# UNIVERSITY OF MUMBAI


## SYLLABUS FOR SEM - V & VI

# Program: B.Sc.

# Course: Physics

(Credit Based Semester and Grading System
w. e. f. the academic year 2018–2019)

**T.Y.B.Sc. Physics Syllabus:** Credit Based Semester and Grading System to be implemented from the Academic year 2018-2019.

| **SEMESTER V** | | | | |
|---|---|---|---|---|
| **Theory** | | | | |
| **Course** | **UNIT** | **TOPICS** | **Credits** | **Lectures per Week** |
| **USPH501** | I | Mathematical Methods in Physics | **2.5** | **4** |
| | II | Mathematical Methods in Physics | | |
| | III | Thermal and Statistical Physics | | |
| | IV | Thermal and Statistical Physics | | |
| **USPH502** | I | Solid State Physics | **2.5** | **4** |
| | II | Solid State Physics | | |
| | III | Solid State Physics | | |
| | IV | Solid State Physics | | |
| **USPH503** | I | Atomic Physics | **2.5** | **4** |
| | II | Atomic Physics | | |
| | III | Molecular Physics | | |
| | IV | Molecular Physics | | |
| **USPH504** | I | Electrodynamics | **2.5** | **4** |
| | II | Electrodynamics | | |
| | III | Electrodynamics | | |
| | IV | Electrodynamics | | |
| **Practicals** | | | | |
| **USPHP05** | Practicals of Course USPH501 + Course USPH502 | | **2.5** | **6** |
| **USPHP06** | Practicals of Course USPH503 + Course USPH504 | | **2.5** | **6** |
| **Project** | | | | |
| **USPHPR1** | USPH501 + USPH502 + USPH503 + USPH504 | | **1** | **4** |

| **SEMESTER VI** | | | | |
|---|---|---|---|---|
| **Theory** | | | | |
| **Course** | **UNIT** | **TOPICS** | **Credits** | **Lectures per Week** |
| **USPH601** | I | Classical Mechanics | **2.5** | **4** |
| | II | Classical Mechanics | | |
| | III | Classical Mechanics | | |
| | IV | Classical Mechanics | | |
| **USPH602** | I | Electronics | **2.5** | **4** |
| | II | Electronics | | |
| | III | Electronics | | |
| | IV | Electronics | | |
| **USPH603** | I | Nuclear Physics | **2.5** | **4** |
| | II | Nuclear Physics | | |
| | III | Nuclear Physics | | |
| | IV | Nuclear Physics | | |
| **USPH604** | I | Special Theory of Relativity | **2.5** | **4** |
| | II | Special Theory of Relativity | | |
| | III | Special Theory of Relativity | | |
| | IV | Special Theory of Relativity | | |
| **Practicals** | | | | |
| **USPH605** | Practicals of Course USPH601 + Course USPH602 | | **2.5** | **6** |
| **USPH606** | Practicals of Course USPH603 + Course USPH604 | | **2.5** | **6** |
| **Project** | | | | |
| **USPHPR2** | USPH601 + USPH602 + USPH603 + USPH604 | | **1** | **4** |

**SCHEME OF THEORY, PRACTICALS AND PROJECT EXAMINATION**
**(SEM- V & VI)**

| | | | | |
|---|---|---|---|---|
| **I.** | **Theory: External Examination: 100 marks** | | | |
| | Each theory paper shall be of **THREE** hours duration. | | | |
| | Each paper shall consist of FIVE questions. All questions are compulsory and will have internal options. Choice in papers has to be 1.5 times. | | | |
| | Q – I : | From Unit – I | | |
| | Q – II : | From Unit – II | | |
| | Q – III : | From Unit - III | | |
| | Q – IV : | From Unit - IV | | |
| | Q – V : | Will consist of questions from all the FOUR Units with equal weightage of marks allotted to each Unit. | | |
| **II.** | **Practicals and Project:** The External Practical Examination will be conducted as per the following scheme. | | | |
| **Sr. No.** | **Particulars of External Practical and Project Examination** | | | **Total Marks** |
| 1 | Laboratory Work | Experiment-1= 60 M | Experiment-2 = 60 M | 120 |
| 2 | Journal | 10 | 10 | 20 |
| 3 | Viva | 10 | 10 | 20 |
| | | | **Sub Total =** | **160** |
| **III.** | **Project** | Internal Examiner (20 M) | External Examiner (20 M) | **40** |
| | | | **Grand Total** | **200** |

**Passing Criteria:**

1. A student should be considered as passed in the practical examination provided he/she fulfills the following passing criteria
    a. Minimum of 20 marks in each practical component - i.e. **USPHP07** and **USPHP08.**
    b. Minimum of 10 marks in Project Component
    c. And cumulatively scoring 80 marks (i.e. 40 % of 200 marks)

| Component | Maximum Marks | Minimum Passing Marks |
|---|---|---|
| **USPHP07** | 80 | 20 |
| **USPHP08** | 80 | 20 |
| **Project 2** | 40 | 10 |
| **Total** | **200** | **80** |

**Scheme of Examination:**

1. The University (external) examination for Theory and Practical shall be conducted at the end of each Semester and the evaluation of Project work at the end of the each Semester.
2. The candidate should appear for **THREE** Practical sessions of **three hours each** as part of his/her Practical course examination.
3. The candidates shall appear for external examination of 2 practical courses each carrying 80 marks and presentation of project work carrying 20 marks at the end of each semester.
4. The candidates shall also appear for internal presentation of project work carrying 20 marks at the end of each semester.
5. The candidate shall prepare and submit for practical examination a certified Journal based on the practical course with **6** experiments from each group.
6. The certified journal must contain a minimum of **12** regular experiments (**6** from each group), **with** minimum **5** demonstration experiments in semester VI. A separate index and certificate in journal is must for each semester course.
7. At the time of practical examination, the candidate must also submit the certified Project Report prepared as per the guidelines given in the Syllabus.

A candidate will be allowed to appear for the practical examination only if the candidate submits a certified journal of TYBSc Physics or a certificate from the Head of the Department to the effect that the candidate has completed the

practical course of TYBSc Physics as per the minimum requirements and a project completion report duly certified by the project in-charge and Head of the Department.

**III. Visits: Visits** to industry, national research laboratories, and scientific exhibitions should be encouraged.

## PRACTICALS - SEMESTER V

The T. Y. B. Sc. Syllabus integrates the regular practical work with a series of skill experiments and the project. There will be separate passing head for project work. During the teaching and examination of Physics laboratory work, simple modifications of experimental parameters may be attempted. Attention should be given to basic skills of experimentation which include:

| | |
|---|---|
| i) | Understanding relevant concepts. |
| ii) | Planning of the experiments |
| iii) | Layout and adjustments of the equipments |
| iv) | Understanding designing of the experiments |
| v) | Attempts to make the experiments open ended |
| vi) | Recording of observations and plotting of graphs |
| vii) | Calculation of results and estimation of possible errors in the observation of results |

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**i) Regular Physics Experiments:** A minimum of **06** experiments from each of the course are to be performed and reported in the journal.

**ii) Skill Experiments:** All the skill experiments are compulsory and must be reported in the journal. Skills will be tested during the examination through viva or practical.

The certified journal must contain a minimum of **12** regular experiments (**06** from each group), **with ALL** Skill experiments in semester V. A separate index and certificate in journal is must for each semester course.

**iii) Project Includes:**

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|---|---|
| a) | Review articles/ PC Simulation on any concept in Physics/ Comparative & differentiative study/Improvement in the existing experiment (Design and fabrication concept) /Extension of any regular experiment/Attempt to make experiment open-ended/Thorough survey of existing active components (devices, ICs, methods, means, technologies, generations, applications etc. / any innovative projects having the concept of physics. |
| b) | Two students (maximum) per project. |
| c) | For evaluation of project, the following points shall be considered …<br>• Working model (Experimental or Concept based simulation)<br>• Understanding of the project<br>• Data collection<br>• Data Analysis<br>• Innovation/Difficulty<br>• Report |

There will be **THREE** turns of **3Hrs each** for the examination of practical courses.

| **SEMESTER V** | |
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| **PRACTICAL COURSE: USPHP05** | |
| **Sr. No.** | **Name of the Experiment** |
| 1 | Determination of ‘g’ by Kater’s pendulum |

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|---|---|
| 2 | Surface tension of soap solution |
| 3 | Elastic constants of a rubber tube |
| 4 | Determination of dielectric constant |
| 5 | Logarithmic decrement |
| 6 | Searle's Goniometer |
| 7 | Determination of Rydberg's constant |
| 8 | Edser's 'A' pattern |
| 9 | Determination of wavelength by Step slit |
| 10 | Determination of e/m by Thomson's method |
| 11 | R. I. by total internal reflection |
| 12 | Velocity of sound in air using CRO |
| **PRACTICAL COURSE: USPHP06** | |
| **Sr. No.** | **Name of the Experiment** |
| 1 | Mutual inductance by BG. |
| 2 | Capacitance by parallel bridge |
| 3 | Hysteresis loop by CRO |
| 4 | L/C by Maxwell's bridge |
| 5 | Band gap energy of Ge diode |
| 6 | Design and study of transistorized astable multivibrator (BB) |
| 7 | Design and study of Wien bridge oscillator |
| 8 | Design and study of first order active low pass filter circuit (BB) |
| 9 | Design and study of first order active high pass filter circuit (BB) |
| 10 | Application of IC 555 timer as a ramp generator (BB) |
| 11 | LM 317 as constant current source |
| 12 | Counters Mod 2, 5, 10 (2 x 5, 5 x 2) |
| **SKILL EXPERIMENTS** | |
| **Sr. No.** | **Name of the Experiment** |
| 1 | Estimation of errors from actual experimental data |

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| 2 | Soldering and testing of an astable multivibrator (Tr./IC555) circuit on PCB |
| 3 | Optical Leveling of Spectrometer |
| 4 | Schuster's method |
| 5 | Laser beam profile |
| 6 | Use of electronic balance: Find the density of a solid cylinder |
| 7 | Dual trace CRO: Phase shift measurement |
| 8 | C1/C2 by B G |
| 9 | Internal resistance of voltage and current source |
| 10 | Use of DMM to test diode, transistor and β factor |

| **References:** | |
|---|---|
| 1. | Advanced course in Practical Physics: D. Chattopadhya, PC. Rakshit & B. Saha (8th Edition) Book & Allied Pvt. Ltd. |
| 2. | BSc Practical Physics: Harnam Singh. S. Chand & Co. Ltd. – 2001. |
| 3. | A Text book of Practical Physics: Samir Kumar Ghosh New Central Book Agency (4th edition). |
| 4. | B Sc. Practical Physics: C. L. Arora (1st Edition) – 2001 S. Chand & Co. Ltd. |
| 5. | Practical Physics: C. L. Squires – (3rd Edition) Cambridge University Press. |
| 6. | University Practical Physics: D C Tayal. Himalaya Publication. |
| 7. | Advanced Practical Physics: Worsnop & Flint. |

## SEMESTER VI

The T. Y. B. Sc. Syllabus integrates the regular practical work with a series of demonstration experiments and the project. There will be separate passing head for project work. During the teaching and examination of Physics laboratory work, simple modifications of experimental parameters may be attempted. Attention should be given to basic skills of experimentation which include:

| | |
|---|---|
| i) | Understanding relevant concepts. |
| ii) | Planning of the experiments. |
| iii) | Layout and adjustments of the equipments |
| iv) | Understanding designing of the experiments |
| v) | Attempts to make the experiments open ended |
| vi) | Recording of observations and plotting of graphs |
| vii) | Calculation of results and estimation of possible errors in the observation of results. |

**i) Regular Physics Experiments:** A minimum of **06** experiments from each of the practical course are to be performed and reported in the journal.

**ii) Demonstration Experiments:** The demonstration experiments are to be performed by the teacher in the laboratory and students should be encouraged to participate and take observation wherever possible.

Demonstration experiments are designed to bring about interest and excitement in Physics. Students are required to enter details of these 'demonstration' experiments in their journal.

The certified journal must contain a minimum of **12** regular experiments (**06** from each practical course), **MINIMUM 06** demonstration experiments in semester VI. A separate index and certificate in journal is must for each course in each semester.

**iii) Project Details:**

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|---|---|
| a) | **Project Includes:** Review articles/Simulation on PC on any concept in Physics/ Comparative & differentiative study/Improvement in the existing experiment (Design and fabrication concept) /Extension of any regular experiment/Attempt to make experiment open-ended/Thorough survey of existing active components (devices, ICs, methods, means, technologies, generations, applications etc. / any innovative projects using the concept of physics. |
| b) | Students/project : 02 (maximum) |
| c) | Evaluation of the project: The following points shall be considered.<br>• Working model (Experimental or Concept based simulation)<br>• Understanding of the project<br>• Data collection<br>• Data Analysis<br>• Innovation/difficulty<br>• Report |

There will be **THREE** turns of **three hours each** for the examination of practical courses.

| **SEMESTER VI** | |
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| **PRACTICAL COURSE: USPHP07** | |
| **Sr. No.** | **Name of the Experiment** |
| 1 | Surface tension of mercury by Quincke's method |
| 2 | Thermal conductivity by Lee's method |
| 3 | Study of JFET characteristics |
| 4 | JFET as a common source amplifier |
| 5 | JFET as switch (series and shunt) |
| 6 | UJT characteristics and relaxation oscillator |
| 7 | Study of Pulse width modulation (BB) |

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| 8 | Study of Pulse position modulation (BB) |
| 9 | Determination of h/e by photocell |
| 10 | R. P. of Prism |
| 11 | Double refraction |
| 12 | Lloyd's single mirror: determination of wavelength |
| **PRACTICAL COURSE: USPHP08** | |
| **Sr. No.** | **Name of the Experiment** |
| 1 | Determination of M/C by using BG |
| 2 | Self-inductance by Anderson's bridge |
| 3 | Hall effect |
| 4 | Solar cell characteristics and determination of $V_{oc}$, $I_{sc}$ and $P_{max}$ |
| 5 | Design and study of transistorized monostable multivibrator (BB) |
| 6 | Design and study of transistorized bistable multivibrator (BB) |
| 7 | Application of Op-Amp as a window comparator |
| 8 | Application of Op-Amp as a Log amplifier |
| 9 | Application of IC 555 as a voltage to frequency converter (BB) |
| 10 | Application of IC 555 as a voltage to time converter (BB) |
| 11 | LM-317 as variable voltage source |
| 12 | Shift register |
| **DEMONSTRATION EXPERIMENTS** | |
| **Sr. No.** | **Name of the Experiment** |
| 1 | Open CRO, Power Supply, and Signal Generator: block diagrams |
| 2 | Data sheets: Diodes, Transistor, Op-amp & Optoelectronic devices |
| 3 | Zeeman Effect |
| 4 | Michelson's interferometer |
| 5 | Constant deviation spectrometer (CDS) |
| 6 | Digital storage oscilloscope (DSO) |
| 7 | Determination of Op-Amp parameters (offset voltage, slew rate, |

| | |
|---|---|
| | input impedance, output impedance, $A_{CM}$) |
| 8 | Transformer (theory, construction and working), types of transformers and energy losses associated with them. |
| 9 | Use of LCR meter |
| 10 | Lux meter / Flux meter |

**References:**


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|---|---|
| 1. | Advanced course in Practical Physics: D. Chattopadhya, PC. Rakshit & B. Saha ($8^{th}$ Edition) Book & Allied (P) Ltd. |
| 2. | BSc Practical Physics: Harnam Singh. S. Chand & Co. Ltd. – 2001. |
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| 5. | Practical Physics: C. L. Squires – ($3^{rd}$ Edition) Cambridge Univ. Press. |
| 6. | University Practical Physics: D C Tayal, Himalaya Publication. |
| 7. | Advanced Practical Physics: Worsnop & Flint. |