

UNIVERSITY OF MUMBAI



Syllabus for the F.Y.B.Sc.

Program: B.Sc.

Course : Physics

(Credit Based Semester and Grading System with
effect from the academic year 2011–2012)

Revised Syllabus in Physics (Theory & Practical)

As per credit based system

First Year B. Sc. 2011 – 2012.

The revised syllabus in Physics as per credit based system for the First Year B. Sc. course will be implemented from the academic year 2011 – 2012.

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	I	Physics [courses USPH101, USPH102 and USPHP1]
Course Code	Title	Credits	
USPH101	Mechanics, Properties of Matter, Heat, Sound & Optics	4 for USPH101 and USPH102	

Unit : I	15 lectures
i) Newton's Laws : Newton's first, second and third laws of motion. Interpretation and applications, pseudo forces. Worked out examples (without friction): 1, 2, 3, 5 Chapter 5 - HCV Worked out examples (with friction): 1, 2, 3, 4 Chapter 6 – HCV Ref.: HCV : 5.1 to 5.5 and 5.7 Add. Ref. : TM, HRW.	
ii) Elasticity : (<i>Elastic constants Y, K, η, σ: review</i>) Equivalence of shear strain to compression and extension strains. Relation between elastic constants, Couple for twist in cylinder. Ref.: HP : 15.2. A to 15.5.A and 15.7.A Add Ref.: DSM	
iii) Fluid Dynamics : Equation of continuity, Bernoulli's equation, streamline and turbulent flow, lines of flow in airfoil, Poiseuille's equation. Ref.: HP 15.2B to 15.6B Add. Ref.: HCV, DSM	

Unit : II	15 lectures
Concept of Heat, The first law, Non adiabatic process and Heat is a path function, Internal energy, Applications of first law to simple processes, Heat Capacity and Specific heat, General relations from the First Law : The Enthalpy, The case of an Ideal gas, Dependence of Temperature of the Atmosphere on Height above sea level, Worked examples, problems. Ref. EG : Chapter 3, Page No. 44 to 64.	

Unit : III	15 lectures
<p>i) Wave motion in one dimension. : General solution of wave equation, Classification of waves, Examples of one dimensional wave: Transverse wave on string. Longitudinal Waves on Rod, Pressure waves in a gas. Ref. SPP : 6.1, 6.2, 6.5, 6.5.1, 6.5.2, 6.5.3.</p> <p>ii) Ultrasonics Piezoelectric effect, Production of Ultrasonic waves: Piezoelectric Crystal Method: Magnetostriction Method. Detection, Properties and applications of Ultrasonic Waves</p> <p>iii) Acoustics of Buildings Reverberation, Sabine's formula (without derivation) Absorption coefficient, Acoustics of Buildings, factors affecting Acoustics of Buildings, Sound distribution in an auditorium. Ref.: MS : 5.1 to 5.6, 5.8, 5.9, 5.10, 5.12, 5.13, 5.14, 5.15.</p>	

Note:

A good number of numerical examples are expected to be covered during the prescribed lectures.

References.

1. **HCV** : Concepts of Physics – H. C. Verma (Part – I) 2002 Ed. Bharati Bhavan Publishers.
2. **HP** : Mechanics – Hans and Puri, 2nd Ed. Tata McGraw Hill.
3. **EG** : Basic Thermodynamics-Evylen Guha (Narosa Publication)
4. **SPP** : Fundamentals of vibration and waves – S P Puri (Tata McGraw Hill)
5. **MS** : Properties of matter and Acoustics – R Murugesan and K. Shivaprasath, S Chand & Co.Ltd. (2005-Ed)

Additional References

Unit – I

1. **TM** : Classical Dynamics – Thornton & Marion (5th Ed)
2. **DSM** : Element of Properties of Matter – D S Mathur, S Chand & Co.
3. **HRW** : Fundamental of Physics (extended) – Haliday, Resnick and Walker (6th Ed.), John Wiley and Sons.

Unit - II

1. Heat and Thermodynamics – M. W Zemansky & R H Dittman. McGraw Hill.
2. Theory and Experiments on Thermal Physics – D. K. Chakrabarti (2006 Ed), Central book.

Unit - III

1. A Text book of Sound - Subramanyam and Brij Lal
2. A Text book of Sound - M. N. Srinivasan, Himalaya Publishing House
3. Acoustics – Waves and Oscillations - S. N. Sen – Wiley Eastern Ltd.
4. Sound – F. G. Mee. Heinemann Educational Books Ltd.

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	I	Physics [courses USPH101, USPH102 and USPHP1]
Course Code	Title	Credits	
USPH102	Electricity, Magnetism, Electronics, Atomic, Nuclear and Modern Physics	4 for USPH101 and USPH102	

Unit : I	15 lectures
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1. Transient response of circuits:

Series LR, CR and LCR circuit. Growth and decay of current

CR : 14.1 to 14.3

2. 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 : II	15 lectures
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1) Nuclear atom, electron orbits, atomic spectra, Bohr atom, energy levels and spectra, correspondence principal, nuclear motion, atomic excitation.

2) X-Rays production, continuous and characteristic X ray spectra, X-Ray Diffraction, Bragg's Law,

AB : 4.1 to 4.8, 2.4, 2.5, 2.6.

Unit : III	15 lectures
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1) **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, π Filter, Voltage stabilization – Zener diode as voltage stabilizer.

VKM : 9.10 to 9.20, 9.22, 9.23.

2) **Transistor as amplifier** – CB, CE, CC modes. Definition of gain α , β (dc & ac) and relation between them. CE amplifier: - operation, Load line Analysis, operating point, cut off and saturation points.

VKM : 11.7 to 11.17, 11.21

3) **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 and its applications : Controlled inverter, Half Adder, Full adder.

VKM : 28.8 to 28.14, 28.19

LM : 6.7

Additional References :

Unit – III

1. Electronic Principles and applications – A B Bhattacharya, Central Publisher.
2. Electronic Devices and Circuit Theory – Boylestad and Nashelsky (6th Ed.), Prentice Hall of India.
3. Electronic Principles – A P Malvino (5th Ed.), Tata McGraw Hill.
4. Digital Principles and Applications – A P Malvino, McGraw Hill International.
5. Digital Electronics – Tokheim (4th Ed.) – McGraw Hill International Edition.

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	I	Physics [courses USPH101, USPH102 and USPHP1]
Course Code	Title	Credits	
USPHP1	i) Mechanics, Properties of Matter, Heat, Sound & Optics ii) Electricity, Magnetism, Electronics, Atomic, Nuclear and Modern Physics	2	

Regular experiments

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. Zener diode as regulator
9. Transistor (CE) characteristics
10. DeMorgan's Theorems
11. EX-OR Gate, NAND and NOR as Universal Building Blocks.

Skill Experiments

1. Use of Vernier Callipers, Micrometer 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 7 experiments from both the papers 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.

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	II	Physics
Course Code	Title	Credits	[courses USPH201, USPH202 and USPHP2]
USPH201	Mechanics, Properties of Matter, Heat, Sound & Optics	4 for USPH201 And USPH202	

Unit : I	15 lectures
<p>i)Composition of two SHM,s : <i>(Definition of SHM and composition of two parallel SHM's of same period : review)</i> Composition of two perpendicular S H M's having same period and period in the ratio 1:2, Lissajous figures. Ref.: SPP 2.4.1, 2.4.3, 2.4.4.</p> <p>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. Rocket motion (neglecting gravity) Ref.: TM: 9.2, 9.3, 9.4, 9.11</p>	

Unit : II	15 lectures
<p>i)Geometrical Optics: Refraction through lenses, Thin lens, Thick lens, Lens combination.</p> <p>ii)Aberrations: Spherical Aberration, Reduction of Spherical Aberration Chromatic Aberration, Condition for Achromatism</p> <p>iii)Simple Table Spectrometer: Adjustments, measurement of angle of minimum deviation</p> <p>iv)Interference of light: Interference in thin films, Fringes in Wedge shaped films, Newton's Rings. Ref.: S. B 2.1 to 2.11, 2.14, 2.15, 3.5 to 3.11, 3.25 to 3.28, 4.36, 4.37, 8.15 to 8.25.</p>	

Unit : III	15 lectures
<p>Laser : Introduction, transition between Atomic energy states (without derivation), Principle of Laser, Properties of Laser, Helium–Neon Laser, Application of Laser to Holography and other applications. Ref.: S P: 9.1, to 9.6, 9.10, 9.11.</p> <p>Fibre Optics : Light propagation through Fibres, Fibre Geometry, Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibres, Applications of Fibres. Ref.: S P : – 13.3, 13.5, 13.9.</p>	

Note:

A good number of numerical examples are expected to be covered during the prescribed lectures.

1. **TM** : Classical Dynamics – Thornton and Marion (5th Ed.) Thomson Books.
2. **SB** : A Text Book of Optics, N. Subramaniam and Brij Lal, S. Chand and Co. 22nd Ed. (1994)
3. **SPP** : Fundamentals of vibration and waves – S P Puri (Tata McGraw Hill)
4. **SP** : Modern Physics Concept and Applications – Sanjeev Puri, Narosa Publication.

Additional References

Unit – I

1. **DSM** : Element of Properties of Matter – D.S. Mathur, S. Chand & Co. (Ed. 2001)
2. **KRS** : Mechanics – K R Symon – Addison – Wesley Publishing Co.

Unit – II

1. Principles of Optics – B. K. Mathur and T. P. Pandya (3rd Ed.) 1981, McGraw Hill International.
2. Fundamentals of Optics – Khanna and Gulati (1994), S. Chand.
3. Optics – C. L. Arora, S. Cand & Co. Ltd (2001)

Unit – III

1. Fundamentals of Optics – Jenkins and White. (4th Ed) McGraw Hill International.
2. Optics – Ajoy Ghatak (2nd Ed.) Tata McGraw Hill.
3. Electronic Communication System and Device – Kennedy. (4th Ed) Tata McGraw Hill.
4. Fibre Optics – Kaiser, McGraw Hill.

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	II	Physics [Courses USPH201, USPH202 and USPHP2]
Course Code	Title	Credits	
USPH202	Electricity, Magnetism, Electronics, Atomic, Nuclear and Modern Physics	4 for USPH201 And USPH202	

Unit : I	15 lectures
<p>1. a) Circuit theorems: Thevenin theorem, Norton theorem, Reciprocity theorem, Maximum power transfer theorem. CR : 7.7, 7.8, 7.9, 7.10, 7.11</p> <p>b) A C bridges: General AC Bridge, Maxwell, de-Sauty, Wien, Schering. CR : 15.14</p> <p>2. Electromagnetic Measuring Instruments: General theory of MCG, Dead beat and Ballistic galvanometer. Difference between Dead beat and Ballistic galvanometer. CR – 12.1, 12.2, 12.4, 12.5.</p>	

Unit : II	15 lectures
<p>1. Nuclear composition, some nuclear properties, stable nuclei, binding energy, Meson theory of nuclear forces.</p> <p>2. Radioactive decay: Five kinds, Radioactivity and the Earth, Radiation Hazards, Half-Life, Radiometric Dating, Successive Disintegration A \Rightarrow B \Rightarrow C(stable), Radioactive Series and Radioactive Equilibrium. AB : 11.1 to 11.4, 11.7, 12.1 to 12.3.</p>	

Unit : III	15 lectures
<p>1. Compton Effect, Pair production, Photons and Gravity, Gravitational Red Shift.</p> <p>2. De Broglie Waves, Wave function, Particle Diffraction, Davisson Germer Experiment, Heisenberg's Uncertainty Principle. AB : 2.7, 2.8, 2.9, 3.1, 3.2, 3.5, 3.7, 3.8, 3.9.</p>	

Note:

A good number of numerical examples are expected to be covered during the prescribed lectures.

References :

1. **CR** : Electricity and Magnetism- D. Chattopadhaya and P. C. Rakshit (4th Ed) Reprint – 2000) Books and Allied (P) Ltd.
2. **AB** : Concepts of Modern Physics – A. Beiser (6th Ed), Tata McGraw Hill.
3. **VKM** : Principles of Electronics – V. K. Mehta and Rohit Mehta (2006 revised Ed), S. Chand and Co.
4. **LM** : Digital Principles and Applications – Leach and Malvino (5th Ed), Tata McGraw Hill.

Additional References**Unit I**

1. Mechanics and Electrodynamics – Brij Lal, N. Subramaniam, Jivan Seshan (Revised and enlarged Ed – 2005) S. Chand.
2. Schaum's Outline Series – Electricity and magnetism – Administer.

Unit II and III

1. Perspectives of modern Physics – A Beiser, Tata McGraw Hill.
2. Quantum Mechanics – S B Singh, M K Bagde, Kamal Singh, S Chand (Reprinted 2000).
3. Nuclear Physics – S B Patel, New Age International Pvt. Ltd.
4. Atomic and Nuclear Physics – S. N. Ghosal (2nd Ed. 2000) S Chand & Co.
5. Atomic and Nuclear Physics - A. B. Gupta and Deepak Ghosh, Books & Allied (P)Ltd. (2nd Ed. 1999.)

Name of the Programme	Duration	Semester	Subject
B.Sc. in Physics	Six semesters	I	Physics [courses USPH201, USPH202 and USPHP2]
Course Code	Title	Credits	
USPHP2	i) Mechanics, Properties of Matter, Heat, Sound & Optics ii) Electricity, Magnetism, Electronics, Atomic, Nuclear and Modern Physics	2	

Regular experiments Paper – I and II

1. J by Electrical Method
2. Spectrometer (determination of angle of prism A)
3. Spectrometer (determination of refractive index μ of material of prism)
4. Combination of lenses
5. Newton's rings
6. Wedge Shaped Film
7. Thevenin's theorem
8. Norton's theorem
9. LR circuit
10. CR circuit
11. Frequency of AC mains
12. LDR characteristics
13. LCR Series Resonance

Demonstration experiments

1. Angular momentum conservation (Rotating platform)
2. Brewster's law
3. Laser beam divergence, intensity
4. Use of oscilloscope
5. Charging and Discharging of a capacitor
6. Use of PC for graphs, demonstration experiments
7. Single Slit Fraunhofer diffraction.
8. Faraday's Induction Experiment

Minimum 7 experiments from both the papers should be completed in the second semester. At least four demonstration experiments are to be reported in journal. Certified journal is must to be eligible to appear for the semester end practical

The scheme of examination for the revised course in Physics at the First Year B. Sc. Semester end examination will be as follows.

Scheme of Examination:

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 40% marks in the first part & by conducting the Semester End Examinations with 60% marks in the second part.

The Course having Practical training will have Practical Examination for 50 marks at the end of Semester, out of which 30 marks for the Practical task assigned at the time of examination. The 20 marks are allotted as Internal Assessment.

The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below:-

Internal Assessment: It is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the Credit based system by way of participation of learners in various academic and correlated activities in the given semester of the programme.

Semester End Assessment : It is defined as the assessment of the learners on the basis of Performance in the semester end Theory/ written/ Practical examination.

Modality of Assessment :

Internal Assessment - 40% **40 marks.**

a) Theory **40 marks**

Sr No	Evaluation type	Marks
1	Two Assignments/Case study/Project	20
2	One class Test (multiple choice questions objective)	10
3	Active participation in routine class instructional deliveries(case studies/ seminars//presentation)	05
4	Overall conduct as a responsible student, manners, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05

b) Practicals **20 marks**

Sr No	Evaluation type	Marks
1	Two best practicals	10
2	Journal	05
3	Viva	05

B) External examination - 60 %

Semester End Theory Assessment - 60% **60 marks**

- i. Duration - These examinations shall be of two hours duration.
- ii. Theory question paper pattern :-
 1. There shall be four questions each of 15 marks. On each unit there will be one question & fourth one will be based on entire syllabus.
 2. All questions shall be compulsory with internal choice within the questions. Each question will be of 20 to 23 marks with options.

3. Questions may be sub divided into sub questions a, b, c, d & e only & the allocation of marks depends on the weightage of the topic.

Practical External Assessment

30 marks

A candidate will be allowed to appear for the examination only if the candidate submits a Certified journal at the time of practical examination of the semester or a certificate from the Head of the Department / Institute to the effect that the candidate has completed the practical course of that semester of F. Y. B. Sc. Physics as per the minimum requirement.