

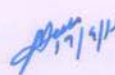
**UNIVERSITY OF MUMBAI**

**No. UG/69 of 2016-17**

**CIRCULAR:-**

A reference is invited to the Syllabi relating to the B.Sc. degree course, **vide** this office Circular No. UG/131 of 2011, dated 13<sup>th</sup> June, 2011 and the Principals of affiliated Colleges in Science are hereby informed that the recommendation made by Board Studies in Physics at its meeting held on 24<sup>th</sup> May, 2016 has been accepted by the Academic Council meeting held on 24<sup>th</sup> June, 2016 **vide** item No. 4.50 and that in accordance therewith, the revised syllabus as per the Credit Based Semester and Grading System for F.Y. B.Sc. Physics (Sem.I & II), which are available on the University's web site ([www.mu.ac.in](http://www.mu.ac.in)) and that the same has been brought into force with effect from the academic year 2016-17.

MUMBAI – 400 032  
21<sup>st</sup> September, 2016

  
(Dr.M.A.Khan)  
REGISTRAR

To,

The Principals of the affiliated Colleges in Science.

A.C/4.50/24.06.2016

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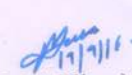
No. UG/69 -A of 2016

MUMBAI-400 032

21<sup>st</sup> September, 2016

Copy forwarded with Compliments for information to:-

- 1) The Deans, faculties of Science,
- 2) The Chairman, Board of Studies in Physics,
- 3) The Professor-cum-Director, Institute of Distance & Open Learning (IDOL)
- 4) The Director, Board of College and University Development,
- 5) The Co-Ordinator, University Computerization Centre,
- 6) The Controller of Examinations.

  
(Dr.M.A.Khan)  
REGISTRAR

PTO..

# UNIVERSITY OF MUMBAI



## **Syllabus for Sem I & II** **Program: B.Sc.** **Course: Physics**

(Credit Based Semester and Grading  
System for Academic year 2016-17)

**Syllabus for B.Sc. Physics (Theory & Practical)**  
**As per credit based system**  
**First Year B.Sc. 2016–2017.**

The revised syllabus in Physics as per credit based system for the First Year B.Sc. Course will be implemented from the academic year **2016–2017.**

**Preamble:**

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

**Objectives:**

- To develop analytical abilities towards real world problems
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem solving, hands on activities, study visits, projects etc.

Course code	Title	Credits
	Semester I	
USPH101	Classical Physics	2
USPH102	Modern Physics	2
USPHP1	Practical I	2
		Total= 06
	Semester II	
USPH201	Mathematical Physics	2
USPH202	Electricity and Electronics	2
USPHP2	Practical II	2
		Total=06

## SEMESTER-I

Name of the Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	I	Physics
CourseCode	Title	Credits	
<b>USPH101</b>	<b>Classical Physics</b>	2for USPH101	

### Learning Outcomes:

On successful completion of this course students will be able to:

1. Understand Newton's laws and apply them in calculations of the motion of simple systems.
2. Use the free body diagrams to analyze the forces on the object.
3. Understand the concepts of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them.
4. Understand the concepts of lens system and interference.
5. Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process.
6. Demonstrate quantitative problem solving skills in all the topics covered

### Unit:I

**15lectures**

#### 1. Newton's Laws:

Newton's first, second and third laws of motion, interpretation and applications, pseudo forces, Inertial and non-inertial frames of reference. Worked out examples (with friction present)

#### 2. Elasticity:

Review of Elastic constants  $Y$ ,  $K$ ,  $\eta$  and  $\sigma$ ; Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple for twist in cylinder.

#### 3. Fluid Dynamics:

Equation of continuity, Bernoulli's equation, applications of Bernoulli's equation, streamline and turbulent flow, lines of flow in airfoil, Poiseuille's equation.

### Unit:II

**15lectures**

1. Lens Maker's Formula (Review), Newton's lens equation, magnification-lateral, longitudinal and angular.

2. Equivalent focal length of two thin lenses, thick lens, cardinal points of thick lens, Ramsden and Huygens eyepiece.
3. Aberration: Spherical Aberration, Reduction of Spherical Aberration, Chromatic aberration and condition for achromatic aberration.
3. Interference: Interference in thin films, Fringes in Wedge shaped films, Newton's Rings (Reflective).

### **UNIT III**

**15 lectures**

1. Behavior of real gases and real gas equation, Van der Waal equation
2. Thermodynamic Systems, Zeroth law of thermodynamics, Concept of Heat, The first law, Non Adiabatic process and Heat as a path function, Internal energy, Heat Capacity and specific heat, Applications of first law to simple processes, general relations from the first law, Indicator diagrams, Work done during isothermal and adiabatic processes, Worked examples, Problems.

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

#### **References:**

1. Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley and Sons.
2. H. C. Verma, Concepts of Physics – (Part–I), 2002 Ed. Bharati Bhavan Publishers.
3. Iradov
4. Brijlal, Subramanyam and Avadhanulu A Textbook of Optics, 25th revised ed.(2012) S. Chand
5. Brijlal, Subramanyam and Hemne, Heat Thermodynamics and Statistical Physics, S Chand, Revised, Multi-coloured, 2007 Ed.
6. Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International.

#### **Additional References :**

1. Thornton and Marion, Classical Dynamics – (5th Ed)
2. D S Mathur, Element of Properties of Matter, S Chand & Co.
3. R Murugesan and K Shivprasath, Properties of Matter and Acoustics S Chand.
4. M W Zemansky and R H Dittman, Heat and Thermodynamics, McGraw Hill.
5. D K Chakrabarti, Theory and Experiments on Thermal Physics, (2006 Ed) Central books.
6. C L Arora, Optics, S Chand.
7. Hans and Puri, Mechanics –, 2nd Ed. Tata McGraw Hill

## SEMESTER-I

Nameofthe Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	I	Physics
CourseCode	Title	Credits	
<b>USPH102</b>	<b>Modern Physics</b>	2for USPH102	

### Learning Outcomes:

After successful completion of this course students will be able to

1. Understand nuclear properties and nuclear behavior.
2. Understand the type isotopes and their applications.
3. Demonstrate and understand the quantum mechanical concepts.
4. Demonstrate quantitative problem solving skills in all the topics covered.

### Unit I

**15lectures**

1. Structure of Nuclei:Basic properties of nuclei, Composition, Charge, Size, Rutherford's expt. for estimation of nuclear size, density of nucleus, Mass defect and Binding energy, Packing fraction, BE/A vs A plot, stability of nuclei (N Vs Z plot) and problems.
2. Radioactivity: Radioactive disintegration concept of natural and artificial radioactivity, Properties of  $\alpha$ ,  $\beta$ ,  $\gamma$ -rays, laws of radioactive decay, half-life, mean life (derivation not required), units of radioactivity, successive disintegration and equilibriums, radioisotopes. Numerical Problems.
3. Carbon dating and other applications of radioactive isotopes (Agricultural, Medical, Industrial, Archaeological -information from net ).

### Unit II

**15 lectures**

Interaction between particles and matter, Ionization chamber, Proportional counter and GM counter, problems

Nuclear Reactions: Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction, Q value equation and solution of the Q equation, problems.

Fusion and fission definitions and qualitative discussion with examples.

1. Origin of Quantum theory, Black body (definition), Black Body spectrum, Wien's displacement law, Matter waves, wave particle duality, Heisenberg's uncertainty Principle. Davisson-Germer experiment, G. P. Thompson experiment.
2. X-Rays production and properties. Continuous and characteristic X-Ray spectra, X-Ray Diffraction, Bragg's Law, Applications of X-Rays.
3. Compton Effect, Pair production, Photons and Gravity, Gravitational Red Shift.

***Note: A good number of numerical examples are expected to be covered during the prescribed lectures***

**References:**

1. Kaplan: Nuclear Physics, Irving Kaplan, 2nd Ed. Narosa Publishing House
2. SBP: Dr. S. B. Patel, Nuclear Physics Reprint 2009, New Age International
3. BSS: N Subrahmanyam, Brijlal and Seshan, Atomic and Nuclear Physics Revised Ed. Reprint 2012, S. Chand
4. Arthur Beiser, Perspectives of Modern Physics : Tata McGraw Hill

**Additional References:**

- 1 S N Ghosal, Atomic Physics S Chand
- 2 S N Ghosal, Nuclear Physics 2<sup>nd</sup> ed. S Chand

## SEMESTER-I

Name of the Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	I	Physics
CourseCode	Title	Credits	
<b>USPHP1</b>	<b>Practical I</b>	2	

### Learning Outcome:

On successful completion of this course students will be able to:

- i) To demonstrate their practical skills.
- ii) To understand and practice the skills while doing physics practical.
- iii) To understand the use of apparatus and their use without fear.
- iv) To correlate their physics theory concepts through practical.
- v) Understand the concepts of errors and their estimation.

### A. Regularexperiments:

1	J by Electrical Method: To determine mechanical equivalent of heat (Radiation correction by graph method)
2	Torsional Oscillation: To determine modulus of rigidity $\eta$ of a material of wire by torsional oscillations
3	Bifilar Pendulum
4	Spectrometer: To determine of angle of Prism.
5	Y by vibrations: To determine Y Young's Modulus of a wire material by method of vibrations- Flat spiral Spring
6	To determine Coefficient of Viscosity ( $\eta$ ) of a given liquid by Poisseuli's Method
7	Surface Tension/ Angle of contact
8	Combination of Lenses To determine equivalent focal length of a lens system by magnification method.
9	Spectrometer: To determine refractive index $\mu$ of the material of prism
10	To study Thermistor characteristic Resistance vs Temperature
11	Constant volume/constant pressure
12	Newton's Rings To determine radius of curvature of a given convex lens using Newton's rings.
13	Wedge Shaped Film



## B. Skill Experiments:

1.	Use of Verniercalipers, Micrometer Screw Gauge, Travelling Microscope
2.	Graph Plotting : Experimental, Straight Line with intercept, Resonance Curve etc.
3.	Spectrometer: Schuster's Method
4.	Use of DMM
5	Absolute and relative errors calculation.

C) Any one out of following is equivalent to two experiments from section A and/ or B

1. Students should collect the information of at least five Physicists with their work. Report that in journal.
2. Students should carry out mini-project upto the satisfaction of professor In-charge of practical.
3. Study tour. Students participated in study tour must submit a study tour report.

Minimum 8 experiments from the list should be completed in the first semester. Any four skill experiments are to be reported in journal. Certified journal is a 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.

### Semester End Practical Examination:

#### Scheme of examination:

There will be no internal assessment for practical.

A candidate will be allowed to appear for the semester end practical 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. The duration of the practical examination will be two hours per experiment. There will be two experiments through which the candidate will be examined in practical. The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for its skill and understanding of physics.

## SEMESTER II

Nameofthe Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	II	Physics
CourseCode	Title	Credits	
<b>USPH201</b>	<b>Mathematical Physics</b>	2for USPH201	

### Learning Outcomes:

On successful completion of this course students will be able to:

1. Understand the basic mathematical concepts and applications of them in physical situations.
2. Demonstrate quantitative problem solving skills in all the topics covered.

### Unit I

15 lectures

1. Vector Algebra :

Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields, Problems based on Vector algebra.

Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws, Scalar Triple product, Vector Triple product (Omit proofs). Problems and applications based on Dot, Cross and Triple products.

2. Gradient, divergence and curl:

The  $\nabla$  operator, Definitions and physical significance of Gradient, Divergence and Curl; Distributive Laws for Gradient, Divergence and Curl (Omit proofs); Problems based on Gradient, Divergence and Curl.

### Unit: II

15lectures

1. Differential equations:

Introduction, Ordinary differential equations, First order homogeneous and non- homogeneous equations with variable coefficients, Exact differentials, General first order Linear Differential Equation, Second-order homogeneous equations with constant coefficients. Problems depicting physical situations like LC and LR circuits, Simple Harmonic motion (spring mass system).

2. Transient response of circuits: Series LR, CR, LCR circuits. Growth and decay of currents/charge.

### Unit:III

15lectures

1. Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats).

2. Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal and unequal frequency and their uses
3. Wave Motion: Transverse waves on string, Travelling and standing waves on a string. Normal modes of a string, Group velocity, Phase velocity, Plane waves, Spherical waves, Wave intensity.

***Note: A good number of numerical examples are expected to be covered during the prescribed lectures***

### **References:**

1. MS: Murray R Spiegel, Schaum's outline of Theory and problems of Vector Analysis, Asian Student Edition
2. CH: Charlie Harper, Introduction to Mathematical Physics, 2009 (EEE) PHI Learning Pvt. Ltd.
3. CR: D. Chattopadhyay, P C Rakshit, Electricity and Magnetism 7th Ed. New Central Book agency.
4. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
5. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
6. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

### **Additional References:**

1. Brij Lal, N. Subrahmanyam, Jivan Seshan, Mechanics and Electrodynamics, (S. Chand) (Revised & Enlarged ED. 2005)
2. A K Ghatak, Chua, Mathematical Physics, 1995, Macmillan India Ltd.
3. Ken Riley, **Michael Hobson and Stephen Bence**, Mathematical Methods for Physics and Engineering, Cambridge (Indian edition).
4. H. K. Dass, Mathematical Physics, S. Chand & Co.
5. Jon Mathews & R. L. Walker, Mathematical Methods of Physics: W A Benjamin Inc.

## SEMESTER II

Name of the Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	II	Physics
CourseCode	Title	Credits	
<b>USPH202</b>	<b>Electricity and Electronics</b>	2for USPH202	

### Unit I :

**15 lectures**

1. Alternating current theory:(Concept of L, R, and C: Review)  
AC circuit containing pure R, pure L and pure C, representation of sinusoids by complex numbers, Series L-R, C-R and LCR circuits. Resonance in LCR circuit (both series and parallel), Power in ac circuit. Q-factor.

2. AC bridges: AC-bridges: General AC bridge, Maxwell, de-Sauty, Wien Bridge, Hay Bridge.

### Unit II: Electronics

**15 lectures**

1.Circuit theorems: (Review: ohm's law, Kirchhoff's laws)  
Superposition Theorem, Thevenin's Theorem, Ideal Current Sources, Norton's Theorem, Reciprocity Theorem, Maximum Power Transfer Theorem.  
Numericals related to circuit analysis using the above theorems.

2.DC power supply: Half wave rectifier, Full wave rectifier, Bridge rectifier, PIV and Ripple factor of full wave rectifier, Clipper and Clampers( Basic circuits only), Capacitor Filter. Zener diode as voltage stabilizer.

3.Digital electronics : Logic gates(Review), NAND and NOR as universal building blocks. EXOR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De-Morgan theorems, Half adder and Full adder

### Unit III : Electrostatics and Magnetostatics

**15 lectures**

1.The Electric Field : Introduction, Coulomb's Law, The Electric Field, Continuous charge Distribution, Electric Potential, Introduction to Potential, Comments on Potential, The Potential of a Localized Charge Distribution

2.Work and Energy in Electrostatics: The Work Done to Move a charge, The Energy of a Point Charge Distribution

3.Magnetostatics: Magnetic Fields

4.The Biot-Savart Law: Steady Currents, The Magnetic Field of a Steady Current

Helmholtz coil and solenoid.

***Note: A good number of numerical examples are expected to be covered during the prescribed lectures***

**References :**

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

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

BN :Boylestad and Nashelsky, Electronic devices and Circuit Theory: 7<sup>th</sup> edition, Prentice Hall of India.

VKM: V K Mehta and R Mehta Electronics Principals, Multicoloured Revised 11th Ed. reprint in 2012 ,S Chand.

David J. Griffiths : Introduction to Electrodynamics, Prentice Hall India (EEE) 3<sup>rd</sup> Ed.

A B Bhattacharya, Electronics Principles and Applications, Central publisher.

A P Malvino, Digital Principles and Applications: Tata McGraw Hill

Tokhiem, Digital electronics, 4<sup>th</sup>ed, McGraw Hill International Edition.

## SEMESTER II

Name of the Programme	Duration	Semester	Subject
B.Sc.inPhysics	Sixsemesters	II	Physics
CourseCode	Title	Credits	
<b>USPHP2</b>	<b>Practical II</b>	2	

Learning Outcome:

- i) To understand and practice the skills while doing physics practical.
- ii) To understand the use of apparatus and their use without fear.
- iii) To correlate their physics theory concepts through practical.
- iv) Understand the concepts of errors and their estimation.

A) Regular experiments:

1	Flywheel
2	To study Zener Diode as Regulator
3	To study load regulation of a Bridge Rectifier
4	LR Circuit: To determine the value of given inductance and phase angle
5	CR Circuit: To determine value of given capacitor and Phase angle
6	Frequency of AC Mains: To determine frequency of AC mains.
7	LCR series Resonance: To determine resonance frequency of LCR series circuit.
8	To study NAND and NOR gates as Universal Building Blocks
9	To study EX-OR Gate, half adder and full adder and verify their truth tables.
10	To verify De Morgan's Theorems
11	Thevenin's Theorem: To verify Thevenin's theorem for DC circuits
12	Norton's Theorem: To verify Norton's Theorem for DC circuits
13	LDR Characteristics: To study the dependence of LDR resistance on intensity of light.

B) List of Demo-experiments: (Min. four)

1.	Angular Momentum conservation ( Rotating Platform)
2.	Light dependent switch
3.	Laser beam divergence, Intensity
4.	Use of Oscilloscope
5	Charging and discharging of a capacitor

6	Use of PC for graph plotting
7	Clipper and Clamper circuits.

- C) Any one out of following is equivalent to two experiments from section A and/ or B
1. Students should collect the information of at least four Physics events and their outcome. Report that in journal.
  2. Students should carry out mini-project up to the satisfaction of professor In-charge of practical
  3. Study tour. Students participated in study tour must submit a study tour report.

Minimum 8 experiments from the list should be completed in the first semester. Any four skill experiments are to be reported in journal. Certified journal is must to be eligible to appear for the semester end practical.

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