Academic Council Item No:_

Devrukh Shikshan Prasarak Mandal's

Nya. TATYASAHEB ATHALYE ARTS, Ved. S.R. SAPRE COMMERCE & Vid. DADASAHEB PITRE SCIENCE COLLEGE, DEVRUKH [AUTONOMOUS]

Syllabus for T.Y. B.Sc.
Program: B.Sc.
Course: Physics
Credit Based Semester and Grading System with the Effect from
Academic Year 2021-22

Syllabus for B.Sc. Physics (Theory and Practical)
As per credit based system
Third Year B.Sc.2021–2022.

The revised syllabus in Physics as per credit based system for the Third Year B.Sc. Course will be implemented from the academic year **2021–2022.**

Preamble: The systematic and planned curricula from these courses shall motivate and encourage learners to understandbasic 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.

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**

SEMESTER VI

Theory Course – USPH603: Nuclear Physics

Objectives:

The course is built on exploring the fundamentals of nuclear matter as well as considering some of the important applications of nuclear physics. Topics include decay modes – (alpha, beta & gamma decay), nuclear models (liquid drop model, introduction to shell model), Applications of Nuclear Physics in the field of particle accelerators and energy generation, nuclear forces and elementary particles. The lecture course will be integrated with problem solving.

Learning Outcomes:

- Upon successful completion of this course, the student will be able to understand the fundamental principles and concepts governing classical nuclear and particle physics and have a knowledge of their applications interactions of ionizing radiation with matter the key techniques for particle accelerators the physical processes involved in nuclear power generation.
- Knowledge on elementary particles will help students to understand the fundamental constituents of matter and lay foundation for the understanding of unsolved questions about dark matter, antimatter and other research oriented topics.

Unit - I	Alpha & Beta Decay	(15 lect.)

1 Alpha decay: Velocity, energy, and Absorption of alpha particles: Range, Ionization and stopping power, Nuclear energy levels. Range of alpha particles, alpha particle spectrum, Fine structure, long range alpha particles, Alpha decay paradox: Barrier penetration (Gamow's theory of alpha decay and Geiger- Nuttal law).

2 Beta decay: Introduction, Velocity and energy of beta particles, Energy levels and decay schemes, Continuous beta ray spectrum-Difficulties encountered to understand it, Pauli's neutrino hypothesis, Detection of neutrino, Energetics of beta decay.

1. IK: 13. 1, 13.2, 13.5, SBP: 4. II. 1, 4. II. 2, 4. II. 3, 1.II.3
2. IK: 14.1, 14.7, SBP: 4. III. 1, 4. III. 2, 4. III. 3, 4. III. 5, SNG : 5.5.

Unit -II	Gamma Decay & Nuclear Models	(15 lect.)

1 Gamma decay: Introduction, selection rules, Internal conversion, nuclear isomerism, Mossbauer effect.

2 Nuclear Models: Liquid drop model, Weizsacker's semi-empirical mass formula, Mass parabolas - Prediction of stability against beta decay for members of an isobaric family, Stability limits against spontaneous fission. Shell model (Qualitative), Magic numbers in the nucleus.

1. SBP: 4. IV. 1, 4. IV.2, 4. IV. 3, 4. IV. 4, 9.4
2. SBP: 5.1, 5.3, 5.4, 5.5. AB: 11.6-pages (460,461).

Unit -III	Nuclear Energy & Particle Accelerators	(15 lect.)

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 U235, Fission of lighter nuclei, Fission chain reaction, Neutron cycle in a thermal nuclear reactor (Four Factor Formula), Nuclear power and breeder reactors, Natural fusion Possibility of controlled fusion.

2. Particle Accelerators: Van de Graaff Generator, Cyclotron, Synchrotron, Betatron and Idea of Large Hadron Collider.

1. SBP: 6.1, 6.3 to 6.9, 9.6, 9.7, 8.1,8.2,8.3
2. SBP: 1.I.4 (i), 1.I.4 (ii), 1.I.4 (iii), 1.I.4 (iv), 6.9, AB: 13.3

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Unit -IV	Nuclear force & Elementary particles	(15 lect.)

1. Nuclearforce: Introduction, Deuteron problem, Meson theory of Nuclear Force- A qualitative discussion.

2. Elementary particles: Introduction, Classification of elementary particles, Particle interactions, Conservation laws (linear &angular momentum, energy, charge, baryon number & lepton number), particles and antiparticles (Electrons and positrons, Protons and anti-protons, Neutrons and anti- neutrons, Neutrinos and anti-neutrinos), Photons, Mesons, Quark model (Qualitative).

1. SBP: 8.6
2. DCT: 18.1, 18.2,18.3, 18.4 , 18.5 to 18.9 AB: 13.5

References	
1.	AB: Concepts of Modern Physics: Arthur Beiser, Shobhit Mahajan, S Rai Choudhury (6^{th} Ed.) (TMH).
2.	SBP: Nuclear Physics, S.B. Patel (Wiley Eastern Ltd.).
3.	IK: Nuclear Physics, Irving Kaplan (2^{nd} Ed.) (Addison Wesley).
4.	SNG: Nuclear Physics, S. N. Ghoshal (S. Chand & Co.)
5.	DCT: Nuclear Physics, D. C. Tayal (Himalayan Publishing House) 5^{th} ed.
Additional References	
1.	Modern Physics: Kenneth Krane (2^{nd} 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.
4	Introduction to Elementary Particles: David Griffith, Second Revised Edition, Wiley-VCH.