UNIVERSITY OF MUMBAI
No. UG/89 of 2016-17

CIRCULAR:-

A reference is invited to the Syllabi relating to the B.Sc. degree course , **vide** this office Circular No. UG/175 of 2010, dated 13th July, 2010 and No.UG/24 of 2005, dated 19th January, 2005 and the Principals of affiliated Colleges in Science are hereby informed that the recommendation made by Board of Studies in Physics at its meeting held on 24th May, 2016 has been accepted by the Academic Council meeting held on 24th June, 2016 **vide** item No. 4.32 and that in accordance therewith, the revised syllabus as per the Choice Based Credit System for (A) T.Y. B.Sc. Physics & (B)T.Y.B.Sc. Physics (Electronic Instrumentation) (Applied Component)(Sem. V & VI), which are available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2016-17.

MUMBAI – 400 032
25th October, 2016

(Dr.M.A.Khan)
REGISTRAR

To,

The Principals of the affiliated Colleges in Science.

A.C/4.32/24.06.2016

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No. UG/89 -A of 2016 MUMBAI-400 032 25th October, 2016

Copy forwarded with Compliments for information to:-

1) The Deans, Faculties of Science,
2) The Chairman, Board of Studies in Physics,
3) The Director, Board of College and University Development,
4) The Co-Ordinator, University Computerization Centre,
5) The Controller of Examinations.

(Dr.M.A.Khan)
REGISTRAR

PTO..

UNIVERSITY OF MUMBAI

Syllabus for Sem V & VI

Program: B.Sc.

Course: Physics

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

T.Y.B.Sc. _Physics_ Syllabus : Credit Based Semester and Grading System

To be implemented from the Academic year 2013-2014

SEMESTER V
Theory

Course	UNIT	TOPICS	Credits	L / 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 and Molecular Physics	**2.5**	**4**
	II	Atomic and Molecular Physics		
	III	Atomic and Molecular Physics		
	IV	Atomic and Molecular Physics		
USPH504	**I**	Electrodynamics	**2.5**	**4**
	II	Electrodynamics		
	III	Electrodynamics		
	IV	Electrodynamics		

Practicals

USPHP05	**Practicals of Course USPH501 + Course USPH502**	**3**	**8**
USPH P06	**Practicals of Course USPH503 + Course USPH504**	**3**	**8**

Scheme of examination: Theory;

(A) **Internal Examination: 40 marks**

Sr. No	Particulars	Marks
1	One Class Test/case study/online examination to be conducted in the given semester	20

2	One assignment based on the curriculum to be assessed by the teacher concerned	10
3	Active Participation in routine class instructional deliveries.	05
4	Overall conduct as a responsible learner, communication and leadership qualities in organizing related academic activities	05

(B) External Examination : 60 marks

1. Each theory paper shall be of two and half hour duration.
   Each paper shall consist of FIVE questions. All questions are compulsory and will have internal option.

   Q – I is from Unit - 1,

   Q – II is from Unit - 2,

   Q - III is from Unit - 3,

   Q - IV is from Unit - 4,

   Q - V will consist of questions from all the FOUR units with equal weightage of

   marks allotted to each unit.

ii) Practicals: There will not be any internal examination for practical. The External examination per practical course will be conducted as per the following scheme,

Sr. No	Particulars of External Practical Examination	Marks%
1	Laboratory Work	80
2	Journal	10
3	Viva	10
	TOTAL	100

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.

iii) Visits to industry, national research laboratories, and scientific exhibitions should be encouraged.

SEMESTER V

Theory Course - USPH501: Mathematical, Thermal and Statistical Physics

UNIT	TOPICS
I	1. Differential equations : Introduction, Ordinary differential equations, First order homogeneous and non-homogeneous equations with variable coefficients, Second-order homogeneous equations with constant coefficients, Second order non-homogeneous equations with constant coefficients. 2. Partial differential equations : Introduction, Some important partial differential equations in Physics, An illustration of the method of direct integration, Method of separation of variables.
II	1. Fourier series : Introduction, Fourier cosine and sine series, Change of interval, Fourier Integral, Complex form of the Fourier series, Fourier transforms : 2. Fourier transforms: Introduction, Formal development of the complex Fourier transform, Cosine and Sine transforms, The transforms of derivatives(with proof),
III	1. Description of a system : Why statistical approach, Particle-states, System-states, Microstates and Macro states of a system, Equilibrium and Fluctuations, Irreversibility, The equi-probability postulate, Statistical ensemble, Number of states accessible to a system, Phase space, Reversible processes. 2. Thermal and Adiabatic Interactions : Thermal interaction, Canonical distribution, Energy fluctuations, Entropy of a system in a heat bath, Helmholtz free energy, Adiabatic interaction and enthalpy, General interaction and the first law of thermodynamics, Infinitesimal general interaction, Gibbs free energy, Phase transitions.
IV	1. Statistical Mechanics : Phase space, The probability of a distribution, The most probable distribution, Maxwell-Boltzmann statistics, Molecular speeds. 2. Quantum Statistics : Bose-Einstein statistics, Black-body radiation, The Rayleigh-Jeans formula, The Planck radiation formula, Fermi-Dirac statistics, Comparison of results, Transition between states.

References :

UNIT - I

1. CH : 5.1, 5.2.1 (omit D), 5.2.3, 5.2.4
2. CH : 5.3.1, 5.3.2, 5.3.3, 5.3.4.

UNIT - II

1. CH : 7.1, 7.1.1, 7.1.2, 7.1.3, 7.1.4, 7.2.
2. CH : 8.1, 8.2.1, 8.2.2, 8.2.4, 8.2.5, 8.2.6.

UNIT - III

1. LG : 1.1 to 1.11
2. LG : 2.1, 2.3 to 2.11

UNIT - V

1. AB : 15.1 to 15.5
2. AB : 16.1 to 16.7

References :

1. CH : Introduction to Mathematical Physics : Charlie Harper 2009 (EEE) PHI Learning Pvt. Ltd.
2. LG. : Statistical and Thermal Physics- an introduction : S. Lokanathan and R. S. Gambhir. (Prentice Hall of India : 2008)
3. AB. : Perspectives of Modern Physics : Arthur Beiser. (Mc Graw Hill International)

Additional References :

1. Mathematical Physics : A K Ghatak, Chua – 1995 Macmillian India Ltd.
2. Mathematical Method of Physics : Riley, Hobson and Bence. Cambridge (Indian edition).
3. Mathematical Physics : H. K. Dass, S. Chand & Co.
4. Mathematical Methods of Physics : Jon Mathews & R. L. Walker, W A Benjamin inc.
5. A Treatise on heat : Saha and Srivastava. (Indian press, Allahabad)
6. Fundamentals of Statistical and Thermal Physics : F. Reif. (Mc Graw - Hill)

SEMESTER V

Theory Course - USPH502: Solid State Physics

UNIT	TOPICS
I	Electrical properties of metals : Classical free electron theory of metals, Drawbacks of classical theory, Relaxation time, Collision time and mean free path, Quantum theory of free electrons, Fermi-Dirac statistics and electronic distribution in solids, Density of energy states and Fermi energy, The Fermi distribution function, Heat capacity of the electron gas, Mean energy of electron gas at 0 K, Electrical conductivity from quantum mechanical considerations, Thermionic emission.
II	1. Superconductivity : A survey, Mechanism of Superconductors, Effects of magnetic field, The Meissner effect, The penetration depth, Type I and Type II Superconductors.

	2. Band theory of solids, The Kronig- Penney model (Omit eq. 6.184 to 6.188), Brillouin zones, Number of wave functions in a band, Motion of electrons in a one-dimensional periodic potential, Distinction between metals, insulators and intrinsic semiconductors.
III	1. Magnetic properties of Matter : Diamagnetism and Paramagnetism, The origin of permanent magnetic dipoles, Diamagnetism and Larmor precession, The static paramagnetic susceptibility. Ferromagnetism- the Weiss molecular field, Comparison of the Weiss theory with experiment, Qualitative remarks about domains, Qualitative idea about antiferromagnetism and ferrites.
IV	1. Conduction in Semiconductors. Electrons and Holes in an Intrinsic Semiconductor, Conductivity, Carrier concentrations, Donor and Acceptor impurities, Charge densities in a Semiconductor, Fermi level in extrinsic semiconductors, Diffusion,Carrier lifetime, The continuity equation, The Hall effect. 2. Semiconductor-diode Characteristics : Qualitative theory of the p-n junction, The p-n junction as a diode, Band structure of an open-circuit p-n junction, The current components in a p-n junction diode, Quantitative theory of p-n diode currents, The Volt-Ampere characteristics, The temperature dependence of p-n characteristics, Diode resistance.

References :

UNIT – I:
1. SOP : Ch. 6 Art : I to V, XIV to XX, XXXI.

UNIT – II:
1. SOP : Ch. 8 Art : II, III, IV, VII, XII and XIII.
2. SOP : Ch. 6 Art : XXXVI to XXXXI.

UNIT - III
1. D : Art 18.1 to 18.4, 19.1 to 19.3, 19.5, 19.9, 19.12.

UNIT – IV:
1. MH : Art 4.1 to 4.10
2. MH : Art 5.1 to 5.8

References :

1. SOP : Solid State Physics : S. O. Pillai, New Age International.
2. SOP : Modern Physics and Solid State Physics : Problems and solutions New Age International.
3. D : Solid State Physics : A. J. Dekker, Macmillan India Ltd.
4. MH : Electronic Devices and Circuits :Millman, Halkias & Satyabrata Jit. (2nd Ed.) Tata McGraw Hill.

Additional References :

1. Solid State Physics : S. P. Kakani and Amit Kakani.

New Age International.

2. Semiconductor Physics and Devices : Donald Neamen (3rd Ed.) TMH.
3. Introduction to Solid State Physics : Ali Omer. Addison Wesley Longman.

SEMESTER V

Theory Course - USPH503: Atomic and Molecular Physics

UNIT	TOPICS
I	1. Schrödinger's equation for Harmonic oscillator, its solution by operator method. Graphical representation of its energy level and wave functions. 2. Hydrogen atom: Schrödinger's equation for Hydrogen atom, Separation of variables, Quantum Numbers: Total quantum number, Orbital quantum number, Magnetic quantum number. Angular momentum, Electron probability density (Radial part).
II	1. Electron Spin: The Stern-Gerlach experiment, Pauli's Exclusion Principle Symmetric and Antisymmetric wave functions. 2. Spin orbit coupling, Hund's Rule, Total angular momentum, Vector atom model, L-S and j-j coupling. Origin of spectral lines, Selection rules.
III	1. Effect of Magnetic field on atoms, The normal Zeeman effect and its explanation (Classical and Quantum), The Lande g factor, Anomalous Zeeman effect. 2. Paschen-Back effect, Paschen-Back effect of principal series doublet, Selection rules for Paschen-Back effect.
IV	1. Molecular Spectra (Diatomic Molecules): Rotational energy levels, Rotational spectra, Vibrational energy levels, Vibrational-Rotational spectra. Electronic Spectra of Diatomic molecules: The Born-Oppenheimer approximation, Intensity of vibrational-electronic spectra : The Franck-Condon principle. 2. Raman Effect: Quantum Theory of Raman effect, Classical theory of Raman effect, Pure Rotational Raman spectra : Linear molecules, symmetric top molecules, Asymmetric top molecules, Vibrational Raman spectra : Raman activity of vibrations.

References:

UNIT – I.

1. M : 5.2 B : 8.7.
2. B : 9.1 to 9.9.

UNIT - II

1 B : 10.1, 10.3.

2. (i) B : 10.2, 10.6, 10.7, 10.8, 10.9. (ii) B : 11.1 and 11.2.

UNIT – III:

1. SA : 9.14, 9.15, 9.16, 9.17.
2. W : 10.7, 10.8, 10.9

UNIT – IV:

1. B : 14.1, 14.3, 14.5, 14.7 BM : 6.11, 6.1.3.
2. BM : 4.1.1, 4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.3.1.

References :

1. B : Perspectives of Modern Physics : Arthur Beiser

McGraw Hill.

2. SA : Introduction to Atomic & Nuclear Physics : H. Semat & J. R. Albright (5^{th} Ed.) Chapman & Hall.
3. W : Introduction to Atomic Spectra : H. E. White. McGraw Hill.
4 BM : Fundamentals of Molecular Spectroscopy : C. N. Banwell & E. M. McCash (TMH).(4^{th} Ed.)
5 M : Introduction to Quantum Mechanics : P. T. Mathews (TMH).

SEMESTER V

Theory Course - USPH504: Electrodynamics

UNIT	TOPICS
I	1. Field lines, Flux and Gauss' law, The divergence of **E**, Applications of Gauss' law, The curl of **E**. Introduction to potential, Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution. 2. First Uniqueness theorem (Without proof), The classic image problem- Infinite conducting plane,
II	1. Dielectrics, Induced Dipoles, Alignment of polar molecules, Polarization, Bound charges and their physical interpretation, Gauss' law in presence of dielectrics, A deceptive parallel, Susceptibility, Permittivity, Dielectric constant, Energy in dielectric systems. 2. Straight-line currents, The Divergence and Curl of **B**, Applications of Ampere's Law in the case of a long straight wire and a long solenoid, Comparison of Magneto-statics and Electrostatics.
III	1. Dia-magnets Paramagnets Ferro magnets, Magnetization, Bound currents and their physical interpretation, Ampere's law in magnetized materials, A deceptive parallel, Magnetic susceptibility and permeability. 2. Energy in magnetic fields, Electrodynamics before Maxwell, Maxwell's correction to Ampere's law, Maxwell's equations, Magnetic charge, Maxwell's equations in matter, Boundary conditions.
IV	1. The continuity equation, Poynting's theorem, Newton's third law in electrodynamics. 2. The wave equation for **E** and **B**, Monochromatic Plane waves, Energy and momentum in electromagnetic waves, Propagation in linear media, Reflection and transmission of EM waves at normal incidence.

References:

UNIT – I
1. DG : 2.2.1 to 2.2.4, 2.3.1 to 2.3.4.
2. DG : 3.1.5, 3.2.1 to 3.2.3.

UNIT - II
1. DG : 4.1.1 to 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.4.1, 4.4.3.
2. DG : 5.3.1 to 5.3.4.

UNIT - III
1. DG : 6.1.1, 6.1.4, 6.2.1, 6.2.2, 6.3.1, 6.3.2, 6.4.1.
2. DG : 7.2.4, 7.3.1 to 7.3.6.

UNIT - IV

1. DG : 8.1.1, 8.1.2., 8.2.1.
2. DG : 9.2.1 to 9.2.3, 9.3.1 to 9.3.2.

References :

DG : Introduction to Electrodynamics : David J. Griffiths (3rd Ed) Prentice Hall of India.

Additional References:

1. Introduction to Electrodynamics: A. Z. Capria and P. V. Panat. Narosa Publishing House.
2. Engineering Electrodynamics : William Hayt Jr. & John H. Buck (TMH).
3. Electricity and Magnetism : Navina Wadhwani (PHI – 2010).

SEMESTER V

The T. Y. B. Sc. Syllabus integrates the regular practical work with a series of demonstration and skill experiments. 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) Recording of observations and plotting of graphs.
v) Calculation of results and estimation of possible errors in the observation of results.

i) Regular Physics Experiments : A minimum of 8 experiments from each of the course are to be performed and reported in the journal.

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

The certified journal must contain a minimum of 16 regular experiments (8 from each group), with all Skills in semester V. A separate index and certificate in journal is must for each semester course.

There will be two turns of three hours each for the examination of practical courses

(Practical Course – USPHP05)

USPHP05	1. Determination of "g" by Kater's pendulum. 2.Flat spiral spring (Y) 3. Stefan's constant σ 4. Koenig's method 5. R.P. of grating 6. Goniometer 7. R.I of liquid using laser 8. Rydberg's constant 9. Edser's A pattern 10. Diameter of lycopodium powder 11. Determination of e/m

SEMESTER V

(Practical Course – USPHP06)

USPHP06	1.Mutual inductance by BG. 2.Hysteresis by magnetometer 3. Maxwell's bridge 4.Band gap of energy. 5.Diode as temperature sensor. 6. Log amplifier using OPAMP 7. High pass (first order active filter) 8. Low pass (first order active filter) 9. Wien bridge oscillator 10. Hall effect 11. LM-317 as voltage regulator 12 LM 317 as current regulator

Skills :

1. Estimation of errors.
2. Soldering advanced circuit.
3. Bread board circuit using IC's.
4. Optical Leveling of Spectrometer.
5. Laser beam profile.
6. Use of electronic balance : radius of small ball bearing.
7. Dual trace CRO : Phase shift measurement.
8. BG : C_1 /C_2 by comparing θ_1 / θ_2.

References :

1. Advanced course in Practical Physics : D. Chattopadhya, PC. Rakshit & B. Saha (8^{th} 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 (4^{rd} edition).
4. B Sc. Practical Physics : C. L. Arora (1^{st} Edition) – 2001 S. Chand & Co. Ltd.
5. Practical Physics : C. L. Squires – (3^{rd} Edition) Cambridge University Press.
6. University Practical Physics : D C Tayal. Himalaya Publication.
7. Advanced Practical Physics : Worsnop & Flint.

T.Y.B.Sc. _Physics_ Syllabus: Credit Based Semester and Grading System
To be implemented from the Academic year 2013-2014

SEMESTER VI

Theory

Course	UNIT	TOPICS	Credits	L / Week
USPH601	**I**	Classical Mechanics	**2.5**	**4**
	II	Classical Mechanics		
	III	Classical Mechanics		
	IV	Nonlinear 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	Introduction to Cosmology		

Practicals

USPHP07	**Practicals of Course USPH601 + Course USPH602**	**3**	**8**
USPHP08	**Practicals of Course USPH603 + Course USPH604**	**3**	**8**

SEMESTER VI

Theory Course – USPH601: Classical Mechanics

UNIT	TOPICS
I	1. Motion under a central force, The central force inversely proportional to the square of the distance, Elliptical orbits. The Kepler problem. Hyperbolic Orbits : The Rutherford problem – Scattering cross section. 2. Moving origin of co-ordinates, Rotating co-ordinate systems, Laws of motion on the rotating earth, Foucault pendulum, Larmor's theorem (with proof).
II	Lagrange's equations: D'Alembert's principle, Generalized coordinates, Lagrange's equations using D'Alembert's principle, Examples, Systems subject to constraints, Examples of systems subject to constraints, Constants of motion and ignorable coordinates.
III	1. Kinematics of moving fluids, Equation of motion for an ideal fluid, Conservation laws for fluid motion, Steady flow. 2. The rotation of a Rigid body : Motion of a rigid body in space, Euler's equations of motion for a rigid body, Euler's angles, Heavy symmetrical top (without nutation).
IV	Non linear mechanics : Qualitative approach to chaos, The anharmonic oscillator, Numerical solution of Duffing's equation, Transition to chaos: Bifurcations and strange attractors, Aspects of chaotic behavior.

References :

UNIT – I

1. KRS : Art. 3.13 to 3.16
2. KRS : Art. 7.1 to 7.5

UNIT – II

1. KRS : Art. 9.1 to 9.6 G:1.4

UNIT - III

1. KRS : Art. 8.6 to 8.9
2. KRS : Art. 11.1, 11.2, 11.4, 11.5, BO : 6.7

UNIT - IV

1. BO : Art. 11.1, 11.3 to 11.5

References :

KRS : Mechanics : Keith R. Symon. (Addision Wesely) 3rd Ed.

BO : Classical Mechanics- a Modern perspective : V. D. Barger and M. G. Olsson. (Mc Graw Hill International 1995 Ed.)

G : Classical Mechanics : Herbert Goldstein, (Narosa 2nd Ed.)

Additional References :

1. Classical Mechanics : Herbert Goldstein (Narosa 2nd Ed.)
2. An Introduction to Mechanics : Daniel Kleppner & Robert Kolenkow Tata Mc Graw Hill (Indian Ed. 2007)
3. Chaotic Dynamics- an introduction. : Baker and Gollup.

SEMESTER VI

Theory Course – USPH602: Electronics

UNIT	TOPICS
I	1. Field effect transistors: JFET: Basic ideas, Drain curve, The transconductance curve, Biasing in the ohmic region and the active region, Transconductance, JFET common source amplifier, JFET analog switch multiplexer, voltage controlled resistor, Current sourcing. 2. MOSFET : Depletion and enhancement mode, MOSFET operation and characteristics, digital switching. 3. Thyristors : SCR – Working, Equivalent circuit, important terms, I-V Characteristics, SCR as a switch, Half wave rectifier and Full wave rectifier. TRIAC: Construction, Operation, I-V Characteristics, Applications. DIAC: Construction, Operation, Characteristics and applications. 4. Optoelectronic Devices: Photo-diode, Phototransistor, Optocoupler.
II	1. Regulated DC power supply: Supply characteristics, series voltage regulator, short circuit protection (current limit and fold back) Monolithic linear IC voltage regulators. (LM 78XX, LM 79XX, LM 317). 2. Differential Amplifier using transistor: The Differential Amplifier, DC and AC analysis of a differential amplifier, Input characteristic-effect of input bias, Offset current and input offset voltage on output, common mode gain, CMRR. 3. Transistor Multivibrators: Astable, Monostable and Bistable Multivibrators, Schmitt trigger.
III	1. Op Amp Applications: Log amplifier, Instrumentation amplifiers, Voltage-controlled current sources (grounded load), First order Active filters, Astable using OP AMP, square wave and triangular wave generator using OP AMP, Wein-bridge oscillator using OP AMP. 2. 555 Timer: Block diagram, Monostable and Astable operation (with VCO), Triggered linear ramp generator.
IV	1. Logic families: Standard TTL NAND, TTL NOR, Open collector gates, Three state TTL devices, MOS inverters, CMOS NAND and NOR gates, CMOS characteristics. 2. Applications of JK flip flop: Types of registers, 4-bit shift register (serial in-serial out), Asynchronous counters, 4-bit up-down counter, MOD-3, MOD-5, Decade counter, Shift counter. 3. Electronic communication techniques: Radio broadcasting, Transmission and reception, Modulation, Amplitude modulation, Modulation factor, Analysis of amplitude modulated wave, Side band frequencies in AM wave, Transistor amplitude modulator, Power in AM wave, Limitations of AM, Frequency modulation. (qualitative)

References :

Unit -I:
1. MB : Art. 13.1 to 13.9, 14.1, 14.2, 14.4, 14.6.
2. VKM : Art. 20.1 to 20.10, 21.1 to 21.6, 21.8, 21.9, 21.10.
3. VKM : Art 7.7 to 7.11. MB : 7.10.

UNIT – II:
1. MB : Art 17.1 to 17.5.
2. KVR : Art. 14.5.2.1, 14.5.2.5, 14.5.2.6, 14.5.4.1.
3. MB : Art. 20.5, 20.8, 21.4, 22.7, 22.8, 23.2. MH : 16.14.

UNIT – III:
1. MB : Art. 23.7 to 23.9.
2. ML : Art. 6.2, 6.4, 6.6, 6.7, 7.2 to 7.4.

UNIT – IV:
1 ML : Art 10.1, 10.2, 11.1, 11.3 to 11.5, 11.7.
2. MB : Art 24.1, 24.3, 24.4.
3. VKM : Art. 16.1 to 16.11.

References :

1. MB : Electronic Principles : A. P. Malvino and D.J. Bates (7^{th} Ed.) – (TMH).
2. VKM : Principles of Electronics : V. K. Mehta and Rohit Mehta. S. Chand Publications. (11^{th} Ed.).
3. KVR : Functional Electronics : K .V. Ramanan (TMH).
4. ML : Digital Principles and Applications : Malvino and Leach (4^{th} Ed) (TMH).
5. MH : Integrated Electronics : Millman and Halkias Mc Graw Hill International.

Additional References :

1. Electronic Devices and Circuits : S. Salivahanan, N. Suresh Kumar and A. Vallavaraj. (2^{nd} Ed.) (Tata McGraw Hill)
2. Pulse, Digital & Switching Waveforms : Millman & Taub. (TMH)

SEMESTER VI

Theory Course – USPH603: Nuclear Physics

UNIT	TOPICS
I	1. Types of Nuclear Reactions, Balance of mass and energy in Nuclear Reaction, the Q-equation and Solution of Q-equation. 2. Alpha decay: Range of alpha particles, Disintegration energy, Alpha decay paradox: Barrier penetration (Gamow's theory of alpha decay and Geiger-Nuttal law), Velocity and energy, Absorption of alpha particles: Range, Ionization and stopping power, Nuclear energy levels.

II	1. Beta decay: Introduction, Continuous beta ray spectrum-Difficulties encountered to understand it, Pauli's neutrino hypothesis, Detection of neutrino, Velocity and energy of beta particles, Energy levels and decay schemes, Energetics of beta decay. 2. Gamma decay: Introduction, Internal conversion, Nuclear isomerism, Mossbauer effect.
III	1. Nuclear radiation detectors: Proportional counter, Scintillation counter, Cloud and Bubble chamber, Ionization chamber, Proportional and GM counter. 2. Liquid drop model, Weizsacher's semi-empirical mass formula, Mass parabolas - Prediction of stability against beta decay for members of an isobaric family, Stability limits against spontaneous fission.
IV	1. Nuclear energy: Introduction, Asymmetric fission - Mass yield, Emission of delayed neutrons, Nuclear release in fission, Nature of fission fragments, Energy released in the fission of U^{235}, Fission of lighter nuclei, Fission chain reaction, Neutron cycle in a thermal nuclear reactor (Four Factor Formula), Nuclear reactors, Natural fusion, Possibility of controlled fusion. 2. Elementary particles: Introduction, Classification of elementary particles, Electrons and positrons, Protons and anti-protons, Neutrons and anti- neutrons, Neutrinos and anti-neutrinos, Photons, Mesons.

References:

UNIT – I:
1. P : 3.1 to 3.5. K : 8.5, 9.5
2. P : 4. II. 1, 4. II. 2, 4. II. 3, 1.II.3 K : 13. 1, 13.2, 13.5.
UNIT – II:
1 P : 4.I.2, 4.I.3, 4. III. 1, 4. III. 2, 4. III. 3, 4. III. 5 K : 14.1, 14.7 G : 5.5.
2. P : 4. IV. 1, 4. IV. 3, 4. IV. 4, 9.4.
UNIT – III:
1. P : 1. I. 3 K : 2.8.
2. P : 5.1, 5.3, 5.4, 5.5.
UNIT – IV:
1 P : 6.1, 6.3 to 6.9, 9.6, 9.7.
2. T : 16.1, 16.2, 16.5 to 16.9.

References:

1. AB : Concepts of Modern Physics : Arthur Beiser (6th Ed.) (TMH).
2. P : Nuclear Physics : S.B. Patel (Wiley Eastern Ltd.).
3. K : Nuclear Physics : Irving Kaplan (2nd Ed.) (Addison Wesley).
4. G : Nuclear Physics : S. N. Ghoshal (S. Chand & Co.)
5. T : Nuclear Physics : D. C. Tayal (Himalayan Publishing House)

Additional References.

1. Modern Physics : Kenneth Krane (2nd Ed.) John Wiley & Sons.
2. Atomic & Nuclear Physics : N Subrahmanyam, Brij Lal. (Revised by Jivan Seshan.) S. Chand.
3. Atomic & Nuclear Physics : A B Gupta & Dipak Ghosh Books & Allied (P) Ltd.

SEMESTER VI

Theory Course – USPH604: Special Theory of Relativity and Introduction to Cosmology

UNIT	TOPICS
I	Relativistic Kinematics: The postulates of the special theory of relativity, Simultaneity, Derivation of Lorentz transformation equations, Some consequences of the Lorentz transformation equations : length contraction, time dilation and meson experiment, The observer in relativity, The relativistic addition of velocities and acceleration transformation equations, Aberration and Doppler effect in relativity, The common sense of special relativity.
II	Relativistic Dynamics: Mechanics and Relativity, The need to redefine momentum, Relativistic momentum, Alternative views of mass in relativity, The relativistic force law and the dynamics of a single particle, The equivalence of mass and energy, The transformation properties of momentum, energy and mass.
III	Relativity and Electromagnetism: Introduction, The interdependence of Electric and Magnetic fields, The Transformation for **E** and **B**, The field of a uniformly moving point charge, Force and fields near a current-carrying wire, Force between moving charges, The invariance of Maxwell's equations.
IV	1. The Geometric Representation of Space-Time: Space-Time Diagrams, Simultaneity, Length contraction and Time dilation, The time order and space separation of events, The twin paradox, The principle of equivalence and general relativity, Gravitational red shift. 2. Introduction to Cosmology: The large scale structure of the Universe: Types of galaxies, radio sources, Quasars, Doppler shift and expansion of the Universe, Hubble's law, Radiation background. 3. Astronomy in different bands of radiation-Optical, Radio and x-ray astronomy.

References :

UNIT – I:

1. RR : Chapter – II

UNIT – II:

2. RR : Chapter – III.

UNIT – III :

1. RR : Chapter – IV.

UNIT – IV:

Relevant sections from the following:

RR : Supplementary topics A, B and C.

ARC:Art 1.4

1. JVNI : Chapter – 1, JVNE : Chapter – 1.
1. JVNI : Chapter – 3, (Omit 3.3, 3.4) JVNE : Chapter – 2
2. ARC : Astrophysics for physicists by Arnab Rai Choudhari., Cambridge University Press.

References :

1. RR : Introduction to Special Relativity : Robert Resnick
(Wiley Student Edition)

Reprint 2007, New Delhi.

2. JVNI : Introduction to Cosmology : J. V. Narlikar. 3rd Ed. 2002 (Cambridge University Press).

3. JVNE : Elements of Cosmology : J. V. Narlikar, 1996 (University Press).

Additional References:

1. Special theory of Relativity : A. P. French.
2. General Relativity & Cosmology : S. K. Srivastava (Prentice Hall of India).

SEMESTER VI

The T. Y. B. Sc. Syllabus integrates the regular practical work with a series of demonstration and skill experiments. 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:

1) Understanding relevant concepts.
2) Planning of the experiments.
3) Layout and adjustments of the equipments.
4) Recording of observations and plotting of graphs.
5) Calculation of results and estimation of possible errors in the observation of results.

i) Regular Physics Experiments: A minimum of 8 experiments from each of the practical course are to be performed and reported in the journal.

ii) Demo 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 'demo' experiments in their journal.

The certified journal must contain a minimum of 16 regular experiments (8 from each practical course), with minimum 6 demonstration experiments in semester VI. A separate index and certificate in journal is must for each semester course.

There will be two turns of three hours each for the examination of practical courses

(Practical Course – USPHP07)

USPHP07	1. Lee's method for thermal conductivity 2. Quincke's method for surface tension of Mercury 3. Flat spiral spring (η) 4. R.P. of prism 5. Lloyd's mirror 6. Double refraction 7. FET characteristics 8. UJT characteristics 9. SCR characteristics 10. Photodiode and phototransistor characteristics

	11. Y by flexural method 12. Determination of wavelength of a laser using diffraction grating.

(Practical Course – USPHP08)

USPHP08	1.M/C using B.G. 2.Capacitance by using parallel bridge. 3.Transistorized Astable multivibrator 4. Transistorized Bistable multivibrator 5. Transistorized Monostable multivibrator. 6.Schmitt trigger using OPAMP. 7.555 Timer Astabe multivibrator 8. 555 Timer as Monostable multivibrator 9. 555 timer as ramp generator. 10. Counters mod 2,5 10. 11.Shift register. 12 OPAMP as monostable/astable using breadboard

Demonstration Experiments :

1. Open CRO, Power Supply, and Signal Generator: Discuss block diagram.
2. Data sheet reading for diodes, Transistor, Op amp and Optoelectronic devices.
3. Circuit designing – single stage amplifier, Transistor Multivibrator etc. and testing on breadboard.
4. Equation solver.
5. Amplitude Modulation.
6. Frequency Modulation.
7. Millikan's oil drop experiment.
8. Zeeman Effect.
9. Michelson's interferometer.
10. Iodine absorption spectra.
11. Standing waves in liquid using Ultrasonic waves.
12. PC simulation of 8085.
13. Use of PC / μP to control real world parameters.
14. Seven segment display.
15. GM counter

References :

1. Advanced course in Practical Physics : D. Chattopadhya, PC. Rakshit & B. Saha (8^{th} 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 (4^{rd} edition).
4. B Sc. Practical Physics : C. L. Arora (1^{st} Edition) – 2001 S. Chand & Co. Ltd.
5. Practical Physics : C. L. Squires – (3^{rd} Edition) Cambridge University Press.
6. University Practical Physics : D C Tayal. Himalaya Publication.
7. Advanced Practical Physics : Worsnop & Flint.

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