K. J. SOMAIYA COLLEGE OF SCIENCE AND COMMERCE, VIDYAVIHAR,

MUMBAI 400 077

AUTONOMOUS- AFFILIATED TO UNIVERSITY OF MUMBAI

Scheme of Course Structure (Faculty of Science) 2019-2020

Syllabus for F.Y.B.Sc.

Program: B.Sc.

Course: Physics

(Choice based Credit System with effect from

The academic year 2017–2018)

Syllabus -F. Y.B.Sc. PHYSICS

Semester I	Course	Course Title	Course code	Credits	Hours	Periods (50min)	Unit/ Module	Lectures (50 MINUTS)	Examination		
	FYBSC	PHYSICS	18US1PH1 18US1PH2 18US1PHP	2					Internal Marks	External Marks	Total Marks
THEORY											
Core courses											
	I	Mechanics	18US1PH1	2	30	36	1	12	40	60	100
							2	12			
							3	12			
	II	Electricity and Electronics	18US1PH2	2	30	36	1	12	40	60	100
							2	12			
							3	12			
PRACTICALS											
CORE COURSES 18US1PHP											
	I	PRACTICAL I		1	2	2.4			20	30	50
	II	PRACTICAL II		1	2	2.4			20	30	50

F.Y. B. Sc. (PHYSICS) SEMESTER I

Course – I

COURSE TITLE: Mechanics:

COURSE CODE: 18US1PH1

[CREDITS - 02]

Preamble-- The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics.

Course outcome --- After completion of the course, Learners will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

- Develop analytical abilities towards real world problems
- Familiarize with current and recent scientific and technological developments
- Enrich knowledge through problem solving, hands on activities, study visits, projects etc

Course Specific Outcome: Applied physics paper is application oriented.

UNIT 1		NO OF LECTURES 12
UNIT 1	**Learning Objective** ----- On successful completion of this course Learners will be able to: ➢ Understand the basic mathematical concepts, Ordinary and partial differential equations and applications of them in physical situations . ➢ Demonstrate quantitative problem solving skills in all the topics covered. ➢ Understand the concepts of elasticity, fluid mechanics and be able to perform calculations using them. ➢ To understand of various properties of fluids ➢ To understand of Poiseuille's equation & various	

	applications of Poiseuille's equation **Learning Outcome** -- At the end of this course, learner will be able to: ▪ Solve higher order linear differential equations and their application. ▪ Solve various partial differential equations. ▪ Use of various properties in solving the problems in fluids . ▪ Use of Poiseuille's equation for solutions in fluids
1	**i] Mathematical Physics** Partial Differentiation, variable treated as constants, Total Derivative, Partial Differentiation of Composite Functions: change of variables ii] **Elasticity: (***Elastic constants Y, K,* η, σ: ***review)*** Equivalence of shear strain to compression and extension strains. Relation between elastic constants, **iii) Fluid Dynamics:** Equation of continuity, Bernoulli's equation, streamline and turbulent flow, lines of flow in air foil, Poiseuille's equation
UNIT 2	NO OF LECTURES 12
2	Learning Objective ---- ➢ To make the Learner conversant with commonly used mechanism for industrial application. ➢ To develop competency in graphical and analytical method for solving problems in static and dynamic force analysis. ➢ To develop competency in conducting laboratory experiments for finding

	moment of inertia of rigid bodies, Learning Outcome--- On completion of the course, learner will be able to– ▪ Identify mechanisms in real life applications. ▪ Perform kinematic analysis of simple mechanisms. ▪ Perform static and dynamic force analysis of for system of particals. ▪ Determine moment of inertia of rigid bodies experimentally.	
	i) Composition of two SHM: **(***Definition of SHM and composition of two parallel SHM's of same period:* ***review****)* Composition of two perpendicular S H M's having same period and period in the ratio 1:2, Lissajous figures. **ii) Mechanics of a system of particles:** Centre of mass of a system of particles, Linear momentum of a system of particles and its conservation.Angular momentum of a system of particles and its conservation (only statement). Rocket motion (neglecting gravity) **iii) Wave motion in one dimension:** General solution of wave equation, Classification of waves, Examples of one dimensional waves, Transverse wave on string, Longitudinal Waves on Rod.	
UNIT 3		NO OF LECTURES 12
3	**Learning Objective:** ➢ Examine how sound is generated and propagates as a principle for architectural acoustic design. ➢ Explore how humans perceive sound as a basic principle in acoustic design.	

	➢ Recognize sound level descriptors and how they are used in architectural acoustics. ➢ Analyze acoustic properties of typically used materials for design consideration. **Learning Outcome** : Having successfully completed this module learner will be able to ▪ Understand standard measurement methods that are used in building acoustics. ▪ Apply prediction methods to assess the transmission of noise in buildings and its mitigation. ▪ Apply prediction methods to assess the reverberation of sound in rooms. ▪ Select appropriate building constructions for the solution of practical noise problems and evaluate their performance
	i) Ultrasonic: Piezoelectric effect, Production of Ultrasonic waves: Piezoelectric Crystal Method, Detection, Properties and applications of Ultrasonic Waves **ii) Acoustics of Buildings:** Reverberation, Sabine's formula (without derivation) Absorption coefficient, Acoustics of Buildings, factors affecting Acoustics of Buildings, Sound distribution in an auditorium. **iii) Bio- Acoustics:** Sound and its characteristics, Functions of Ear as a hearing, Physical basis of hearing, Module of intensity of sound, Physical aspects of Transmission or conduction of sound in Ear.

References:

1) **BVR**: B V Ramana .Higher Engineering Mathematics- Tata McGraw Hill

2) **HP:** Hans and Puri. Mechanics –, 2nd Ed. Tata McGraw Hill.

3) **EG:** EvylenGuha .Basic Thermodynamics- (Narosa Publication)

4) **SPP:** S P Puri. Fundamentals of vibration and waves – (Tata McGraw Hill)

5) **MS:** R Murugeshan and K. Shivaprasath, (2005-Ed) Properties of matter and Acoustics – S Chand &Co.Ltd.

6) **P.N. Roy**: R N Roy A text book Bio Physics-(Revised Edition) (New Central Book Agency ltd)

Course – II

COURSE TITLE: **Electricity and Electronics:**

COURSE CODE: 18US1PH2

[CREDITS - 02]

UNIT 1	Learning Objective ---- ➢ To make the learner capable of analysing any given electrical network. ➢ To familiarise the learner how to synthesize an electrical network from a given impedance/admittance function. Learning Outcome – ▪ Apply the knowledge of basic circuital law and simplify the network using reduction techniques. ▪ Analyze the circuit using Kirchhoff's law and Network simplification theorems. ▪ Infer and evaluate transient response, Steady state response, network functions	NO OF LECTURES 12

	▪ Obtain the maximum power transfer to the load , and Analyze the series resonant and parallel resonant circuit.	
1	**i) Circuit theorems:** Thevenin theorem, Norton theorem, Reciprocity theorem, Maximum power transfer theorem. **CR: 7.7, 7.8, 7.9, 7.10, 7.11 (**more problems oriented**)** **ii) A C bridges:** General AC Bridge, Maxwell, de-Sauty, Wien, Schering. **CR: 15.14 (**more problems oriented**)**	
UNIT 2	Learning Objective ---- ➢ Knowledge in analysis of sinusoidal steady-state circuits and AC power Learning Outcome --- ● Learner understand the relationship between sinusoids and phasors. ● The concepts of impedance and admittance. &able to analyze circuits in the frequency domain. ● lerners understand the concept of effective, or rms, value. And relationships between real, reactive, and apparent power	12 LECTURES
2	**i) Transient response of circuits:** Series LR,CR and LCR circuit. Growth and decay of current **CR: 14.1 to 14.3** **ii) Alternating current theory:** ***(****Concept of L, R and C:* ***Review****)* Complex numbers, AC circuit containing pure R, Pure L and pure C, Series L-R, C-R and LCR circuits. Resonance in LCR circuit(both series and parallel), Power in AC circuit, Q factor. Transformer (Ref. CR: Art 5.12 Omit phasor	

	diagram & Auto transformer) **CR - 15.2, 15.5 to 15.12**	
UNIT 3	Learning Objective ---- ➢ Basic understanding of analysis of nonlinear circuits containing diodes ➢ To understand number representation and conversion between different representation in digital electronic circuits. ➢ To learn Number System, Binary Codes and Boolean Algebra. ➢ Learner will learn Boolean function representation and minimization techniques ➢ To learn about Combinational Logic Circuits and Sequential Logic Circuits. Learning Outcome ---After completion of course ▪ Learners understand the concept of nonlinearity & the concept of rectification. ▪ Understand the fundamentals of converting from one number system to another. ▪ Represent signed decimal numbers in 2's complement form, and vice versa. ▪ Analyze, design and implement sequential logic circuits.	12 LECTURES
3	**i) Rectifier Circuit:** (Half wave and Full wave rectifier: **Review**) Bridge rectifier: Efficiency and Ripple factor of Full wave Rectifier, Filter circuits: types of filter circuits – capacitor filter, choke input filter, **VKM: 9.10 to 9.20, 9.22, 9.23** ii) **Digital electronics** (Logic Gates: **Review**) De-Morgan's Theorems, NAND & NOR as Universal Building blocks.	

	EX-OR gate: Logic expression, logic symbol, truth table, Implementation using basic gates Number System: Decimal, Binary and Hexadecimal (their conversion) Addition and Subtraction of Binary numbers using 2's compliments, SOP and POS methods

References:

1))**CR:** D. Chattopadhyay, P C Rakshit , Electricity and Magnetism 7th Ed. New Central Book agency.

2) **TT** :B.L. Theraja and A.K. Theraja , A Textbook of Electrical Technology Vol. I , S. Chand Publication

3)**BN** :Boylestad and Nashelsky, Electronic devices and Circuit Theory: 7thedition, Prentice Hall of India.

4)**VKM:** V K Mehta and R Mehta Electronics Principals, MulticolouredRevised 11th Ed. reprint in 2012 ,S Chand.

5)**M L:**A P Malvino, Digital Principles and Applications: Tata McGraw Hill

Tokhiem, Digital electronics, 4thed, McGraw Hill International Edition

Evaluation Pattern: Theory

For each course I, II

External Evaluation – Semester End Examination (60 M) - Duration : 2 hours

Paper Pattern

Question No	Module	Marks with Option	Marks without Option
Q.1 (A) Attempt any One/Two (B) Attempt Three/Fou	1	08 12	16 16

Q.2 (A) Attempt any One/Two (B) Attempt Three/Four	2	08 12	16 16
Q.3 (A) Attempt any One/Two (B) Attempt Three/Four	3	08 12	16 16

Internal Evaluation - (40 M)

Evaluation type	Marks
Class Test and Assignment **OR** Project +presentation+ report writing+ Viva **OR** Chapter review +presentation+ report writing +Viva	30 + 10 40 40

F. Y. B. Sc. (PHYSICS)

SEMESTER I - Practicals

Course-I & II

COURSE CODE: ----18US1PHP

Experiments	Number of Credits	Number of hours
1. Flywheel 2. Torsional oscillations 3. Bifilar Pendulum 4. Helmholtz Resonator 5. Y by Vibration 6. η By Poisseuli Method 7. Bridge rectifier (to study load regulation) 8. LR Circuit 9. C R Circuit 10. De-Morgan's Theorems 11. NAND and NOR as Universal Building Blocks. 12. Thevenin's Theorem 13. Determination of Unknown Capacitance by De-Sauty's Method 14. Spectrometer- Determine Angle of prism	2	3 HOURS/EXPERIMENT

Skill Experiments

1. Use of Vernier Callipers, Micrometre Screw Gauge and Travelling Microscope
2. Graph plotting (Exponential, Straight line with intercept, Resonance curve etc.)
3. Spectrometer: Schuster's Method
4. Use of DMM

Minimum of 8 experiments from the Courses should be completed in first semester. All the skill experiments are to be reported in journal. Certified journal is must to be eligible to appear for the semester end practical examination.

F.Y. B. Sc. (PHYSICS) SEMESTER II

Course – I

COURSE TITLE: **Modern Physics and Nuclear Physics**

COURSE CODE: 18US2PH1

[CREDITS - 02]

UNIT 1		NO OF LECTURES 12
	Learning Objective— This Course Enables the Learner to ➢ Study and develop the Bohr theory of the hydrogen atom . ➢ Distinguish between the energy levels of a rigid and a non-rigid rotor. ➢ Describe the origin of X-ray and their emission and absorption spectra. Learning outcomes--- After successful completion of this course a Learner will be able to: ▪ Calculate the effects of an electric field on the energy levels of the hydrogen atom. ▪ Understand the concept of origin of X-rays and x ray spectra.	
1	**i) Atomic Physics:** (Review of Bohr's Postulates) Nuclear atom, Electron orbits, atomic spectra, Bohr atom, energy levels and	

	spectra, correspondence principle, nuclear motion, atomic excitation. **ii)X-Rays:** X-Rays production(Review) , continuous and characteristic X ray spectra, X-Ray Diffraction, Bragg's Law, Diffractometer	
UNIT 2		NO OF LECTURES 12
2	Learning Objective ---- After completing the course, learner will have the following competence: ➢ Know what radioactivity is and how it arises. ➢ Know radioactivity in nature and why it is there. ➢ Know fundamental concepts e.g. half-life, radioactive series and isotope generators. ➢ To impart knowledge about basic nuclear physics properties Learning Outcome ---- Learners will have achieved the ability to: ▪ Explain the ground state properties of the nucleus for study of the nuclear structure behaviour. ▪ Explain the deuteron behaviour at ground and excited states.	
2	**i) Radioactivity:** Radioactive decay: Five kinds, Radioactivity and the Earth, Radiation Hazards, Half-Life, Radiometric Dating, Successive Disintegration A B =>C (stable), Radioactive Series and Radioactive Equilibrium. **AB: 11.1 to 11.4, 11.7, 12.1 to 12.3.** **ii) Nuclear Physics:** Nuclear composition, nuclear properties, Stable nuclei, Binding energy, Meson	

	theory of nuclear forces.	
UNIT 3		NO OF LECTURES 12
3	Learning Objective— The main objective of this course is to make Learners aware about the ➢ The development of quantum mechanics with previous knowledge and learn the basic properties of quantum world. ➢ basic formulations in quantum mechanics. ➢ wave functions of system of identical particles. Learning outcomes --- After taking this course Learners will be able to appreciate the beauty of quantum mechanics. ▪ They will be knowing all types of representations of operators and ways to apply them in different problems. ▪ The most important thing Learners learned form this course was how to solve the hydrogen atom problem by using quantum mechanics. ▪ understand the idea of wave function. ▪ understand the uncertainty relations & Compton effect.	
	i) Introduction to Quantum Mechanics I: De Broglie Waves, Wave function, Particle Diffraction, Davisson Germer Experiment, Heisenberg's Uncertainty Principle. **ii)Introduction to Quantum Mechanics II:** Compton Effect, Pair production, Photons and Gravity, gravitational red shift **AB: 2.7, 2.8, 2.9, 3.1, 3.2, 3.5, 3.7, 3.8, 3.9** ***Note:*** ***A good number of numerical examples are expected to be covered during the prescribed lectures.***	

References:

1) **AB:** A. Beiser .Concepts of Modern Physics – (6th Ed), Tata McGraw Hill.

2) **K:** Kaplan: Irving Kaplan, Nuclear Physics, 2nd Ed. Narosa Publishing House

3)**SBP:** Dr. S. B. Patel, Nuclear Physics Reprint 2009, New Age International

4)**BSS:** N Subrahmanyam, Brijlal and Seshan, ,Atomic and Nuclear Physics Revised Ed. Reprint 2012S. Chand

Course – II

COURSE TITLE: **Applied Physics**

COURSE CODE: 18US2PH2

[CREDITS - 02]

UNIT 1		NO OF LECTURES 12
1	Learning Objective ---- ➢ Understand basics of material science ➢ Understand the concepts of LASERs and fibre optics and their applications. ➢ Introduce the concept of astrophysics and biophysics ➢ Demonstrate quantitative problem solving skills in all the topics covered. Learning Outcome --- ▪ Learners will be able to describe the basic structure of materials at the molecular, microscopic, and macroscopic scales, and will be able to describe modern methods of characterizing materials at each of these length scales. ▪ Learners will understand diffusion and electrochemical processes in materials.	
1	**i) Material Science:** Classification and selection of materials: Classification of materials, organic, semiconductor materials, current trends and advances in materials, Material structure and examination, Selection of materials. Nano- Materials: Definitions of nano materials, size dependent properties of nano materials, alternate approaches of preparations of nano materials, synthetic	

	strategies. **ii) Crystal geometry and structure**: Crystals, single crystal, lattice point and space lattice. Unit cell, primitive cell, Atomic radius, Density of crystal, Direction lattice planes, Miller indices, Inter-planer spacing. **KK:** Chapter 1(3 TO 9) Chapter 3 (1 TO 18, 33) **BV:** Chapter 1 (1.1 to 1.4) S: 12.1, 12.1.1, 12.1.2,1 2.4.1, 12.4.2, 12.4.3[Note: A good number of numerical examples are expected to be covered during the prescribed lectures.]	
UNIT 2	Learning Objective ---- ➢ Understand basics of material science. ➢ Understand the concepts of LASERs and fibre optics and their applications. ➢ Introduce the concept of astrophysics and biophysics ➢ Demonstrate quantitative problem solving skills in all the topics covered. ➢ The course aims to present various aspects of the foundations, design, operation and application of lasers. Learning Outcome –Learners will gain a good understanding of the building blocks of lasers. In particular, they will be able to ▪ Predict fundamental (and ultimate) characteristics of laser systems. ▪ Demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber.	NO.OF LECTURES 12

2	**i)Laser:** Introduction, transition between atomic energy states (without derivation), Principle of Laser, Properties of Laser, Types of Lasers, Helium–Neon Laser, Application of Laser to Holography and other applications. **S P: 9.1, to 9.6, 9.10, 9.11.** ii) **Fiber Optics:** Light propagation through Fibers, Fiber Geometry, Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibers, Applications of Fibers S P: – 13.3, 13.5, 13.9. Note: A good number of numerical examples are expected to be covered during the prescribed lectures.	
UNIT 3	Learning Objective ---- ➢ Understand basics of material science. ➢ Understand the concepts of LASERs and fibre optics and their applications. ➢ 3. Introduce the concept of astrophysics and biophysics ➢ 4. Demonstrate quantitative problem solving skills in all the topics covered. Learning Outcome – ▪ Learner will identify the biological, chemical, and physical properties of organisms on a molecular and cellular level. ▪ Learners will solve problems involving the physics of biological materials. ▪ Learners will demonstrate a conceptual understanding of connections between physics and biology	NO.OF LECTURES 12
3	**i) Bio Physics:** Introduction, definition, History & scope of biophysics, biological fluids, physico-chemical properties, viscosity, surface tension, pH, osmosis, osmotic pressure, diffusion,	

	Thermodynamics approach to bio Physics, Laws of thermodynamics and living organism, First and Second law of thermodynamics, comparison of living and non living system as a thermodynamics system. **ii) Astro -Physics:** Basic Astro-Physics: Planck's Theory of Radiation, Photo electric effect, Pressure of Radiation, Type of Spectrum, Doppler Effect **BB:** 2.1, 2.2, 2.3, 2.4, 2.5 Large Scale Structure of the Universe: Introduction, Structural Hierarchy, Hubble's law, Radiation Background, Life cycle of star **JN:** 1.1, 1.2, 1.3, 1.4, 1.5

References:

1) **KK :** S. K. Kakani and AmitKakani Reprint 2004. Material Science –, New Age International (P) Ltd.

2) 2) **BV:** B. Viswanathan, Fourth Reprint- 2013.Nano materials, Narosa Publication House,

3) **SP:** SanjeevPuri, Modern Physics Concept and Applications –Narosa Publication

4) **Roy**: R N Roy (Revised Edition) A text book Bio Physics- (New Central Book Agency ltd)

5)**BB:** BaidyanathBasu, 2010.Introduction to Astro-Physics, PHI learning Pvt Ltd,

6) **JN:**JayantNarlikar, Ltd 1996Elements of Cosmology, University Press (India)

Refrences For Biophysics unit

1. Gerald Karp Cellular and Molecular Biology: Concept and Experiment

2. Geoffery Cooper The Cell: A Molecular Approach

3. James Claycomb Introductory Biophysics: Perspective on living state

4. Guyton Medical Physiology

5. Bruce Albert Molecular Biology of Cell

6. by R N Roy Text Book of Biophysics Chapter1, Chapter 3: 3.1.3.3, 3.4.1, 3.4.2, 3.6.1, 3.6.2, 3.14

Evaluation Pattern: Theory

For each course I, II

External Evaluation – Semester End Examination (60 M)- Duration : 2 hours

Paper Pattern

Question No	Module	Marks with Option	Marks without Option
Q.1 (A) Attempt any One/Two (B) Attempt Three/Four	1	08 12	16 16
Q.2 (A) Attempt any One/Two (B) Attempt Three/Four	2	08 12	16 16
Q.3 (A) Attempt any One/Two (B) Attempt Three/Four	3	08 12	16 16

Internal Evaluation - (40 M)

Evaluation type	Marks
Class Test and Assignment **OR** Project +presentation+ report writing+ Viva **OR** Chapter review +presentation+ report writing +Viva	30 + 10 40 40

SEMESTER II - Practicals

Course-I & II

COURSE CODE: ----18US2PHP

Experiments	Number of Credits	Number of hours
1 Laser Divergence 2. LDR characteristics 3. Spectrometer (determination of refractive index μ of material of prism) 4. Combination of lenses 5. Surface Tension of Biological Fluid 6. Viscosity by Stoke's Method 7. Norton's Theorem 8. Use of CRO 9. I-V Characteristics of LED 10. Frequency of AC mains 11. LCR Series Resonance 12. EX OR gate – half adder 13. Implementation of Boolean expression 14. Photo Electric Effect	2	3 HOURS/EXPERIMENT

Demonstration experiments

1. Fiber optics
2. Brewster's law
3. Laser beam- Diffraction
4. Charging and discharging of a capacitor
5. Use of PC for graphs, demonstration experiments
6. Single Slit Fraunhoffer diffraction.
7. Faraday's Induction Experiment

Minimum of 8 experiments from the Courses should be completed in first semester. All the demonstration experiments are to be reported in journal. Certified journal is must to be eligible to appear for the semester end practical examination.

Evaluation pattern: Practicals

External evaluation: 40 Marks practical examination at the end of each semester per course. The learner will be examined in **two experiment per semester**. The experiment will be of Three hours duration. Minimum **08** Experiments per semester and 4 skill/Demo experiments are required to be completed. Learners are required to report all these experiments in the journal. The learner will be evaluated at the time of viva voce on the basis of regular experiments and skill/Demo experiments

A learner will be allowed to appear for the semester end practical examination only if he/she submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics of a particular Semester (I / II)as per the minimum requirements.

Maximum Marks= 100.

Internal evaluation: There will be no internal assessment for practical.

Fair Journal – 10

Viva- 10