DEPARTMENT OF PHYSICS
<u>SIDO KANHO MURMU UNIVERSITY DUMKA</u>

SEMESTER-I & II SYLLABUS FOR THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

As per Provisions of NEP-2020

to be implemented from Academic Session 2022-26

Program Structure

SEMESTER-I

Paper Code	Title of the course	Category of the course	Semester Internal Examination		End Semester Examination				Full Marks
			Theory		Theory		Practical		
			FM	PM	FM	PM	FM	PM	
MJ-1	Mechanics and Properties of Matter	Major	15	06	60	24	25	10	100
IRC-1	Mathematical Physics	Introductory Regular	15	06	60	24	25	10	100

SEMESTER-II

Paper Code	Title of the course	Category of the course	Semester Internal Examination		End Semester Examination				Full Marks
			Theory		Theory		Practical		
			FM	PM	FM	PM	FM	PM	
MJ-2	Electricity and Magnetism	Major	15	06	60	24	25	10	100
IRC-2	Thermal Physics	Introductory Regular	15	06	60	24	25	10	100

Note:
MJ – Major Course
IRC – Introductory Regular Course
FM – Full Marks
PM – Pass Marks

SEMESTER-I
PHY-MJ-1: MECHANICS AND PROPERTIES OF MATTER
(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Full Marks:
15 (Semester Internal Examination: 1Hr) + 60 (End Semester Examination: 3Hrs) =**75**
Pass Marks:
Semester Internal Examination = **06**
End Semester Examination = **24**

Instruction for evaluation:
Semester Internal Examination (marks:15)
The Semester Internal Examination will have two components:
(a) One Semester Internal Assessment Test of 10 Marks - There will be two group of questions.
- Group A is compulsory which will contain very short answer type consisting of five questions of 1 mark each. (**5×1=5**)
- Group B will contain descriptive type two questions of five marks each, out of which any one to answer. (**1×5=5**)

(b) Class Attendance Score of 5 marks - Conversion of Attendance into score may be as follows:

Attendance	Marks
less than 45%	1
upto 55%	2
upto 65%	3
upto 75%	4
More than 75%	5

End Semester Examination (marks: 60)
There will be two group of questions.
- Group A is compulsory which will contain three questions.
  - Question No.1 will be very short answer type consisting of five questions of 1 mark each. (**5×1=5**)
  - Question No.2 & 3 will be short answer type of 5 marks. (**2×5=10**)
- Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer. (**3×15=45**)

General Properties of Matter: Hooke's law. Stress-strain diagram. Elastic moduli. Poisson's Ratio-expression for Poisson's ratio in terms of elastic constants. Relation between Elastic constants. Work done in stretching and work done in twisting a wire-Twisting couple on a cylinder. Bending moment. Cantilevers, beam supported at the end and loaded at middle and its application to determine Young's modulus. Searle's experiments. Kinematics of Moving

Fluids: Viscous fluid, Poiseuille's Equation for Flow of a Liquid through a Capillary Tube with correction, Flow of compressible fluid through a capillary tube, Rankine's methods for measurement of viscosity of gas. Effect of temperature and pressure onviscosity. Surface tension and surface energy. Angle of contact. Expression for excess pressure. Principal of virtual work. Ripples and Gravity waves. Effect of temperature and pressure on surface tension. **(20 Lectures)**

Central Force Motion: Motion of a particle under a central force field. Two bodies problem. Conservation of angular momentum. Kepler's Laws of planetary motion and their deduction. Satellite in circular orbit and applications. Weightlessness. **(10 Lectures)**

Oscillations: 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. **(14 Lectures)**

Special Theory of Relativity: Inertial and Non-inertial frames. Centrifugal force and Coriolis force and its applications. Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Lorentz contraction. Time dilation. Simultaneity and order of events. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. **(16 Lectures)**

Reference Books:

• An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
• Mechanics, D. S. Mathur.
• Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
• Feynman Lectures, Vol. I, R.P. Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
• Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
• University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

PRACTICAL: PHY-MJ-1-LAB

Full Marks:
End Semester Examination: 3Hrs =**25**
Pass Marks: 10

Instruction for evaluation:
There will be one practical examination of 3Hrs duration. Evaluation of practical examination may be as follows:

Experiment	: 15 marks
Practical record notebook	: 05 marks
Viva-voce	: 05 marks

List of Practicals: 60 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study errors: Truncation and round off errors, Absolute and relative errors.
3. To determine the height of a building using a Sextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c)Modulus of rigidity.
5. To determine the elastic Constants of a wire by Searle's method.
6. To determine the value of g using Bar Pendulum.
7. To determine the value of g using Kater's Pendulum.

References:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn. , 2012, PHI Learning Pvt. Ltd.
2. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.
5. Numerical Methods, E Balagurusamy, McGraw Hill Education.

INTRODUCTOTY REGULAR COURSE

PHY-IRC-1: MATHEMATICAL PHYSICS
(Credits: Theory-02, Practicals-01)

Theory: 30 Lectures

Full Marks:
15 (Semester Internal Examination: 1Hr) + 60 (End Semester Examination: 3Hrs) =**75**
Pass Marks:
Semester Internal Examination = **06**
End Semester Examination = **24**

Instruction for evaluation:
Semester Internal Examination (marks:15)
The Semester Internal Examination will have two components:
 (a) One Semester Internal Assessment Test of 10 Marks - There will be two group of questions.
- Group A is compulsory which will contain very short answer type consisting of five questions of 1 mark each. (**5×1=5**)
- Group B will contain descriptive type two questions of five marks each, out of which any one to answer. (**1×5=5**)
 (b) Class Attendance Score of 5 marks - Conversion of Attendance into score may be as follows:

Attendance	Marks
less than 45%	1
upto 55%	2
upto 65%	3
upto 75%	4
More than 75%	5

End Semester Examination (marks: 60)
There will be two group of questions.
- Group A is compulsory which will contain three questions.
  - Question No.1 will be very short answer type consisting of five questions of 1 mark each. (**5×1=5**)
  - Question No.2 & 3 will be short answer type of 5 marks. (**2×5=10**)
- Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer. (**3×15=45**)

Calculus: Taylor and Binomial series (statements only). First Order Differential Equations and IntegratingFactor. Second Order Differential equations: Homogeneous Equations with constant coefficients. Partial derivatives, exact and inexact differentials. Condition for a function to be maximum or minimum. (**10 Lectures**)

Vector Calculus: Scalar and Vector fields, Product of two vectors and their applications. Vector Differentiation: Directional derivatives and normal derivatives. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field and their physical interpretation. (**12 Lectures**)

Determinants and Matrices: Properties of determinants. Various types of matrices. Addition of matrices. Subtraction of matrices. Matrix multiplication. (**8 Lectures**)

References:

1. Mathematical Physics, H. K. Dass, S. Chand.
2. Mathematical Physics, B. D. Gupta, 4th Edn, Vikas Publishing House PVT LTD.
3. Mathematical Physics, B. S. Rajput, Pragati Prakashan.
4. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, Elsevier.

PRACTICAL: PHY-IRC-1-LAB

Full Marks:
End Semester Examination: 3Hrs =**25**
Pass Marks: 10

Instruction for evaluation:
There will be one practical examination of 3Hrs duration. Evaluation of practical examination may be as follows:

Experiment	: 15 marks
Practical record notebook	: 05 marks
Viva-voce	: 05 marks

List of Practicals: 30 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study errors: Truncation and round off errors, Absolute and relative errors.
3. To determine the height of a building using a Sextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
5. To determine the elastic Constants of a wire by Searle's method.

References:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn. , 2012, PHI Learning Pvt. Ltd.
2. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.
5. Numerical Methods, E Balagurusamy, McGraw Hill Education.

SEMESTER-II
PHY-MJ-2: ELECTRICITY AND MAGNETISM
(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Full Marks:
15 (Semester Internal Examination: 1Hr) + 60 (End Semester Examination: 3Hrs) =**75**
Pass Marks:
Semester Internal Examination = **06**
End Semester Examination = **24**

Instruction for evaluation:
Semester Internal Examination (marks:15)
The Semester Internal Examination will have two components:
(b) One Semester Internal Assessment Test of 10 Marks - There will be two group of questions.
- Group A is compulsory which will contain very short answer type consisting of five questions of 1 mark each. (**5×1=5**)
- Group B will contain descriptive type two questions of five marks each, out of which any one to answer. (**1×5=5**)

(b) Class Attendance Score of 5 marks - Conversion of Attendance into score may be as follows:

Attendance	Marks
less than 45%	1
upto 55%	2
upto 65%	3
upto 75%	4
More than 75%	5

End Semester Examination (marks: 60)
There will be two group of questions.
- Group A is compulsory which will contain three questions.
  - Question No.1 will be very short answer type consisting of five questions of 1 mark each. (**5×1=5**)
  - Question No.2 & 3 will be short answer type of 5 marks. (**2×5=10**)
- Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer. (**3×15=45**)

Electric Field and Electric Potential: Electric flux. Gauss' law in integral and differential form and its applications. Conservative nature of Electrostatic Field. Laplace's and Poisson equations. The Uniqueness Theorem. Electric field and Potential due to electric dipole and quadrupole. Conductors in an electrostatic Field. Surface charge and force on a conductor. (**10 Lectures**)

Dielectric Properties of Matter: Electric Field in matter. Polarization, Polarizability and electrical susceptibility and Dielectric constant, Displacement vector D. Relations between E, P and D. Clausius Mossotti equation, Gauss' Law in dielectrics. (**15 Lectures**)

Magnetic Properties of Matter: Magnetization vector (M). Magnetic Intensity(H). Magnetic Susceptibility and permeability. Relation between B, H, M. B-H curve and hysteresis. Properties of magnetic materials- Dia, Para and Ferromagnetism, Langevin's theory, Measurement of susceptibility by Quincke's Method. (**15 Lectures**)

Electrical Circuits: 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. Anderson's bridge, De-Sauty bridge and Cary Foster bridge. Equivalent circuit and vector diagram. Transformer, Losses in transformer. (**12 Lectures**)

Ballistic Galvanometer: Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping. (**8 Lectures**)

Reference Books:
1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw.
2. Introduction to Electrodynamics, D.J. Griffiths, Cambridge University Press.
3. Feynman Lectures Vol.2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education.
4. Electricity and Magnetism by R. K. Tewary, S Chand.

PRACTICAL: PHY-MJ-2-LAB

Full Marks:
End Semester Examination: 3Hrs =**25**
Pass Marks: 10

Instruction for evaluation:
There will be one practical examination of 3Hrs duration. Evaluation of practical examination may be as follows:

Experiment	: 15 marks
Practical record notebook	: 05 marks
Viva-voce	: 05 marks

List of Practicals: 60 Lectures

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. Measurement of field strength B and its variation in a solenoid (determine dB/dx).
4. 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.
5. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
6. To visualize the magnetic field produced by several configurations of simple bar magnets using magnetic compasses.
7. Measure ε_0, the permittivity of free space.
8. Investigate the magnetic force between two current carrying wires and measure the permeability constant μ_0.

References:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. A Laboratory Manual of Physics for undergraduate classes, D. P. Khandelwal, 1985, Vani Pub.

PHY-IRC-2: THERMAL PHYSICS
(Credits: Theory-02, Practicals-01)

Theory: 30 Lectures

Marks:
15 (Semester Internal Examination: 1Hr) + 60 (End Semester Examination: 3Hrs) =**75**
Pass Marks:
Semester Internal Examination = **06**
End Semester Examination = **24**

Instruction for evaluation:
Semester Internal Examination (marks:15)
The Semester Internal Examination will have two components:
 (c) One Semester Internal Assessment Test of 10 Marks - There will be two group of questions.
- Group A is compulsory which will contain very short answer type consisting of five questions of 1 mark each. (**5×1=5**)
- Group B will contain descriptive type two questions of five marks each, out of which any one to answer. (**1×5=5**)
(b) Class Attendance Score of 5 marks - Conversion of Attendance into score may be as follows:

Attendance	Marks
less than 45%	1
upto 55%	2
upto 65%	3
upto 75%	4
More than 75%	5

End Semester Examination (marks: 60)
There will be two group of questions.
- Group A is compulsory which will contain three questions.
  - Question No.1 will be very short answer type consisting of five questions of 1 mark each. (**5×1=5**)
  - Question No.2 & 3 will be short answer type of 5 marks. (**2×5=10**)
- Group B will contain descriptive type five questions of fifteen marks each, out of which any three are to answer. (**3×15=45**)

Kinetic Theory of Gases Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy, Specific heats of Gases. (**10 Lectures**)

Molecular Collisions: Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance. (**8 Lectures**)

Real Gases: Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO_2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Boyle Temperature. Vander-Waal's Equation of State for Real Gases by virial method. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. P-V Diagrams. Joule's Experiment. Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Vander-Waal Gases. Temperature of Inversion. Joule- Thomson Cooling. (**12 Lectures**)

References:

1. Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, Indian Press.
3. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill.

PRACTICAL: PHY-IRC-2-LAB

Full Marks:
End Semester Examination: 3Hrs =**25**
Pass Marks: 10

Instruction for evaluation:
There will be one practical examination of 3Hrs duration. Evaluation of practical examination may be as follows:

Experiment	: 15 marks
Practical record notebook	: 05 marks
Viva-voce	: 05 marks

List of Practicals: 30 Lectures

1. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
2. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
3. To measure the coefficient of linear expansion for given material.
4. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.

References:

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.