA+20P)

2. 2 credit papers = 50 marks (30T+10IA+10P) & AEC: 50 marks (40T+10IA)

Question pattern:

- For 100 marks papers [1 marks x 7 (no option) , 2 marks x 4(no option) , 5 marks x 3 (5 options), 10 marks x 3 (5 options)]
- For 50 marks papers [1marks x 4 (no option), 2 marks x 3 (no option), 5 marks x 2 (4 options), 10 marks x 1 (2 options)]
- For AEC 50 marks papers [1 marks x 4 (no options) , 2 marks x 3 (no options), 5 marks x 2 (4 options), 10 marks x 2 (4 options)]

SEMESTER I
Course Code: PHYS-MAJ-1014
Course Paper: MECHANICS

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives: -

1. To get acquainted with the dynamics of the system of particles, motion, elasticity.
2. To understand the concept of gravitation and special theory of relativity.

Learning Outcome: -

1. Successful students would be able to develop knowledge on the mechanics and dynamics of the particles and special theory of relativity and can apply its concept on various physical phenomena.
2. The students would be able to understand the basics of material properties like elasticity, elastic constants and their relation, torsion of a cylinder, bending of a beam, cantilever, beam supported at its ends and loaded in the middle.

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CONTENTS:

Theory:

UNIT 1: FUNDAMENTALS OF DYNAMICS

1.1 LINEAR AND ROTATIONAL DYNAMICS (LECTURES 10)

Momentum of variable mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse, Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.

1.2 WORK AND ENERGY (LECTURES 4)

Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy.

1.3 COLLISIONS AND ELASTICITY (LECTURES 4)

Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames, Relation between Elastic constants. Twisting torque on a Cylinder or Wire, Cantilever

UNIT 2: GRAVITATION AND CENTRAL FORCE MOTION (LECTURES 7)

Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. Motion of a particle under a central force field. Two-body problem and its reduction to one body problem and its solution. The energy equation and energy diagram. Kepler's Laws.

UNIT 3: OSCILLATIONS (LECTURES 6)

SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor. Compound Pendulum.

UNIT 4: RELATIVITY (LECTURES 14)

Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications, Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum.

Practical/ Presentation:
A minimum of seven experiments to be done.

1. Measurements of length (or diameter) using vernier caliper, screw gauge, Spherometer and travelling micro- scope.
2. To study the Motion of Spring and calculate (a) Spring constant and (b) Rigidity modulus.
3. To determine the Moment of Inertia of a cylinder about two different axes of symmetry by torsional oscillation method.
4. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
5. To determine the Young's Modulus of the material of a wire by Searle's apparatus.
6. To determine the Modulus of Rigidity of a Wire Static method.
7. To determine the value of g using Bar Pendulum.
8. To determine the value of g using Kater's Pendulum.
9. To determine the height of a building using a Sextant.
10. To determine g and velocity for a freely falling body using Digital Timing Technique.

Suggested Readings:

- Mechanics, Prof. D.S.Mathur and Dr. P. S. Hemne, First Edition, Reprint 2014, S Chand.
- Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley
- BSc Practical Physics, N N Ghosh, 2017, Bharati Pawan Publishers.
- A Text Book of Practical Physics, Dr. Samir Kumar Ghosh, 2005, New Central Book Agency.
- An Introduction to Mechanics, D. Kleppner, R. J. Kolenkow, 1973, McGraw-Hill.
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
- University Physics, F. W. Sears, M. W. Zemansky, H.D Young 13/e, 1986, Addison Wesley.
- Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
- An Advance course in Practical Physics, D Chattopadhyay and P C Rakshit, 2013, New Central Book Agency.

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SEMESTER II

Course Code: PHYS-MAJ-2014

Course Paper: ELECTRICITY AND MAGNETISM

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives: -

1. The emphasis of the course is to provide better perspective and understanding on electric and magnetic fields and their interactions with the matter and various circuit theories.
2. The practical are designed in such a way that the students can have implications with the prescribed theories.

Learning Outcome: -

1. After successful completion of this course, students would be able to understand electric and magnetic fields in matter.
2. The students would be able to understand magnetic properties of matter, electromagnetic induction and also would be able to apply Kirchhoff's law. The hands-on experiment will provide a better understanding of electricity and magnetism and various parameters of the circuit.

CONTENTS:

Theory:

UNIT 1: ELECTRIC FIELD AND ELECTRIC POTENTIAL (LECTURES 15)

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. Potential and Electric Field of a dipole. Force and Torque on a dipole

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor.

UNIT 2: DIELECTIC PROPERTIES OF MATTER (LECTURES 10)

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics.

UNIT 3: MAGNETOSTATICS AND ELECTROMAGNETIC INDUCTION (15)

Magnetic force between current elements and definition of Magnetic Field B, Biot-Savart's Law and its simple applications: straight wire and circular loop, Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole), Ampere's Circuital Law and its application to Solenoid and Toroid, Properties of B: curl and divergence, Scalar potential and Vector Potential. Faraday's Law, Lenz's Law, Self-Inductance and Mutual Inductance, Reciprocity Theorem, Energy stored in a Magnetic Field, Introduction to Maxwell's Equations, Charge Conservation and Displacement current.

UNIT 4: ELECTRICAL CIRCUITS (LECTURES 5)

AC Circuits: Kirchhoff's laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width, Parallel LCR Circuit.

Practical/ Presentation

A minimum of five experiments to be done

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To verify the Thevenin and Norton theorems.
6. To determine self-inductance of a coil by Anderson's bridge.
7. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width
8. To study the response curve of a parallel LCR circuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q.

Suggested Readings:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw.
- Electricity and Magnetism, R. Murugeshan, S Chand
- An Advance course in Practical Physics, D Chattopadhyay and P C Rakshit, 2013, New Central Book Agency.
- BSc Practical Physics, N N Ghosh, 2017, Bharati Pawan Publishers.
- Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education.
- Feynman Lectures Vol.2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- A Text Book of Practical Physics, Dr. Samir Kumar Ghosh, 2005, New Central Book Agency.

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SEMESTER I
Course Code: PHYS-MIN-1014
Course Paper: MECHANICS

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives: -

3. To get acquainted with the dynamics of the system of particles, motion, elasticity.
4. To understand the concept of gravitation and special theory of relativity.

Learning Outcome: -

3. The successful students would be able to develop the knowledge on the mechanics and dynamics of the particles and special theory of relativity and can apply its concept on various physical phenomena.
4. The students would be able to understand the basics of material properties like, elasticity, elastic constants and their relation, torsion of a cylinder, bending of a beam, cantilever, beam supported at its ends and loaded in the middle.

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CONTENTS:

Theory:

UNIT 1: FUNDAMENTALS OF DYNAMICS

1.1 LINEAR AND ROTATIONAL DYNAMICS (LECTURES 10)

Momentum of variable mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse, Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Kinetic energy of rotation.

1.2 WORK AND ENERGY (LECTURES 4)

Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy.

1.3 COLLISIONS AND ELASTICITY (LECTURES 4)

Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames, Relation between Elastic constants. Twisting torque on a Cylinder or Wire, Cantilever

UNIT 2: GRAVITATION AND CENTRAL FORCE MOTION (LECTURES 7)

Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. Motion of a particle under a central force field. Two-body problem and its reduction to one body problem and its solution. Kepler's Laws.

UNIT 3: OSCILLATIONS (LECTURES 6)

SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy, and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor. Compound Pendulum.

UNIT 4: RELATIVITY (LECTURES 14)

Reference frames. Galilean transformations; Galilean invariance. Non-inertial frames and fictitious forces. Uniformly rotating frame. Centrifugal force. Coriolis force and its applications, Michelson-Morley Experiment, and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence.

Practical/ Presentation

A minimum of five experiments to be done.

1. Measurements of length (or diameter) using vernier caliper, screw gauge, Spherometer and travelling micro- scope.
2. To study the Motion of Spring and calculate (a) Spring constant and (b) Rigidity modulus.
3. To determine the Moment of Inertia of a cylinder about two different axes of symmetry by torsional oscillation method.
4. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
5. To determine the Young's Modulus of the material of a wire by Searle's apparatus.
6. To determine the Modulus of Rigidity of a Wire Static method.
7. To determine the value of g using Bar Pendulum.
8. To determine the value of g using Kater's Pendulum.
9. To determine the height of a building using a Sextant.
10. To determine g and velocity for a freely falling body using Digital Timing Technique.

Suggested Readings:

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- Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley
- BSc Practical Physics, N N Ghosh, 2017, Bharati Pawan Publishers.
- A Text Book of Practical Physics, Dr. Samir Kumar Ghosh, 2005, New Central Book Agency.
- An Introduction to Mechanics, D. Kleppner, R. J. Kolenkow, 1973, McGraw-Hill.
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
- University Physics, F. W. Sears, M. W. Zemansky, H.D Young 13/e, 1986, Addison Wesley.
- Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
- An Advance course in Practical Physics, D Chattopadhyay and P C Rakshit, 2013, New Central Book Agency.

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SEMESTER II
Course Code: PHYS-MIN -2014
Course Paper: ELECTRICITY AND MAGNETISM

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives: -

3. The emphasis of the course is to provide better perspective and understanding on electric and magnetic fields and their interactions with the matter and various circuit theories.
4. The practical are designed in such a way that the students can have implications with the prescribed theories.

Learning Outcome: -

1. After successful completion of this course, students would be able to understand electric and magnetic fields in matter.
2. The students would be able to understand magnetic properties of matter, electromagnetic induction and also would be able to apply Kirchhoff's law. The hands on experiment will provide the better understanding of electricity and magnetism and various parameters of the circuit.

CONTENTS:

Theory:

UNIT 1: ELECTRIC FIELD AND ELECTRIC POTENTIAL (LECTURES 15)

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. Potential and Electric Field of a dipole. Force and Torque on a dipole

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor.

UNIT 2: DIELECTIC PROPERTIES OF MATTER (LECTURES 10)

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics.

UNIT 3: MAGNETOSTATICS AND ELECTROMAGNETIC INDUCTION (15)

Magnetic force between current elements and definition of Magnetic Field B, Biot-Savart's Law and its simple applications: straight wire and circular loop, Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole), Ampere's Circuital Law and its application to Solenoid and Toroid, Properties of B: curl and divergence, Scalar potential and Vector Potential. Faraday's Law, Lenz's Law, Self Inductance and Mutual Inductance, Reciprocity Theorem, Energy stored in a Magnetic Field, Introduction to Maxwell's Equations, Charge Conservation and Displacement current.

UNIT 4: ELECTRICAL CIRCUITS (LECTURES 5)

AC Circuits: Kirchhoff's laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width, Parallel LCR Circuit.

Practical/ Presentation

A minimum of seven experiments to be done

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To verify the Thevenin and Norton theorems.
6. To determine self-inductance of a coil by Anderson's bridge.
7. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width
8. To study the response curve of a parallel LCR circuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q.

Suggested Readings:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw.
- Electricity and Magnetism, R. Murugeshan, S Chand
- An Advance course in Practical Physics, D Chattopadhyay and P C Rakshit, 2013, New Central Book Agency.
- BSc Practical Physics, N N Ghosh, 2017, Bharati Pawan Publishers.
- Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education.
- Feynman Lectures Vol.2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- A Text Book of Practical Physics, Dr. Samir Kumar Ghosh, 2005, New Central Book Agency

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SEMESTER I
Course Code: PHYS-IDC-1014
Course Paper: PHYSICS FOR EVERYONE

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives:-

1. To understand the basics principles, laws of physics in daily life.
2. To develop the scientific literacy among students through physics.

Learning Outcome:-

1. The successful students would be able to develop the knowledge on various physical phenomena happening in daily life and develop the logical thinking.
2. The course will develop the understanding of some most interesting topics and will make the students naturally motivated.

CONTENTS:

Theory:

UNIT1: MEASUREMENT AND NEWTON'S LAW OF MOTION AND ITS APPLICATION (LECTURES 15)

Physical quantities, Standards and Units, International system of Units, Standards of time, length and mass, Precision and significant figures.

Newton's first law. Force, mass. Newton's second law. Newton's third law, Mass and weight. Applications of Newton's laws.Projectile motion: Shooting a falling target, Physics behind Shooting, Javelin throw and Discus throw.

UNIT 2: ENERGY AND POWER (LECTURES 7)

Explosions and energy; Energy, heat and its units; Energy table and discussions; Discussion of cost of energy; Measuring energy; Power; Different power sources; Kinetic energy.

UNIT 3: GRAVITY, FORCE AND SPACE (LECTURES 10)

The force of Gravity; Newton's third law; Weightlessness; Low earth orbit; Geosynchronous satellites; Spy satellites; Medium Earth Orbit satellite; Circular Acceleration; momentum; Rockets; Airplanes, helicopters and fans; Hot air and helium balloons; angular momentum and torque.

UNIT 4: NUCLEI AND RADIOACTIVITY (LECTURES 13)

Atomic nuclei and its structure, Radioactivity; Elements and isotopes; Radiation and rays; Seeing radiation; The REM – The radiation poisoning; Radiation and cancer; The linear hypothesis; Different types of radiation; The half-life rule; Smoke detectors; measuring age from radioactivity; Environmental radioactivity; Glow of radioactivity; Nuclear fusion.

Practical/ Presentation: Topics to be selected based on course content of the theory.

Suggested Readings:

This course is extracted from the book titled “Physics and Technology for Future Presidents: An Introduction to the Essential Physics Every World Leader Needs to Know” by Richard A Muller, WW Norton and Company, 2007. (Units 1 to 3 are from chapters 1, 3, 4 respectively).

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SEMESTER II
Course Code: PHYS-IDC-2014
Course Paper: BASIC ASTRONOMY

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objectives: -

To familiarize the field of astronomy among the students.

Learning Outcome: -

The students would be able to understand and acquire knowledge on solar systems,planets, stars and galaxies.

CONTENTS:

Theory:

UNIT 1: THE SUN AND THE SOLAR FAMILY (LECTURES 11)

Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity, Basics of Solar Magneto-hydrodynamics. Helioseismology. Solar System: Facts and Figures, Origin of the Solar System: The Nebular Model, Tidal Forces and Planetary Rings, Extra-Solar Planets.

UNIT 2: STELLAR SPECTRA AND CLASSIFICATION STRUCTURE (LECTURES 7)

Atomic Spectra, Stellar Spectra, Spectral Types and Their Temperature Dependence, Black Body Approximation, H R Diagram, Luminosity Classification

UNIT 3: THE MILKY WAY (LECTURES 6)

Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way, Differential Rotation of the Galaxy and Oort Constant, Rotation Curve of the Galaxy and the Dark Matter, Nature of the Spiral Arms, Stars and Star Clusters of the Milky Way, Properties of and around the Galactic Nucleus.

UNIT 4: GALAXIES (LECTURES 14)

Galaxy Morphology, Hubble's Classification of Galaxies, Elliptical Galaxies, The Intrinsic Shapes of Elliptical, de Vaucouleurs Law, Stars and Gas. Spiral and Lenticular Galaxies (Bulges, Disks, Galactic Halo) The Milky Way Galaxy, Gas and Dust in the Galaxy, Spiral Arms.

Practical/ Presentation: Topics to be selected based on course content of the theory.

Suggested Readings:

- Modern Astrophysics, B.W. Carroll & D.A. Ostlie, Addison-Wesley Publishing Co.
- Introductory Astronomy and Astrophysics, M. Zeilik and S.A. Gregory, 4th Edition, Saunders College Publishing.
- The physical universe: An introduction to astronomy, F.Shu, Mill Valley: University Science Books.
- Fundamental of Astronomy (Fourth Edition), H. Karttunen et al. Springer
- K.S. Krishnasamy, 'Astro Physics a modern perspective,' Reprint, New Age International (p) Ltd, New Delhi,2002.
- Baidyanath Basu, 'An introduction to Astro physics', Second printing, Prentice -

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SEMESTER-I
Course Code: PHYS-SEC-1014
Course Paper: PHYSICS WORKSHOP SKILL

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objective: The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode.

Learning Outcome: By the end of this course students would be able to use various mechanical and electrical tools and the course would be helpful for various job oriented courses.

CONTENTS:

Theory:

UNIT1: INTRODUCTION (LECTURES 10)

Measuring units. conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

UNIT 2: MECHANICAL SKILL (LECTURES 15)

Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

UNIT 3: ELECTRICAL AND ELECTRONIC SKILL (LECTURES 10)

Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, electronic switch using transistor and relay.

UNIT 4: INTRODUCTION TO PRIME MOVERS (LECTURES 10)

Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

Practical/ Presentation: Topics to be selected based on course content of the theory.

Suggested Readings:

- A text book in Electrical Technology - B L Theraja – S. Chand and Company.
- Performance and design of AC machines – M.G. Say, ELBS Edn.
- Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.

- Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
- New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

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SEMESTER-II

Course Code: PHYS-SEC-2014

Course Paper: ELECTRICAL CIRCUIT & NETWORK SKILLS

Paper Credit: 04 (3T+1P)

Total No. of Lectures: 45L + 15P **Total Marks=100 (T60 + IA20 + P20)**

Objective:

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode.

Learning Outcome:

Successful students would be able to impart their knowledge and skills in practical fields.

CONTENTS:

Theory:

UNIT 1: BASIC ELECTRICITY PRINCIPLES (LECTURES 12)

Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements.

UNIT 2: AC/DC POWER SOURCES (LECTURES 15)

Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and mone, DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers, Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor.

UNIT 3: ELECTRICAL PROTECTION (LECTURES 10)

Relays, Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device),

UNIT 4: ELECTRICAL WIRING (LECTURES 08)

Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

Practical/ Presentation: Topics to be selected based on course content of the theory.

Suggested Readings:

- A text book in Electrical Technology - B L Theraja - S Chand & Co.
- A text book of Electrical Technology - A K Theraja
- Performance and design of AC machines - M G Say ELBS Edn.