FACULTY OF SCIENCE & TECHNOLOGY

NORTH MAHARASHTRA UNIVERSITY, JALGAON

'A' Grade
NAAC Re-Accredited
(3rd Cycle)

SYLLABUS

FOR

F. Y. B. Sc. (PHYSICS)

(AS PER CHOICE BASED CREDIT SYSTEM PATTERN OF UGC)

(With effect from June - 2018)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process and examination & evaluation systems. In that context in the last decade, North Maharashtra University, Jalgaon has taken several initiatives to upgrade and enhance the academic excellence, examination reforms and developing the skilled minds and skilled hands. As per the directions of UGC, NMU, Jalgaon is going to implement the Choice Based Credit (CBCS) pattern to undergraduate program run by various colleges affiliated to NMU, Jalgaon. As per the initiatives led by the Honorable Vice Chancellor, Pro-Vice Chancellor and Dean of the Faculty of Science and Technology of our university, one day workshop were organized for syllabus framing and teachers of the affiliated colleges and university department were participated in workshop of re-structuring the syllabi of F.Y.B.Sc. (Physics) as per the CBCS pattern and it has been finalized during the workshop and the same will be effectively implemented from the academic year 2018-19. The main objective of the re-structuring the syllabi of F.Y.B.Sc. (Physics) is to create skilled minds and therefore expectation is to equip the students with the knowledge and understanding of concepts of physics rather than the ability to remember facts so that they may have a reasonable comprehensive and complete grasp of principles of physics. It is expected that the students studying physics will apply investigations and problem solving skills, effectively communicate the theoretical concepts, and appreciate the contribution that the study of physics makes to our understanding of the world.

Board of Studies (Physics),
North Maharashtra University, Jalgaon

OBJECTIVES:

1. To provide education in physics of the highest quality at the undergraduate level and generate graduates of the caliber sought by industries and public service as well as academic teachers and researchers of the future;
2. To acquire deep knowledge in fundamental aspects of Physics and basic knowledge in the specialized thrust areas like Mechanics, electricity and magnetism, electrostatics and mathematical physics;
3. To develop ability among the students to identify, remember and grasp the meaning of basic facts, concepts and principles of Physics;
4. To develop observational skills, confidence in using scientific equipment and relate the knowledge of scientific concepts to quantitative and physical measurement;
5. Acquire knowledge, skills, working methods and ways of expression which will reflect on all round development of the students' attitudes towards scientific thinking and its applications;
6. To develop attitudes such as concern for accuracy and precision, objectivity, and enquiry;
7. The overall aim is to provide comprehensive knowledge and understanding in the relevant fields and enable students to pursue the physics subject at an advanced level later and to attract outstanding students from all backgrounds.

NORTH MAHARASHTRA UNIVERSITY, JALGAON

Class: **F. Y. B. Sc.**

Subject: **Physics**

Choice Base Credit System (With effect from June 2018)

The Board of Studies in Physics in its meeting held on **4th July 2018**has unanimouslyaccepted the revised syllabus (as per CBCS pattern) prepared by different committees, discussed and finalized inworkshop for F.Y.B.Sc. Syllabi revision. The titles of the papers for F.Y.B.Sc. (Physics) areas given below;

Semester	Course as per UGC	Core Course		No of Credits	Hours/ Semester	Marks	
		Course Code	Course Title			Int.	Ext.
I	PHYSICS-DSC 1A: MECHANICS (Credits: Theory-04, Practicals-02) PHYSICS LAB	PHY-101	Basic Mechanics	2	30	40	60
		PHY-102	Dynamics and Elasticity	2	30	40	60
		PHY-103	LAB -I	2	60	40	60
II	PHYSICS-DSC 2A: ELECTRICITY AND MAGNETISM (Credits: Theory-04, Practicals-02) PHYSICS LAB	Course Code	Course Title	No of Credits	Hours/ Semester	Marks	
						Int.	Int.
		PHY-201	Electricity and Electrostatics	2	30	40	60
		PHY-202	Magnetism and Electromagnetism	2	30	40	60
		PHY-203	LAB -II	2	60	40	60

Note:

The industrial/study tour is compulsory for students of F. Y. B. Sc. (Physics).

NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus of F. Y. B. Sc. Physics

(Choice Based Credit System)

Semester I

PHYSICS-DSC 1 A: MECHANICS

Theory: 60 Lectures

Course description:

This course is aimed at introducing the fundamentals of Mechanics to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in basic mechanics.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept of use of knowledge of mechanics to real life problems.
2. Understanding of the course will create scientific temperament.

PHY 101: BASIC MECHANICS (30 Lectures)

(Credits: Theory-04, Practicals-02)

Course Content

1. **Vectors:** Vector algebra, Scalar and vector products, Derivatives of a vector with respect to a parameter. **(04 Lectures, 12 Marks)**
2. **Ordinary Differential Equations:**Types of differential equations, degree and order of differential equation (definitions only), linear and non-linear differential equations (definitions only), homogeneous and non-homogeneous differential equations (definitions only)1^{st} order homogeneous differential equations, 2^{nd} order homogeneous differential equations with constant coefficients (definitions with examples). **(08 Lectures, 16 Marks)**
3. **Laws of Motion:** Frames of reference, Newton's Laws of motion, Dynamics of a system of particles, Centre of Mass. **(10 Lectures, 16 Marks)**
4. **Momentum and Energy:** Conservation of momentum, Work and energy, Conservation of energy, Motion of rockets. **(04 Lectures, 08 Marks)**
5. **Rotational Motion:** Angular velocity and angular momentum, Torque, Conservation of angular momentum. **(04 Lectures, 08 Marks)**

PHY 102: DYNAMICS AND ELASTICITY (30 Lectures)

1. **Gravitation:** Newton's Law of Gravitation, Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws (statement only), satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS).**(08 Lectures, 16 Marks)**
2. **Oscillations:** Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Damped oscillations. **(07 Lectures, 14 Marks)**
3. **Elasticity:** Hooke's law, Stress-strain diagram, Elastic moduli, Relation between elastic constants, Poisson's Ratio, Expression for Poisson's ratio in terms of elastic constants, Work done in stretching and work done in twisting a wire, Twisting couple on a cylinder, Determination of Rigidity modulus by static torsion, Torsional pendulum, Determination of Rigidity modulus and moment of inertia - q, η and σ by Searles method. **(08 Lectures, 16 Marks)**
4. **Viscosity:** Introduction, definition of viscosity, general concept of fluid flow, Streamline and turbulent flow, Energy possessed by a liquid and Bernoulli'sTheoremand its application: venturimeter,Rate flow of liquid in a capillary tube-Poiseuille's formula, determination of coefficient of viscosity of a liquid by using Poiseuillie's equation, variations of viscosity of a liquid with temperature.

(07 Lectures, 14 Marks)

Note: *Students are not familiar with vector calculus. Hence all examples involve differentiation either in one dimension or with respect to the radial coordinate*.

Reference Books:

1. University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison-Wesley
2. Mechanics Berkeley Physics course, V-1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
3. Physics: Resnick, Halliday & Walker 9/e, 2010, Wiley
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press

5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. Elements of Properties of Matter –D. S. Mathur, Shamlal Charitable trust, New Delhi.

PHYSICS LAB: DSC 1A LAB: MECHANICS (60 lectures)

PHY 103: LAB-I

(Students should perform at least **ten**experiments from the following list)

1. Calculation of errors from given data.
2. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
3. To determine the Height of a Building using a Sextant.
4. To determine the Moment of Inertia of a Flywheel.
5. To determine the Young's Modulus of a Wire by Optical Lever Method.
6. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
7. To determine the Elastic Constants of a Wire by Searle's method.
8. To determine 'g' by Bar Pendulum.
9. To determine 'g' by Kater's Pendulum.
10. To determine 'g' and velocity for a freely falling body using Digital Timing Technique
11. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of 'g'
12. To determine the Moment of Inertia of a Disc.
13. To determine Y by using flat spiral spring.
14. To determine Y of a rectangular beam by bending.
15. To determine η by using flat spiral spring.
16. To determine η by torsional oscillations.
17. To determine Y by vibrational cantilever.
18. To determine Poisson's Ratio of rubber by using rubber cord/tube.
19. Determination of coefficient of viscosity of water by Poiseuille's method.
20. Verification of Bernoulli's theorem.

Reference Books:

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, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S.Panigrahi&B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition,2011, KitabMahal, New Delhi.
5. A text Book of Experimental Physics-Dr. V.Y. Rajopadhye, V.L.Purohit and A.S. Deshpande (Continental Prakashan, Poona-30)
6. Practical Physics by R. K. Shukla, AnchalSrivastava (New Age International).
7. Advance Practical Physics by S.P.Singh (Pragati).
8. Practical Physics: Gupta and Kumar (PragatiPrakashan Meerut)
9. University Practical Physics by D. C. Tayal, Himalaya Publishing House.

Semester II

PHYSICS-DSC 2A: ELECTRICITY AND MAGNETISM
Theory: 60 Lectures

Course description:
This course is aimed at introducing the fundamentals of Electricity and Magnetism to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Electricity and Magnetism.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:
Learner will be able to ….

1. Apply the concept of use of knowledge of Electricity and Magnetism to real life problems.
2. Understanding of the course will create scientific temperament.

(Credits: Theory-04, Practicals-02)

PHY 201: ELECTRICITY AND ELECTROSTATICS (30 Lectures)

1. **Vector Analysis**: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume, integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). **(10 Lectures, 20 Marks)**
2. **Network theorems in current electricity:** Kirchhoff's laws and loop analysis by Kirchhoff's laws, Network theorems: Thevenin's theorem and Norton's theorem with illustrations, Maximum power transfer theorem (D. C. Source only), Electric power, Electricity bill calculation, Joule's law. (**10 Lectures, 20 Marks)**
3. **Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics, Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. **(10 Lectures, 20 Marks)**

PHY 202: DIELECTRICS, MAGNETISM AND ELECTROMAGNETISM

(30 Lectures)

1. **Capacitance and dielectrics:** Introduction, Capacitance of an isolated spherical conductor, Parallel plate, spherical and cylindrical condenser, Energy per unit volume in electrostatic field, Dielectric medium, Polarisation, Displacement vector, Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric. **(10 Lectures, 20 Marks)**
2. **Magnetism:** Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, Brief introduction of dia-, para- and ferro-magnetic materials. Introduction of Magnetostatics: Biot-Savart's law & its applications-straight conductor, circular coil, solenoid carrying current, Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law.

   (08 Lectures, 16 Marks)
3. **Electromagnetic Induction:** Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils, Energy stored in magnetic field. **(06 Lectures, 12 Marks)**
4. **Maxwell`s equations and Electromagnetic wave propagation:** Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization. **(06 Lectures, 12 Marks)**

Reference Books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Electricity and Magnetism, J.H. Fewkes& J. Yarwood. Vol. I, 1991, Oxford Univ.Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.11
5. Introduction to Electrodynamics, 3rd Edn,D.J. Griffiths, 1998, BenjaminCummings.
6. Electrodynamics- D. J. Griffiths

PHYSICS LAB- DSC 2A LAB: ELECTRICITY AND MAGNETISM (60 Lectures)

PHY 203: LAB-II

(Students should perform at least **ten** experiments from the following list)

1. To use a Multimeter for measuring (a) Resistances, (b) A.C. and D.C. Voltages, (c) D.C. Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
   (i) Measurement of charge and current sensitivity
   (ii) Measurement of CDR
   (iii) Determine a high resistance by Leakage Method
   (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
5. To study the Characteristics of a Series RC Circuit.
6. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b)Quality Factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and(b) Quality factor Q
8. To determine a Low Resistance by Carey Foster's Bridge.
9. Verification of Kirchhoff's laws.
10. To verify Thevenin's theorem
11. To verify Norton's theorem
12. To verify Maximum Power Transfer Theorem
13. To verify Joule's law.
14. To determine time constant of R-C circuit using charging and discharging of condenser through resistor.
15. Determination of time constant of L-R circuit.
16. Electric billing with energy meter.
17. Frequency of a. c. using vibrating wire and magnet.
18. To determine efficiency and turns ratio of transformer.

Reference Books

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, AsiaPublishing House.
2. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition,2011, KitabMahal, New Delhi.
3. Engineering Practical Physics, S.Panigrahiand B. Mallick, 2015, CengageLearningIndiaPvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
5. Practical Course in Electronics by Prof. J. R. Patil and other (JaydeepPrakashan).

Equivalence Courses

Semester	Core Course		No of Credits	Hours/ Semester	Marks		Old Syllabus Code
	Course Code	Course Title			Int.	Ext.	
I	PHY-101	Basic Mechanics	2	30	40	60	PHY-122
	PHY-102	Dynamics and Elasticity	2	30	40	60	PHY-111
	PHY-103	LAB -I	2	60	40	60	PHY-113
II	Course Code	Course Title	No of Credits	Hours/ Semester	Marks		Old Syllabus Code
					Int.	Int.	
	PHY-201	Electricity and Electrostatics	2	30	40	60	PHY-112
	PHY-202	Magnetism and Electromagnetism	2	30	40	60	PHY-121
	PHY-203	LAB -II	2	60	40	60	PHY-123