SHARDA UNIVERISITY
SCHOOL OF BASIC SCIENCES AND RESEARCH
DEPARTMENT OF PHYSICS

May 29, 2018

Minutes of the meeting

A meeting of the members of Board of Studies of the Physics Department and other invited members was held on 29th May, 2018 in room 201 (Block 1). Following members were present:

1. Dr. Munendra Singh — Chairman
2. Prof. R.C. Singh — Internal member
3. Dr. P.K. Singh — Invited member
4. Dr. Mohit Sahni — Internal member
5. Ms. Sandhya Gupta — Internal member
6. Dr. Meenal Gupta — Invited member
7. Dr. K.K. Pandey — Invited member

The external experts of the BOS present ~~were~~ was

1. Dr. S.A. Hashmi, Professor, University of Delhi.

The members critically examined and discussed the proposed changes in the programs and courses. After the meeting following were agreed upon:

- The modifications in course/credit structures of B.Sc. Hons (2016, 2017 and 2018 onwards batches) are approved.
- New program structure for M.Sc. is approved.
- Four new courses for B.Sc. – B.Ed., two for B.Sc. Hons Physics, seven for B.Tech., two for M.Sc. nano science specialization, four for M.Sc. and three open electives were approved.
- CA for M.Sc. and B.Sc.: theory and lab

  Board members finalized that CA mechanism should be decided at school level and should be according to the teacher's/department's wisdom.

- The same will be produced for approval in the meeting of the Faculty Board of the school.

Meeting ended with the extension of thank towards the members present.

Meenal Gupta S.A. Hashmi

29/05/2018

29/5/18

SHARDA UNIVERISITY

SCHOOL OF BASIC SCIENCES AND RESEARCH

DEPARTMENT OF PHYSICS

May 29, 2018

Agenda of the BoS meeting

Following are the agenda points to be discussed and to be approved in the next BoS meeting:

1. To approve modifications in B.Sc. Hons structure for 2016 batch.
2. To approve modifications in B.Sc. Hons structure for 2017 batch.
3. To approve new B.Sc. Hons structure (as per CBCS) for 2018 and onward batches.
4. To approve new program structure for M.Sc. Physics.
5. To approve four new courses for B.Sc. – B.Ed. program.
6. To approve two new courses for B.Sc. Hons Physics program.
7. To approve seven new courses for B.Tech. program.
8. To approve two new courses for M.Sc. nano science specialization.
9. To approve four new courses for M.Sc. program.
10. To approve three open electives to be offered at university level.
11. Discuss and finalize CA procedure for B.Sc. and M.Sc. programs.

29.05.2018

Modifications for 2016 batch (B.Sc. Hons)

Course structure of B.Sc.(Hons)/ M.Sc. (integrated) students

Physics Department, SBSR, Sharda University

Agenda : 1

Batch: 2016-2019/20 (Sixth batch) **Program: B.Sc.(Hons)/M.Sc. (integrated)**

Semester 1 (2016-17)

No.	Code	Course	C
1.	PHB114	Mechanics & props of matter	4
2.	CHB101	General & physical chemistry-1	4
3.	MSM101	Foundation course in Maths	4
4.	CSE107	Logic building & problem solving using 'C'	4
5.	ENG102	Functional English-1	2
6.	PHB151	Physics Lab-1	1
7.	CHB151	Chemistry Lab-1	1
8.	CSP107	'C' programming lab	1
9.	ENP102	English Lab-1	1
		Total Credits:	22

Semester 2 (2016-17)

No.	Code	Course	C
1.	PHB115	Optics	4
2.	CHB102	Inorganic Chemistry-1	4
3.	MSM103	Applied Mathematics-1	4
4.	CSE108	Advanced concepts of 'C' programming	3
5.	ENG103	Functional English-2	2
6.	EVS103	Environmental Science	2
7.	PHB152	Physics Lab-2	1
8.	CHB152	Chemistry Lab-2	1
9.	CSP108	Advanced concepts of C programming lab	1
10.	ENP103	Functional English Lab-2	1
		Total Credits:	23

Semester 3 (2017-18)

No.	Code	Course	C
1.	PHB218	Solid state Physics	4
2.	CHB211	Organic Chemistry-1	4
3.	MSM203	Applied Mathematics-2	4
4.	PHB219	Electricity and magnetism	4
5.	PHB220	Instrumentation	4
6.	PHB251	Physics Lab-3	1
7.	CHB251	Chemistry Lab-3	1
		Total Credits:	22

Semester 4 (2017-18)

No.	Code	Course	C
1.	PHB221	Classical mechanics & relativity	4
2.	PHB222	Mathematical physics	4
3.	PHB223	Thermal physics	4
4.	PHB224	Basic electronics	4
5.	PHB225	Nuclear Physics	4
6.	PHB254	Physics lab – 4	2
7.	PHB255	Physics lab – 5 (Electronics)	2
		Total Credits:	24

Semester 5 (2018-19)

No.	Code	Course	C
1.	PHB332	Quantum mechanics	4
2.	PHB333	Elective (Applied optics)	4
3.	PHB334	Oscillations & waves	4
4.	PHB335	Analog electronic devices	4
5.	PHB336	Statistical mechanics	4
7.	PHB366	Physics lab – 6	2
8.	PHB367	Physics lab – 7	2
9.	~~PHB361~~ PHB371	~~Project 1~~ Dissertation-1	3
		Total Credits:	27

Total credits of the B.Sc. (hons) program : 145

Semester 6 (2018-19)

No.	Code	Course	C
1.	PHB337	Renewable energy	4
2.	PHB338	Atomic & molecular physics	4
3.	PHB339	Electromagnetic theory	4
4.	PHB340	Digital electronics	4
5.	PHB341	Particle & astrophysics	4
7.	PHB368	Physics lab – 8	2
8.	PHB369	Physics lab – 9	2
10.	~~PHB362~~ PHB372	~~Project 2~~ Dissertation-2	3
		Total Credits:	27

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Modifications for 2017 batch (B.Sc. Hons)

Agenda : 2

Course structure of B.Sc.(Hons)

Physics Department, SBSR, Sharda University

Batch: 2017-2020/21 (Seventh batch) **Program: B.Sc.(Hons)** **No. of students:**

Semester 1 (2017-18)

No.	Code	Course	C
1.	PHB114	Mechanics & props of matter	4
2.	BCH101	Physical Chemistry 1	4
3.	MSM101	Foundation course in Maths	4
4.	CSE107	Logic building & problem solving using 'C'	4
5.	ENG107/ ENG109	Basic/ Intermediate English	2
6.	PHB151	Physics Lab-1	1
7.	BCH151	Chemistry Lab-1	1
8.	CSP107	'C' programming lab.	1
9.	ENP102	English Lab-1	1
		Total Credits:	22

Semester 2 (2017-18)

No.	Code	Course	C
1.	PHB115	Optics	4
2.	BCH102	Organic Chemistry 1	4
3.	MSM103	Applied Mathematics-1	4
4.	CSE108	Advanced concepts of 'C' programming	3
5.	EVS106	Environmental Studies	3
6.	PHB152	Physics Lab-2	1
7.	BCH152	Chemistry Lab-2	1
8.	CSP108	Advanced concepts of C programming lab	1
		Total Credits:	21

Semester 3 (2018-19)

No.	Code	Course	C
1.	PHB218	Solid state Physics	4
2.	BCH201	Inorganic Chemistry 1	4
3.	MSM203	Applied Mathematics-2	4
4.	PHB219	Electricity and magnetism	4
5.	PHB220	Instrumentation	4
6.	PHB251	Physics Lab-3	1
7.	BCH251	Chemistry Lab-3	1
~~8.~~	~~MSM250~~	~~Statistics Lab-1~~	~~1~~
		Total Credits:	~~23~~ 22

Semester 4 (2018-19)

No.	Code	Course	C
1.	PHB221	Classical mechanics & relativity	4
2.	PHB222	Mathematical physics	4
3.	PHB223	Thermal physics	4
4.	PHB224	Basic electronics	4
5.	PHB225	Nuclear Physics	4
6.	PHB254	Physics lab – 4	2
7.	PHB255	Physics lab – 5 (Electronics)	2
		Total Credits:	24

Semester 5 (2019-20)

No.	Code	Course	C
1.	PHB332	Quantum mechanics	4
2.	PHB333	Elective (Applied optics)	4
3.	PHB334	Oscillations & waves	4
4.	PHB335	Analog electronic devices	4
5.	PHB336	Statistical mechanics	4
7.	PHB366	Physics lab – 6	2
8.	PHB367	Physics lab – 7	2
9.	~~PHB361~~ PHB 371	~~Project 1~~ Dissertation-1	3
		Total Credits:	27

Total credits of the B.Sc. (hons) program : ~~144~~ 143

Semester 6 (2019-20)

No.	Code	Course	C
1.	PHB337	Renewable energy	4
2.	PHB338	Atomic & molecular physics	4
3.	PHB339	Electromagnetic theory	4
4.	PHB340	Digital electronics	4
5.	PHB341	Particle & astrophysics	4
7.	PHB368	Physics lab – 8	2
8.	PHB369	Physics lab – 9	2
10.	~~PHB362~~ PHB 372	~~Project 2~~ Dissertation. 2	3
		Total Credits:	27

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New proposed Structure for B.Sc. Hons from 2018 (admitted batch)

Agenda: 3

Course structure of B.Sc.(Hons) Physics students
Physics Department, SBSR, Sharda University

Batch: 2018-2021 (Eighth batch) **Program: B.Sc. (Hons)** **No. of students:**

Semester 1

No.	Code	Course	C
1.	PHB114	Mechanics & props of matter	4
2.	BCH101	Physical Chemistry 1	4
3.	MSM101	Foundation course in Maths	4
4.		Computers	4
5.	ENG107/ ENG109	Basic/ Intermediate English	2
6.	PHB151	Physics Lab-1	1
7.	BCH151	Chemistry Lab-1	1
		Total Credits:	20

Semester 2

No.	Code	Course	C
1.	PHB115	Optics	4
2.	BCH102	Organic Chemistry 1	4
3.	MSM103	Applied Mathematics-1	4
4.	PHB117	Thermal Physics	4
5.	EVS106	Environmental Studies	3
6.	PHB152	Physics Lab-2	1
7.	BCH152	Chemistry Lab-2	1
		Total Credits:	21

Semester 3

No.	Code	Course	C
1.	PHB218	Solid state Physics	4
2.	BCH201	Inorganic Chemistry 1	4
3.	MSM203	Applied Mathematics-2	4
4.	PHB219	Electricity and magnetism	4
5.	PHB226	Biophysics and radiation science	4
6.		Open elective	2
7.	PHB251	Physics Lab-3	1
8.	BCH251	Chemistry Lab-3	1
		Total Credits:	24

Semester 4

No.	Code	Course	C
1.	PHB221	Classical mechanics & relativity	4
2.	PHB222	Mathematical physics	4
3.	PHB220	Instrumentation	4
4.	PHB224	Basic electronics	4
5.	PHB225	Nuclear Physics	4
6.	PHB254	Physics lab – 4	2
7.	PHB255	Physics lab – 5 (Electronics)	2
		Total Credits:	24

Semester 5

No.	Code	Course	C
1.	PHB332	Quantum mechanics	4
2.	PHB333	Applied optics	4
3.	PHB334	Oscillations & waves	4
4.	PHB335	Analog electronic devices	4
5.	PHB336	Statistical mechanics	4
7.	PHB366	Physics lab – 6	2
8.	PHB367	Physics lab – 7	2
9.	PHB371	Dissertation 1	3
		Total Credits:	27

Semester 6

No.	Code	Course	C
1.	PHB337	Renewable energy	4
2.	PHB338	Atomic & molecular physics	4
3.	PHB339	Electromagnetic theory	4
4.	PHB340	Digital electronics	4
5.	PHB341	Particle & astrophysics	4
7.	PHB368	Physics lab – 8	2
8.	PHB369	Physics lab – 9	2
9.	PHB372	Dissertation 2	3
		Total Credits:	27

Total credits of the B.Sc. (hons) program : 143

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Agenda : 4

Course structure of M.Sc.
Physics Department, SBSR, Sharda University

Batch: 2018 onwards **Program: M.Sc. Physics**

Semester 1

No.	Code	Course	C
1.	MPH112	Solid state physics	4
2.	MPH113	Electronics	4
3.	MPH120	Quantum mechanics	4
4.	MPH119	Mathematical Physics	4
5.		Fundamentals of MATLAB	3
6.	MPH155	Physics Lab-1	3
7.	MPH156	Physics Lab-2	3
		Total Credits:	25

Semester 2

No.	Code	Course	C
1.	MPH115	Renewable energy sources	4
3.	MPH117	Statistical mechanics	4
	MPH111	Classical mechanics	4
4.	MPH118	Spectroscopy	4
5.	MPH122	Advanced quantum mechanics	4
6.	MPH157	Physics Lab-3	3
7.	MPH158	Physics Lab-4	3
		Total Credits:	26

Semester 3

No.	Code	Course	C
1.	MPH204	Electromagnetics	4
2.	MPH205	Materials Physics	4
3.	MPH208	Synthesis of Materials	4
		Open elective	2
4.	MPH256	Dissertation – 1	4
5.	MPH257	Material science lab	3
		Total Credits:	~~21~~ 23

Semester 4

No.	Code	Course	C
	MPH217	Nuclear and particle physics	4
1.	MPH209	Characterization of Materials	4
2.	MPH210	Properties of Materials	4
3.	MPH258	Dissertation - 2	6
		Total Credits:	~~18~~ 16

Total credits of the M.Sc. program: 90

* Name of MPH 118 is changed to "Atomic, and molecular physics and spectroscopic techniques".

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Agenda: 5

B.Sc.-B.Ed. IV term

LTP (Credits): 3-1-0 (4)

Waves and optics (PHB227)

Unit 1: Waves

Superposition of Two Collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity.

Unit 2: Wave optics and Interference

Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. Introduction of interference, Coherent sources, Concept of spatial and temporal coherence, Interference of light,Young's Double slit experiment, Division of wave front: Fresnel's bi-prism, Division of amplitude: Interference in thin films, wedge shaped films, Newton's rings.

Unit 3: Diffraction

Introduction, Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction due to single slit, double slit and n slits, Plane diffraction grating (intensity of principal maxima and minima). Resolving power, Rayleigh criteria, Resolving power of microscope, telescope and diffraction grating.

Unit 4: Polarization

Phenomenon of polarization, Production of polarized light by reflection, refraction, Brewster's law, Malus law, Nicol prism, Polarization by double refraction Retardation plates (Quarter and half wave plates), production and analysis of circularly and elliptically polarized light, Optical activity, specific rotation, polarimeter.

Unit 5: Lasers and optical fiber

Laser: Basic principle, induced absorption, spontaneous emission and induced emission, Einstein's coefficients, construction and working of ruby, He-Ne and semiconductor laser, characteristics and applications of lasers.

Optical Fiber: Basic idea and construction, types of fibers, acceptance angle and cone, numerical aperture, propagation mechanism and communication in optical fiber, advantages and applications of optical fibers.

Reference Books:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Optics, by Brijlal and Subrahmanyam (text book)
3. Optics by Vasudeva (text book)
4. Optics by A. K.Ghatak
5. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
6. Thyagarajan, K. and Ghatak, A.K., "Lasers (Theory and Application)",
7. Ghatak, A.K. and Thyagarajan, K., "Introduction to fiber"
8. Laser and non-linear optics by B.B. Laud, New Age Int.

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(7)

B.Sc.-B.Ed. VI term LTP (Credits): 3-1-0 (4)

Elements of ~~modern~~ Advanced Physics (PHB343)

Unit 1: Semiconductors

Semiconductor materials, Intrinsic and Extrinsic (P-type and N-type), P-N junction diode, depletion width and potential barrier, junction capacitance, I-V characteristics, Rectifier, ripple factors, filter circuits, efficiency.

Unit 2: Nuclear Physics

Introduction to the nucleus, Fermi gas model, Binding energy, Bethe-Weizsaecker mass formula and its application to explain most stable isobars and nuclear fission, brief description of liquid drop and Shell model. Kinds of reactions; Nuclear Fission & Fusion; Nuclear reactors.

Unit 3: Particle Physics

Fundamental Interactions, Classification of Elementary Particles, Particles and Antiparticles, Baryons, Hyperons, Leptons, and Mesons. Elementary Particles, Quantum Numbers : Baryon Number, Lepton Number, Strangeness, Electric Charge, Hypercharge and Isospin. Eightfold 62 way : Supermultiplets of Mesons and Baryons. Conservation Laws and Symmetry. Different Types of Quarks and Quark Contents of Spin ½ Baryons.

Unit 4: Relativity

Postulates of special theory of relativity, Derivation of Lorentz transformation and physical significance of Lorentz invariance, Length contraction and time dilation, Concept of simultaneity, Relativistic velocity transformation relations, mass energy relation, Concept of zero rest mass of photon, Relativistic relation between energy and momentum. (qualitative discussion only)

Unit 5: Statistical Mechanics

Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics, Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, and comparison of three statistics.

Reference Books:

1. Concepts of modern physics, A. Beiser, TMH
2. Concepts of Nuclear Physics- B.L. Cohen (Tata McGraw Hill)
3. Statistical Mechanics, R.K. Patharia, Pergamin press, Oxford.
4. Electronic Devices and Circuit Theory- Robert Boylestad and Louis Nashelsky, Prentice Hall.

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B.Sc.-B.Ed. VI term

LTP (Credits): 3-1-0 (4)

Elements of advanced Physics (PHB344)

Unit 1: Electromagnetism

Electromagnetic induction; Faraday's law; Lenz's Law, displacement current, Maxwell's Equations in differential and integral form and their physical significance, Application of Maxwell's equation in finding speed of light.

Unit 2: Nuclear Physics

Introduction to the nucleus, Fermi gas model, Binding energy, Bethe-Weizsaecker mass formula and its application to explain most stable isobars and nuclear fission, brief description of liquid drop and Shell model. Kinds of reactions; Nuclear Fission & Fusion; Nuclear reactors.

Unit 3: Lasers and optical fiber

Laser: Basic principle, induced absorption, spontaneous emission and induced emission, Einstein's coefficients, construction and working of ruby, He-Ne and semiconductor laser, characteristics and applications of lasers.

Optical Fiber: Basic idea and construction, types of fibers, acceptance angle and cone, numerical aperture, propagation mechanism and communication in optical fiber, advantages and applications of optical fibers.

Unit 4: Relativity

Postulates of special theory of relativity, Derivation of Lorentz transformation and physical significance of Lorentz invariance, Length contraction and time dilation, Concept of simultaneity, Relativistic velocity transformation relations, mass energy relation, Concept of zero rest mass of photon, Relativistic relation between energy and momentum. (qualitative discussion only)

Unit 5: Statistical Mechanics

Phase space. Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics, Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, and comparison of three statistics.

Reference Books:

1. Concepts of modern physics, A. Beiser, TMH
2. Concepts of Nuclear Physics- B.L. Cohen (Tata McGraw Hill)
3. Statistical Mechanics, R.K. Patharia, Pergamin press, Oxford.
4. Fundamentals of Electricity and Magnetism, D. N. Vasudeva, S. Chand & Co.
5. Thyagarajan, K. and Ghatak, A.K., "Lasers (Theory and Application)".
6. Ghatak, A.K. and Thyagarajan, K., "Introduction to fiber".

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Skill Enhancement Course for B.Ed. LTP (Credits): 2-0-0 (2)

INSTRUMENTATION PHB345

Unit-1: Instrumentation of Electro-Analytical Techniques- Measurements of Electrical Resistance and Conductivity; Basic principle and Applications of Conductometry; Potentiometry; Coulometry; Amperometry; PH ~~metry~~ meter; Voltammetry.

Unit-2: Spectrophotometry and Microscopy- Atomic energy levels: Ground and excited energy states; vibrational energy levels; Raman Effect; Nuclear spin behavior; electronic spin behavior: X-ray energy levels; Absorption and Emission spectroscopy; Absorption Laws of Light; Lambert-Bouguer Law; Beer's Law; Quantitative Use of Beer's Law, Basic principle, instrumentation and applications of Scanning Electron Microscopy (SEM); Transmission Electron Microscopy (TEM); Atomic Force Microscopy (AFM).

Unit-3: Radio-analytical methods- Neutron activation analysis; Isotope dilution analysis; Radiometric titrations; particle induced X-ray Emission; Use of radioisotopes in industry; agriculture and physicochemical studies.

References:

1. Principles of instrumental analysis; Skoog; 2nd edn.
2. Instrumentation Reference Book; Walt Boyes; 3rd Edition.
3. Instrumental methods of Analysis; Willard, Meritt, Dean, Settle; 7th Edition.

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New Syllabus Agenda: 6

PHB117: THERMAL PHYSICS

(L-T-P: 3-1-0; Credit: 4)

Unit 1: Zeroth and first law of thermodynamics (5 lectures)

Thermodynamic Equilibrium; Zeroth Law of Thermodynamics and Concept of Temperature; Work and Heat Energy; First Law of Thermodynamics; Applications of First Law; General Relation between Cp and Cv; Work Done during Isothermal and Adiabatic Processes.

Unit 2: Second law of thermodynamics (8 lectures)

Limitations of first law of thermodynamics, Reversible and Irreversible Processes; Heat Engines; Carnot Cycle; Carnot Engine and its Efficiency; Refrigerator and its Efficiency; Otto engine, Kelvin-Planck and Clausius Statements and their Equivalence; Carnot Theorem; Second Law of Thermodynamics; Thermodynamic Scale of Temperature.

Unit 3: Entropy (6 lectures)

Entropy of a State; Clausius Theorem; Clausius Inequality; Second Law of Thermodynamics in terms of Entropy; Entropy of a Perfect Gas; Entropy Changes in Reversible and Irreversible Processes; Principle of Increase of Entropy; Third Law of Thermodynamics; Temperature-Entropy Diagrams

Unit 4: Real gases (8 lectures)

Behavior of Real Gases; Deviations from the Ideal Gas Equation; The Virial Equation; Andrew's Experiments on CO_2 Gas; Critical Constants; Continuity of Liquid and Gaseous State; Vapour and Gas; Boyle Temperature; Van der Waal's Equation of State for Real Gases; Values of Critical Constants; P-V Diagrams; Joule-Thomson Porous Plug Experiment; Joule-Thomson Effect for Real and Van der Waal Gases; Temperature of Inversion.

Unit 5: Thermodynamic Equations (6 lectures)

Extensive and Intensive Thermodynamic Variables; Thermodynamic Potentials U; H; F and G; Their Definitions; Properties and Applications; Derivations of Maxwell's Relations; Applications of Maxwell's Relations: (1) Clausius Clapeyron equation; (2) Values of Cp-Cv; (3) Tds Equations; (4) Joule-Kelvin Coefficient for Ideal and Van der Waal Gases; (5) Energy Equations (6) Cooling due to Adiabatic demagnetization; Approach to Absolute Zero (7). Stefan-Boltzmann law.

Reference books

1. A Treatise on Heat ; Including Kinetic Theory of Gases; Thermodynamics and Recent Advances in Statistical Thermodynamics By Meghnad Saha; B; N; Srivastava (Indian Press; 1958)
2. Heat and Thermodynamics; An Intermediate Textbook By Mark Waldo Zemansky; Richard Dittman (McGraw-Hill; 1981) (Text Book)
3. Thermal Physics by Garg; Bansal and Ghosh (Tata McGra-Hill; 1993)

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New Syllabus

PHB226: Biophysics and radiation science

(L-T-P: 3-1-0; Credit: 4)

Unit 1: Origin of life
Prebiotic earth, Darwin's theory of evolution, Scientific theory behind the formation of Biomolecules, DNA- carrier of genetic message by an experimental proof, DNA-the master plan for cell formation and cellular activities, Central Dogma

Unit 2: Biophysics as a basis of Bio-molecules
Biophysics as the basis of molecular system, Membrane Biophysics, Nerve cell, Bioelectrical and biochemical conduction of nerve impulses, Membrane potential, Resting potential and action potential. Gross bioelectrical phenomenon of ECG and EEG, Molecular basis of muscle contraction, ultra structure and / or molecular basis of vision and hearing

Unit 3: Radiation Chemistry:
Elementary ideas of fission, fusion and nuclear reactors. Direct and Indirect effects of radiations, radiation chemical yields and G-values, formation of free radicals, radiolysis of water, radiation effects on simple chemical systems, interactions of free radicals with several solutes.

Unit 4: Radiation biology:
Stages of damage in tissue - response to different radiation types, Radiobiological effects - molecular damage and repair, cell survival, Human exposure and risk, Environmental factors. Radiation effects on Cell: membrane, energy metabolism, synthetic processes, chromosomes, chromosomal type aberrations, chromatid type aberrations, sub-chromatid aberrations, relation between aberration structure and the mitotic and meiotic cycles. Radiation effects on cell division.

Unit 5: Radiation generators:
Cyclic generators: Principle and applications of Cyclotron, Synchro – Cyclotron , Betatron.
Linear generators: Principle and applications of Klystron, magnetron, Van De Graff Generator.

References:

1. Biophysics-Principles and Techniques-M.A. Subramanian, MJP Publishers, Chennai, India.
2. Pattabhi. V. and Gautham.N. (2002) Biophysics. Narosa Publishing House, India.
3. Essentials of Nuclear Chemistry, H. J. Arnikar, 4th Edition Wiley Eastern (1987).
4. Segre E., Experimental Nuclear Physics.

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Agenda : 7

B.Tech. (EC, EE) II term

LTP (Credits): 2-1-0 (3)

Electricity and Magnetism (PHY118)

Unit 1: Electrostatics

Coulomb's law – force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution. Electric field, electric field due to a point charge, electric flux, Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside), charged solid sphere (insulating and metallic).

Unit 2: Potential and Capacitance

Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipoles in an electrostatic field. Capacitors and capacitance, capacitance of a parallel plate, Cylindrical and spherical capacitors. Capacitance with and without dielectric medium between the plates of capacitor, energy stored in a capacitor.

Unit 3: Magnetic Effects of Current and Magnetism

Biot-Savart law and its application to current carrying circular loop, Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids.

Unit 4: Electromagnetism

Electromagnetic induction; Faraday's law, induced emf and induced current; Lenz's Law, displacement current, Maxwell's Equations in differential and integral form and their physical significance.

Reference books

1. Fundamentals of Electricity and Magnetism, D. N. Vasudeva, S. Chand & Co. New Delhi
2. Fundamentals of Physics, Halliday, Resnick and Walker, John Wiley.
3. Electricity and Magnetism, J. Yarwood and J. H. Fewkes. University Tutorial Press (1991).

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B.Tech. (ME, CE) I term

LTP (Credits): 3-1-0 (4)

Mechanics (PHY119)

Unit 1: Measurements, errors and vectors

Measurement of fundamental and derived quantities, International system of units, accuracy, precision of instruments and errors in measurement. Scalar and vector quantities, addition, subtraction and multiplication of vectors. Gradient, divergence and curl and their physical significance.

Unit 2: Motion, Work, Energy and Momentum

Concept of Force, work, power and energy; Law of conservation of energy; Potential energy, Conservative forces; Centre of mass, Conservation law of momentum; Collision of bodies; Centre of mass frame of reference, Laboratory frame of reference, Free body diagrams, equilibrium & its equations, applications.

Unit 3: Rotational Motion

Angular Momentum of a Particle and System of Particles. Torque. Conservation of Angular Momentum. Rotation about a Fixed Axis. Kinetic Energy of Rotation. Motion involving both Translation and Rotation.

Unit 4: Moment of Inertia

Moment of inertia, Parallel Axes Theorem, Perpendicular axes theorems, Principal Moment of Inertia. Mass Moment of Inertia of Circular Ring, Disc, Cylinder, Sphere and Cone about their axis. Centre of gravity and Moment of Inertia of triangular body and Rectangular body.

Unit 5: Simple Harmonic Motion

Oscillations. Simple harmonic oscillations, Equation of Simple Harmonic Motion; Potential and Kinetic Energy of a Harmonic Oscillator and their variation, Simple pendulum, Compound Pendulum.

References books

1. Principles of physics, J. Walker, D. Halliday and R. Resnick, Wiley India pvt. Ltd.
2. Mechanics, D.S. Mathur, S. Chand & Co.
3. Engineering Mechanics by Irving H. Shames, Prentice-Hall
4. The Feyman Lectures on Physics, volume 1.

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B.Tech. (BT) I term LTP (Credits): 3-1-0 (4)

Thermodynamics (PHY121)

Unit 1: Zeroth and first law of thermodynamics

Thermodynamic Equilibrium; Zeroth Law of Thermodynamics and Concept of Temperature; Thermometers. Work and Heat Energy; First Law of Thermodynamics; Applications of First Law: General Relation between Cp and Cv; Work Done during Isothermal and Adiabatic Processes.

Unit 2: Second law of thermodynamics

Limitations of first law of thermodynamics, Reversible and Irreversible Processes; Heat Engines; Carnot Cycle: Carnot Engine and its Efficiency; Refrigerator and its Efficiency; Kelvin-Planck and Clausius Statements and their Equivalence; Carnot Theorem (no proof); Second Law of Thermodynamics.

Unit 3: Entropy

Entropy of a State; Clausius Theorem; Clausius Inequality; Second Law of Thermodynamics in terms of Entropy; Entropy of a Perfect Gas; Entropy Changes in Reversible and Irreversible Processes: Principle of Increase of Entropy; Third Law of Thermodynamics.

Unit 4: Real gases

Behavior of Real Gases; Deviations from the Ideal Gas Equation, Andrew's Experiments on CO_2 Gas; Critical Constants; Vapour and Gas; Boyle Temperature; Van der Waal's Equation of State for Real Gases: Values of Critical Constants; P-V. Diagrams; Joule-Thomson Porous Plug Experiment: Joule-Thomson Effect for Real and Van der Waal Gases (qualitative discussion only): Temperature of Inversion.

UNIT V: Heat transfer

Modes of heat flow, Heat Conduction (Steady State): Introduction, thermal conductivity, 1-D heat conduction through a plane wall, long hollow cylinder, hollow sphere. Heat Transfer by Radiation: Thermal radiation, The Stephen-Boltzmann law, The black body radiation, Laws of black body radiation, Plank's law (qualitative).

Reference books:

Engineering Fluid Mechanics	By K. L. Kumar, S. Chand & Co.
Fluid Mechanics	By V. L. Streeter, Wylie, MGH
Engg. Thermodynamics-	Hawkins, G.A. John Wiley & Sons.
Engg. Thermodynamics-	Nag, P.K. Tata McGraw Hill.
Heat Transfer-Principles & Applications	-Binay K. Dutta, PHI, New Delhi
Thermal Radiation Heat Transfer	-Siegel, R. and J.R. Howell, Mc. Graw Hill

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B.Tech. (BT) II term LTP (Credits): 2-1-0 (3)

Fluids (PHY122)

Unit 1: Fluids

Physical properties of fluids, Concept of fluid and flow. Types of fluids- Ideal and real fluids, Continuum concept, Density, Specific weight, Specific volume, Specific gravity, Compressibility, Elasticity.

Unit 2: Fluid statics

Pascal's law, hydrostatic equation, hydrostatic forces on plane surface, Pressure-density-height relationship, Manometers, Buoyancy, Stability of immersed and floating bodies.

Unit 3: Surface Tension

Surface Tension: Definition and dimensions of surface tension; Excess of pressure over curved surfaces; Application to spherical and cylindrical drops and bubbles; Variation of Surface tension with temperature, Jaegar's method.

Unit 4: Viscosity

Streamline Flow: Bernoulli's Theorem and applications; Co-efficient of viscosity and its dimensions - Rate of flow of liquid in a capillary tube - Poiseuilles' formula, Variation of viscosity of a liquid with temperature.

Reference books:

1. Engineering Fluid Mechanics, K. L. Kumar, S. Chand & Co.
2. Fluid Mechanics, V. L. Streeter, Wylie, MGH
3. Properties of matter, D.S.Mathur, S.Chand & Co,

B.Tech. (CS.) II term LTP (Credits): 2-1-0 (3)

Engineering Physics (PHY116)

Unit 1: Fiber Optics and Holography

Introduction. structure of optical fibre, Light guidance through optical fibre, Acceptance angle and Acceptance cone, Numerical aperture, Types of optical fibres, Attenuation and Dispersion in optical fibre. Applications of optical fibres.

Basic principle of holography, Recording of holograms, Reconstruction process, Applications of holography.

Unit 2: Electrostatics and Magnetostatics

Coulomb's law, Electric field, electric field due to a point charge, electric flux, Gauss's theorem and its applications to find field due to infinitely long straight wire, Electric potential, and potential difference, Biot-Savart law and its application to current carrying circular loop, Ampere's law and its applications to infinitely long straight wire, and solenoids.

Unit 3: Electromagnetism

Electromagnetic induction; Faraday's law, induced emf and induced current; Lenz's Law, displacement current, Maxwell's Equations in differential and integral form and their physical significance. Application of Maxwell's equation in finding speed of light.

Unit 4: Quantum Mechanics

Inadequacy of classical Physics, Wave particle duality, de-Broglie wavelength, Davisson-Germer experiment, Schrodinger wave equation, particle in a 1 dimensional box, Quantum Entanglement and Quantum Cryptography (qualitative).

Reference books

1. Fundamentals of Electricity and Magnetism, D. N. Vasudeva, S. Chand & Co. New Delhi
2. Fundamentals of Physics, Halliday, Resnick and Walker, John Wiley.
3. Electricity and Magnetism, J. Yarwood and J. H. Fewkes. University Tutorial Press (1991).
4. Lasers (Theory and Application): K.Thyagarajan & A.K.Ghatak
5. Introduction to fiber: A.K.Ghatak & K.Thyagarajan
6. Concepts of modern Physics, A. Beiser, TMH.

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B.Tech. (CS, EC, EE) I term LTP (Credits): 3-1-0 (4)

Semiconductor Physics (PHY117)

Unit 1:-Physics of Semiconductor

Introduction, classical free electron theory (Lorentz-Drude theory and limitations), Quantum theory of free electron (Fermi energy, effect of temperature on Fermi-Dirac distribution) (qualitative analysis), Energy bands, Classification of Solids on the basis of energy band.

Unit 2:- Transport Phenomena in semiconductors

Mobility, conductivity, electrons and holes in an intrinsic semiconductors, Donor and Acceptor impurities (n-type and p-type semiconductor) , Fermi levels , carrier densities in semiconductor (concentration of electrons in conduction band and holes in valence band) , Drift and diffusion current, Hall effect.

Unit 3:- p-n Junction

p-n junction, types of p-n junction (step-graded and Linearly-graded junction) , formation of depletion region, barrier potential, Zener diode, Characteristics of Zener diode , Avalanche and Zener breakdown, comparison of Zener diode and pn junction diode, concept of tunneling, I-V characteristics of tunnel diode.

Unit 4:-Laser Physics

Coherent sources, interaction of radiation with matter (spontaneous and stimulated emission), Einstein's relation, population inversion and pumping, active components of laser, optical amplification or gain, threshold condition for laser action, three and four level lasers, Ruby and He-Ne lasers.

Unit 5:-Optoelectronic Devices

Optical sources: Light emitting diode (construction, basic working principle), semiconductor laser (construction, basic working principle), optical detectors: photodiode (working principle), p-i-n photodiode (working principle), photovoltaic effect, p-n junction solar cell (basic working idea).

Text book: Integrated Electronics- Millman - Halkias, Tata Mc Graw Hill.

Reference books

1. ~~Semiconductor Devices Physics and Technology- S M Sze, John Wiley & Sons~~
2. Semiconductor Device Fundamentals- Robert F. Pierret Addison Wesley Longman.
3. Semiconductor Devices- Kanaan Kano, Pearson Education.
4. Basic Electronics by B.L Thareja
5. Principles of Electronics by V.K Mehta
6. Laser and non linear optics by B.B. Laud, New Age Int.
7. Electronics devices and circuit theory by R.L. Boylestad, Pearson.

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B.Tech. (ME, CE) II term LTP (Credits): 2-1-0 (3)

Engineering Physics (PHY120)

Unit 1: Elasticity

Hooke's Law. Stress- Strain Diagram, Elastic moduli, Relation between elastic constants, Poisson's Ratio. Determination of Poisson's ratio; Energy stored per unit volume in a strain; Bending of beam; Bending moment, Cantilever.

Unit 2: Waves

Transverse and Longitudinal Waves, speed of a travelling wave, wave speed on a stretched string. energy and power, wave equation, interference, standing waves and resonance.

Unit 3: Zeroth and first law of thermodynamics

Thermodynamic Equilibrium; Zeroth Law of Thermodynamics and Concept of Temperature; Work and Heat Energy; First Law of Thermodynamics; Applications of First Law; General Relation between Cp and Cv; Work Done during Isothermal and Adiabatic Processes.

Unit 4: Second law of thermodynamics

Limitations of first law of thermodynamics, Reversible and Irreversible Processes; Carnot Cycle; Kelvin-Planck and Clausius Statements and their Equivalence; Second Law of Thermodynamics; Concept of Entropy.

References books

1. Principles of physics, J. Walker, D. Halliday and R. Resnick, Wiley India pvt. Ltd.
2. Heat and Thermodynamics, Brijlal and N. Subramanyan, S.Chand and Sons.
3. The Feyman Lectures on Physics, volume 1.

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MPH218: Functional Materials

(L-T-P: 4-0-0; Credit: 4)

Unit 1: Semiconductor quantum dots: Growth mechanism, shape and composition control of semiconductor nanocrystals, Synthesis of semiconductor nanocrystals in organic solvents, Aqueous synthesis of semiconductor nanocrystals, Multishell semiconductor nanocrystals, Layer-by-layer (LBL) assembly with semiconductor nanoparticles and Nanowires, Fluorescence spectroscopy of single CdSe nanocrystals, Applications of quantum dots in biomedicine.

Unit 2: Nanotubes and nanowires: Fabrication of TiO2 Nanotube Arrays by Electrochemical Anodization: Four Synthesis Generations, Material Properties of TiO2 Nanotube Arrays: Structural, Elemental, Mechanical, Optical, and Electrical, Applications, Boron Nitride Nanotubes: Synthesis and Structure, One-Dimensional Semiconductor and Oxide Nanostructures, Inorganic nanowires

Unit 3: Nanofibers: Introduction, The Electrospinning Process, Key Processing Parameters, Nanofiber Yarns and Fabrics Formation, Potential Applications of Electrospun Fibers, Nanofibers for Tissue Engineering Scaffolds, Nanofibers for Chemical/Bio Protective Membranes, Nanocomposite Fibers for Structural Applications.

Unit 4: Metal Oxide Frameworks

Metal Oxide Frameworks, definitions, advantages, disadvantages, methods of synthesis, Structural originality of MOFs, properties, Applications.

Unit 5: Thin Film Growth Mechanism

Introduction- Nucleation and early stages of film growth - Three dimensional nucleation and growth - Two dimensional Nucleation and Growth - Stranski-Krastanov Nucleation and Growth - Capillarity theory.

References

1. TiO_2 Nanotube Arrays: Synthesis, Properties, and Applications by Craig A. Grimes and Gopal K. Mor, Springer Publisher
2. Nanotubes and Nanofibers; Advanced Materials Series, Series Editor: Yury Gogotsi, Drexel University, Philadelphia, Pennsylvania, USA, Nanotubes and Nanofibers by Yury Gogotsi
3. Hybrid porous solids: past, present, future by Gerard Ferey, Chemical Society Reviews, 37 (2008) 191-214. DOI: 10.1039/b618320b
4. Semiconductor Nanocrystal, Quantum Dots: Synthesis, Assembly, Spectroscopy and Applications by Andrey L. Rogach (Ed.), Springer Publisher
5. Nanotubes and Nanowires, CNR Rao and Govindraj, RSC Publishers
6. Quantum well, wires and dots, Paul Harison, Wiley Publisher

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MPH219: Nanocomposites

(L-T-P: 4-0-0; Credit: 4)

UNIT 1: Introduction

Nanocomposites: An Introduction, Types of Nanocomposite, Difference between composite & nanocomposites, Ceramic Nanocomposite. Metal based Composites- Metal -Ceramic nano composites, Metal-metal nanocomposites,

UNIT 2: Preparation, Characterization and properties of nanocomposites

Different methods for the preparation of nanocomposites, Characterization techniques, Properties of composite vs. nanocomposites. Preparation of carbon nanotubes by arc discharge, laser ablation, CVD and other techniques.

UNIT 3: Polymer nanocomposites

Preparation and characterization of polymer-nanocomposites, Direct Mixing, Solution Mixing, In-Situ Polymerization, In-Situ Processing of Ceramic/Polymer and Metal/Polymer nanocomposites, Polymer-carbon nanotubes based composites. Properties and industrial applications of polymer based nano composites.

UNIT 4: Carbon based nanocomposites

Carbon and its allotropes, Carbon nanotube, Carbon-carbon nanocomposites, Polymer ~~onto~~ - Carbon nanocomposite, Applications of nanocomposites..

UNIT 5: Natural and Bionanocomposites

Nanocomposite biomaterials, teeth and bone substitution, Natural nanocomposite systems as spider silk, bones, shells; organic-inorganic nanocomposite formation through self-assembly, Biomimetic synthesis of nanocomposite material.

References

1. Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V. Braun (2003)
2. Physical Properties of Carbon Nanotubes- R. Saito (1998)
3. Carbon Nanotubes (Carbon , Vol 33) - M. Endo, S. Iijima, M.S. Dresselhaus
4. The search for novel, superhard materials- Stan Veprįek (Review Article) JVST A, 1999
5. Electromagnetic and magnetic properties of multi component metal oxides, hetero Nanometer versus micrometer-sized particles-Christian Brosseau,Jamal Ben, Youssef, Philippe Talbot, Anne-Marie Konn, (Review Article) J. Appl. Phys, Vol 93, 2003

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MPH119: Mathematical Physics

(LTP: 4-0-0, Credits 4)

Unit 1: Ordinary Differential Equations

Linear ordinary differential equations of first & second order, series solution of differential equation, Special functions (Hermite, Bessel, Laguerre and Legendre functions). Green's function, Partial differential equations (Laplace, wave and heat equations in two and three dimensions)

Unit 2: Fourier series, Fourier and Laplace transforms

Fourier series, Fourier series in change of interval, Half range sine and cosine series. Fourier Transforms, Fourier Cosine and sine Transform, properties of Fourier Transform. Laplace transform of some standard functions and its properties, Inverse Laplace transform and Convolution theorem.

Unit 3: Complex Analysis

Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals.

Unit 4: Probability and Statistics

Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

Unit 5: Numerical Techniques

Elements of computational techniques: root of functions, interpolation, extrapolation, integration by trapezoidal and Simpson's rule, Solution of first order differential equation using Runge-Kutta method and Finite difference methods.

References:

1. Ramana B V, "Higher Engineering mathematics" ,Tata McGraw Hill.
2. Jain, M.K. and Iyenger, S.R.K., "Advanced Engineering mathematics", Narosa Publications.
3. Thomas, B.G., and Finny R.L., "Calculus and Analytical Geometry", Pearson education Asia, Adison Wisley.
4. Narayan Shanti," Differential Calculus", S Chand Publication
5. Gupta,S.C and Kapoor,V.K, "Fundamental of Mathematical Statistics".
6. Schaum's Outline of Complex Variables, 2ed by By Murray Spiegel, Seymour Lipschutz, John Schiller, Dennis Spellman
7. Elements of Numerical Analysis by R. S. Gupta, Macmillan India Ltd, 2009.
8. Kreyszig !

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MPH120: Quantum Mechanics

(LTP: 4-0-0, Credits 4)

Unit 1: Linear vector space – State space, Dirac notation and Representation of State Spaces, Concept of Kets, Bras and Operators, Expectation Values, Superposition Principle, Orthogonality, Completeness, Expansion of State Vector, Non commutating Observables, Commutation and Compatibility, Change of basis, Unitary operators. Generalized Uncertainty Relations, Ehrenfest theorem

Unit 2: Postulates of Quantum mechanics, State function and its interpretation, Wave-function in coordinate and momentum representations, Expansion of a State Function.... and Superposition of states, Matrix representation of State Vectors and operators, Continuous Basis, Relation between a State Vector and its wave function.

Unit 3: Schrödinger equation and its applications- In one dimensional consideration: Schrödinger equation (time-dependent and time-independent). Eigenvalue problems: Particle in one-dimensional potential well (finite and infinite depth) and its energy states; Solutions of different one-dimensional barriers (finite and infinite width) and penetration problems.

Unit 4: Schrödinger equation and its applications in three dimensional consideration: Free particle wave function; Motion of a charged particle in a spherically symmetric field; Energy states associated wave functions of Hydrogen atom; Expression of Bohr radius.

Unit 5: Schrödinger, Heisenberg and Interaction Pictures in quantum mechanics, Linear harmonic oscillator: solution of the Linear Harmonic Oscillator with Operator Method, Coherent States.

References:

1. B. H. Bransden and C. J. Joachain, Quantum Mechanics, Pearson Education 2nd Ed. (2004)
2. R. L. Liboff, Introductory Quantum Mechanics, Pearson Education, 4th Ed. (2003).
3. J. J. Sakurai, Modern Quantum Mechanics, Pearson Education (2002).
4. K. Gottfried and T-M Yan, Quantum Mechanics: Fundamentals,2nd Ed., Springer (2003).
5. D. J. Griffiths, Introduction to Quantum Mechanics, Pearson Education (2005).
6. P. W. Mathews and K. Venkatesan, A Textbook of Quantum Mechanics, Tata McGraw Hill(1995).
7. F. Schwabl, Quantum Mechanics, Narosa (1998).
8. L. Schiff, Quantum Mechanics, Mcgraw-Hill (1968).
9. E. Merzbacher, Quantum Mechanics, John Wiley (Asia) (1999).
10. ~~B. H. Bransden and C. J. Joachain, Quantum Mechanics, Pearson Education 2nd Ed. (2004~~

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MPH122: Advanced Quantum Mechanics (LTP: 4-0-0, Credits 4)

Unit 1: Generalised angular momentum, Infinitesimal rotation, Generator of rotation, Commutation rules, Matrix representation of angular momentum operators, Spin, Pauli spin matrices, Rotation of spin states, Coupling of two angular momentum operators, Clebsch Gordon co-efficients, Applications.

Unit 2: Approximation methods- Time-independent perturbation theory for non-degenerate and degenerate states, Application: anharmonic oscillator, Helium atom, Stark effect in hydrogen atom.

Unit 3: Variational method and its applications (1-D harmonic oscillator, ground state energy of Hydrogen atom), WKB approximation and application to 1-D harmonic oscillator, WKB method; Connection formula, Time-dependent perturbation theory; Harmonic perturbation; Fermi's golden rule. Sudden approximation.

Unit 4: Scattering theory- Scattering of a particle by a fixed centre of force, scattering amplitude differential and total cross sections, Method of partial waves, Phase shifts, Optical theorem, Scattering by a hard sphere and potential well, Integral equation for potential scattering, Green's function, Born approximation, Yukawa and Coulomb potential.

Unit 5: Relativistic quantum mechanics: Klein-Gordon and Dirac equations, Semi-classical theory of radiation.

References:

1. B. H. Bransden and C. J. Joachain, Quantum Mechanics, Pearson Education 2nd Ed. (2004)
2. R. L. Liboff, Introductory Quantum Mechanics, Pearson Education, 4th Ed. (2003).
3. J. J. Sakurai, Modern Quantum Mechanics, Pearson Education (2002).
4. K. Gottfried and T-M Yan, Quantum Mechanics: Fundamentals,2nd Ed., Springer (2003).
5. D. J. Griffiths, Introduction to Quantum Mechanics, Pearson Education (2005).
6. P. W. Mathews and K. Venkatesan, A Textbook of Quantum Mechanics, Tata McGraw Hill(1995).
7. F. Schwabl, Quantum Mechanics, Narosa (1998).
8. L. Schiff, Quantum Mechanics, Mcgraw-Hill (1968).
9. E. Merzbacher, Quantum Mechanics, John Wiley (Asia) (1999).
10. ~~B. H. Bransden and C. J. Joachain, Quantum Mechanics, Pearson Education 2nd Ed. (2004).~~

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MPH217: Nuclear and Particle Physics (LTP : 4-0-0; Credit 4)

Unit 1: Nuclear Interaction and Nuclear Forces

Nuclear Forces- Exchange Forces; Two body problem-ground state if deuteron- magnetic moment, quadrupole moment, nucleon-nucleon interaction; Exchange forces and tensor forces; Meson theory of nuclear forces-Yukawa potential; Nucleon- nucleon scattering; spin dependence of nuclear force; charge independence and charge symmetry of nuclear forces; Isospin.

Unit 2: Nuclear Reactions

Types of reactions and conservation laws; energies of nuclear reactions; dynamics of nuclear reactions: The Q-value equation; Scattering and reaction cross section; compound nucleus reactions, direct reactions; Resonance scattering-Breit Wigner one level formula (qualitative analysis)

Unit 3: Nuclear Models

Liquid drop model; Bohr - Wheeler theory of fission; Experimental evidence for shell effects; Shell model; spin orbit coupling-magic numbers; angular momenta and parities of nuclear ground states; Qualitative discussion: estimate of transition rates, magnetic moments and Schimdt lines.

Unit 4: Nuclear Decay

Beta decay; Fermi theory of beta decay; Shape of beta spectrum; Total decay rate-Mass of the neutrino –angular momentum and parity selection rules; Allowed and forbidden decays; Neutrino Physics— Non-conservation of parity; Gamma decay-Multipole transitions in nuclei; Angular momentum and parity selection rules; Internal conversion; Nuclear isomerism.

Unit 5: Particle Physics

Basic forces; Classification of elementary particles; Spin and parity; Determination of isospin; strangeness, lepton number, baryon number; Conservation laws, Gellmann-Nishijima scheme; Meson and Baryon Octet; Elementary ideas of SU (3), Symmetry quark model; High energy physics: Tyoes of interaction- typical strength and time scale; Conservation loss; Parity and time reversal, CPT theorem.

Books:

1. R R Roy and B P Nigam, "Nuclear Physics" New Age International Ltd
2. M K Pal, "Theory of Nuclear Structure" East West Press Pvt Ltd, Delhi.
3. D C Tayal, "Nuclear Physics" Himalaya Publication Home
4. S N Ghoshal "Nuclear Physics" S Chand
5. Bernard L Cohen, "Concept of Nuclear Physics" Mc Graw Hill.
6. K S Krane, 1987, Introductory Nuclear Physics, Wiley New York
7. Kaplan Irving, Nuclear Physics, Narosa Publishing House
8. S P Kuila, "Concept of Nuclear Physics" New Central Book Agency Ltd
9. Kakani and Kakani, "Nuclear and Particle Physics" Viva Books
10. D Griffiths, "Introduction to Elementary Particle Physics" Harper and Row

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Open Elective

LTP (Credits): 2-0-0 (2)

Mechanics beyond Newton

(Note this is an open elective course, meant for those who are not students of Physics. Hence all of the topics are qualitative only and aims to make non-Physics students familiar with certain interesting aspects of the Physics)

Unit- 1: Relativistic Mechanics

Laws of Newton, relative velocity, problem in Newtonian mechanics, successful failure of Michelson Morley experiment, new mechanics of Einstein, Lorentz transformations. Special effects of relative speed: shortening of length, dilation of time, increment in mass. Momentum in photon, muon's prolonged life time, twin paradox, $E=mc^2$, relativistic velocity addition, constancy of speed of light. Photo electric effect, Pair production.

Unit – 2: Quantum Mechanics

Inadequacy of classical mechanics, origin of quantum theory, Blackbody radiation and Plank's hypothesis., de-Broglie Hypothesis, electrons as waves, Experimental evidence (Davission and Germer experiment). Quantization of Energy, Heisenberg Uncertainty Principle and its use to prove nonexistence of electron in a nucleus. Wave functions, time Independent Schrodinger equation. how the quantum mechanics works: particle in a box.

Text book: Concepts of modern Physics by A. Beiser, TMH.

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Open Elective LTP (Credits): 2-0-0 (2)

Nano Science and Technology

(Note: this is an open elective course, meant for those who are not students of Physics. Hence all of the topics are qualitative only and aims to make non-Physics students familiar with certain interesting aspects of the Physics)

Unit I:

Background to Nanoscience: Defination of Nano, Scientific revolution-Atomic Structure and atomic size, emergence and challengs of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties.

Unit II

Types of nanostructure and properties of nanomaterials: One dimensional, Two dimensional and Three dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.

Unit III

Application of Nanomaterial: Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application

(Add Reference books)

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Open Elective . LTP (Credits): 2-0-0 (2)

Astro Physics

(Note: this is an open elective course, meant for those who are not students of Physics. Hence all of the topics are qualitative only and aims to make non-Physics students familiar with certain interesting aspects of the Physics)

UNIT 1: Our universe

Beginning and expansion of the universe, Galaxies, Stars and their temperatures and magnitudes. H-R diagram, red giants, White dwarfs, Chandrashekhar mass limit, pulsars, neutron stars and black holes, Schwarzschild radius, dark matter and dark energy, wormholes, time travel, gravity waves, how the universe will end?

UNIT 2: Our Solar system

Formation of solar system, composition of solar system, planets, dwarf planets, Meteoroids, Meteors, asteroids, comets, terrestrial palnets, Jovian palnets, Sun, energy production, solar structure and activity, sunspots, solar flares, effects on the Earth.

Reference books

1. The origin and evaluation of the solar system by MM Woolfson, The institute of Physics, London.
2. Introduction to Astronomy by Karina Kjaer.
3. Black holes, wormholes and time machines by Jim al-Khalili, Institute of Physics Publishing, Bristol.