Following papers have been modified during Board of Studies (Under Graduate) meeting held on 9^{th} November 2015.

Existing B.Sc. 5^{th} and 6^{th} Semester Physics Syllabus effective from 2010

EXISTING PAPERS FOR 5th SEMESTER
BSc Physics
COMPULSORY PAPER - Paper 5 .
Title of paper : ATOMIC ,MOLECULAR AND NUCLEAR PHYSICS
(Course duration : 14 weeks with three hours of instructions per week)
PART -A

The electron : Determination of e/m of an electron by Thomson method. Determination of the charge of the electron by Millikan's oil-drop method. **2hrs**

Atomic spectra : A qualitative account of Sommerfeld relativistic atomic model. Excitation and ionization potentials-Frank-Hertz experiment. Vector model of an atom. Electron spin. Space quantisation. Magnetic moment of an electron due to its orbital motion. Stern-Gerlach experiment. Spin-orbit interaction and the fine structure of spectral lines. Quantum numbers and selection rules. Pauli's exclusion principle, Electronic configuration of atoms. Valence electron.Brief mention of LS and JS coupling for multi electron atoms. **8hrs**

Zeeman effect : explanation of the normal Zeeman effect on the basis of the vector model of the atom. Expression for the Zeeman shift and experimental details. **2hrs**

Molecular spectra : Rotation and vibration and electronic spectra of molecules. Associated quantum numbers and selection rules. Theory of pure rotation spectra **3hrs**

The Raman effect : Experiment, Quantum theory intensity and polarization of Raman lines. Applications **2hrs** 2Hrs

Lasers.: General principles. Three level laser, The He-Ne laser.

Modified B.Sc. 5^{th} and 6^{th} Semester Physics Syllabus effective from 2016-2017

MODIFIED PAPERS FOR 5th SEMESTER
BSc PHYSICS
COMPULSORY PAPER I - Paper 5
Paper code:
Title of paper : SPECTROSCOPY AND ELECTRONICS
(Course duration : 14 weeks with TWO hours of instructions per week)

The electron: Determination of e/m of an electron by Thomson method. Determination of the charge of the electron by Millikan's oil-drop method. **2hrs**

Atomic spectra : A qualitative account of Sommerfeld relativistic atomic model. Excitation and ionization potentials-Frank-Hertz experiment. Vector model of an atom. Electron spin. Space quantisation. Magnetic moment of an electron due to its orbital motion. Stern-Gerlach experiment- experimental details and theory, Spin-orbit interaction and the fine structure of spectral lines. Quantum numbers and selection rules. Pauli's exclusion principle, Electronic configuration of atoms. Valence electron. Brief mention of LS and JJ coupling for multi electron atoms, Zeeman effect- Types , Experimental details of normal Zeeman effect, explanation of the normal Zeeman effect on the basis of the vector model of the atom. Expression for the Zeeman shift. **9hrs**

Molecular spectra : Salient features of molecular spectra, Rotation and vibration and electronic spectra of molecules. Associated quantum numbers and selection rules. Theory of pure rotation spectra,The Raman effect - Salient features, Experimental setup, Quantum theory, intensity and polarization of Raman lines. Applications.

4hrs

Laser Applications : Medical applications, Laser Communications, Industrial applications cutting , drilling, welding, Scribing **4hrs**

PART -B

Wave mechanics: Failure of classical mechanics in the microscopic domain. The concept of matter waves. The Davisson and Germer experiment. Heisenberg's uncertainty principle- the gamma ray microscope. Setting up the time-independent and time dependent Schredinger equations. Born's interpretation of the wave function. Solution of the time-dependent Schredinger equation for particle in one-dimensional box and its eigen-values. Mention of energy eigen-values for the one-dimensional simple harmonic oscillator, and The zero-point energy. **8hrs**

The nucleus : Neutron discovery and Properties . The proton-neutron hypothesis. Nuclear forces and their characteristics. Yukawa's theory (qualitative) **2hrs**

Radioactive decay: Successive disintegration, Radioactive equilibrium radioactive series, Range and energy of alpha-particle and their measurement. Theory of alpha-decay(qualitative). Geiger-Nuttal law. Beta Decay - Paulis neutrino hypothesis K-electron capture, Internal conversion, Nuclear isomerism. **6hrs**

Accelerators: Cockroft-Walton voltage multiplier. LINAC, Cyclotron **3hrs**

Nuclear Detectors : G.M. counter, Bubble chamber. Principle of semiconductor detector. **2hrs**

Books for reference :

1. B L Theraja and R S Sedha : Principles of electronic devices and circuits (Revised edition 2011)
2. Bapat YN : Electronic circuits and Systems, TMH , New Delhi, 2013.
3. Alan Motttershead : Electronic devices and circuits , Prentice hall of India ltd , New Delhi , 2012.

Electronics

Network Theorems: Thevenins theorem, Norton's Theorem, application to the analysis of DC circuits. **2hrs**

Semiconductor Devices: Types of semiconductors, Diode current equation, I - V characteristics, Static and dynamic resistance of a diode, Bridge rectifier, Expression for ripple factor and efficiency. Filters, Zener breakdown and Avalanche breakdown. Regulated power suppliesshunt regulator using zener diode. **3hrs**

Transistors: Type and configuration, Methods of transistor biasing- voltage divider bias, Fixing Operating point, drawing load line. Effect of temperature on operating point, Thermal runway. **2hrs**

Amplifier: Transistor amplifiers, two stage transistor RC coupled amplifier, mathematical analysis, frequency response curve, half power frequencies bandwidth. **2hrs**

Oscillators : The feed back concept-positive and negative feed back. Mention of the Barkhausen criteria. Types of oscillator - Hartley oscillator. **2hrs**

Logic gates: Construction of AND, OR & NOT logic gates using Diodes & Transistors (two input). Symbols and discussion of truth table using Boolean expressions for NOR, NAND and XOR logic gates. **2hrs**

Books for Reference:

1. Halliday and Resnick: Fundamentals of Physics, 9th edition, Wiley India, 2011.
2. Arthur Beiser: Concepts of modern physics, 6th edition, TMH, New Delhi.2008.
3. A. K. Saxena: Atomic and Molecular Spectra and Lasers, 1st edition, CBS Publishers and Distributors, 2009
4. C. N. Banwell and E. M. McCash: Fundamentals of Molecular spectroscopy, 4th edition, TMH, 1994

4. A K Saxena, Narosa :Principles of Modern Physics ,publishing house pvt. Ltd., 4th edition, 2014.

5. V K Mehta, Rohit Mehta: Principles of Electronics, S Chand & Company Ltd., Reprint 2015.

6. Atomic Physics (Modern Physics) - Dr. S. N. Ghoshal, S. Chand & Company Ltd., Reprint 2010.

5. Satya Prakash: Optics and Atomic Physics, 11th edition, Ratan Prakashan Mandir, 1994

6. R. Murugeshan and K. Sivaprasath: Modern Physics, 12th edition, S. Chand and Co., 2005

7. F.R. Richtmeyer. E.H. Kennard and T. Lauritsen : Introduction to modern Physics

8. R S Sedha : A text book of applied electronics, S Chand & Company Ltd., Multicolour, Reprint 2014.

9. Donal P Leach, Albert Paul Malvino and Gautam saha : Digital Principles and Applications (sixth edition 2010)

10. B L Theraja and R S Sedha : Principles of electronic devices and circuits (Revised edition 2011)

11. Bapat YN : Electronic circuits and Systems, TMH , New Delhi, 2013.

12. Alan Motttershead : Electronic devices and circuits , Prentice hall of India ltd , New Delhi , 2012.

13. A K Saxena, Narosa :Principles of Modern Physics ,publishing house pvt. Ltd., 4th edition, 2014.

14. V K Mehta, Rohit Mehta: Principles of Electronics, S Chand & Company Ltd., Reprint 2015.

15. Atomic Physics (Modern Physics) - Dr. S. N. Ghoshal, S. Chand & Company Ltd., Reprint 2010.

16. Jacob Millman Christos C Halkias, Satyabrata Jit: Millmans Electronic Devices and Circuits, McGraw Hill Education (India) Private Limited, New Delhi,4 edition, 5th Reprint 2014.

COMPULSORY PAPER II

NIL

MODIFIED PAPERS FOR 5th SEMESTER
BSc PHYSICS
Paper 6 - COMPULSORY PAPER II
Paper code:

Title of paper : CONDENSED MATTER PHYSICS

(Course duration : 14 weeks with TWO hours of instructions per week)

Statistical physics : The Maxwell-Boltzmann. Bose-Einstein and Fermi-Dirac energy distribution formulae (no derivation). A qualitative comparison of the three distribution formulae. **2hrs**

Bonding in crystals: Inter atomic forces and types of Bond in a crystal, properties and characteristics of -Ionic bond, covalent bond, Metallic bond, Molecular bond and Hydrogen bond. **2hrs**

Thermal properties of solids : Dulong and Petit's law and its limitations. Einstein's theory of specific heat. Debye's theory of specific heat. **3hrs**

Electrical properties of Metals: Band theory of solids-review, Free electron theory of metals - Classical theory and Quantum Theory. Expression for electrical conductivity-Ohm's law. WeidmanFranz law, Statement of number of the available energy states between E and E+dE. Expression for the Fermi-energy Hall effect and magneto resistance in metals. Expression for Hall coefficient in metals **6hrs**

Dielectric properties: Dielectric materials and its properties, Methods of determining dielectric constant for solids and liquids. **2hrs**

Superconductivity : Elementary ideas and experimental facts. Meissner effect. Magnetic properties of type-I and type-II superconductors, Critical magnetic field. Influence of external agents on superconductivity, Cooper pairs, BCS theory (qualitative), Applications of superconductivity. introduction to high-temperature superconductors. **4hrs**

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X-rays: Brag's law and the Bragg spectrometer. A brief mention of the different types of crystals. Miller indices, structure of NaCl and KCl crystals. Continuous x-ray spectra, Duane and Hunt limit. Characteristic x-ray spectra. Mosley law and its significance. Compton effect- expression for Compton shift **6hrs**

Lasers: General principles. Three level laser-action The He-Ne laser- construction and working, Applications of Laser - Laser Cooling, Material Processing (Lasers in Welding, Drilling, and Cutting), Medicine, Laser-induced Fusion, Laser Soldering, scribing, Laser Heat Treatment, LIDAR **3hrs**

Books for Reference:

1. Hugh D. Young, Roger A Freedman and A. Lewis Ford: University Physics 13th edition
2. Arthur Beiser: Concepts of modern physics, 6th edition, TMH, New Delhi.2008.
3. J.B. Blackmore: Introduction to solid state physics 2nd Edition reprint, Press Syndicate of the University of the Cambridge, , United Kingdom, 1998
4. M A Wahab , solid state physics 2nd Edition , Narosa Publishing House, New delhi.2009.
5. A. J. Dekkar : Solid State physics , MACMILLAN & CO LTD , Reprint, 1967
6. MN Avadhanulu, An Introductions to LASERS-Theory & Applications, S Chand & Co, (2001)
7. A.K. Saxwna, Atomic and Molecular Spectra and Lasers, 1st Edition, CBS Publishers and Distributors 2009
8. B B Laud, Lasers and Non-linear optics,2nd Edition , New age International, New Delhi.2004
9. B S Saxsena, R C Guptha and P N Saxsena, Fundamentals of Solid State Physics, 17th edition, Pragathi prakashana,Meerut 2000

.

10. K R Nambiar, Lasers principles,Types and Applications, New age International, New Delhi.2010.

11. G D Baruah, Essentials of lasers and Non Linear Optics, 1st Edition Pragathi Prakashan, Meerut.2000.

FIFTH SEMESTER BSc Physics
ELECTIVE PAPER 1 : Paper 6.1
Paper code :
Title of paper : NUCLEAR AND CONDENSED MATTER PHYSICS
(Course duration : 14 weeks with three hours of instructions per week)
PART -A

X-rays: Brag's law and the Bragg spectrometer. A brief mention of the different types of crystals. Miller indices, structure of NaCl and KCl crystals. Continuous x-ray specta, Duane and Hunt limit. Characteristic x-ray spectra. Mosley law and its significance. Compton effect- expression for Compton shift **7hrs**

Electrical properties: Quantum free electron theory of metals , Hall effect and magneto resistance. Expression for Hall coefficient.(metals and semiconductors). **3hrs**

Dielectric properties: Dielectric materials and its properties, Methods of determining dielectric constant for solids and liquids. **2hrs**

Specific heat of solids : Dulong and Petit's law and its limitations. Einstein's theory of specific heat. Debye's theory of specific heat **3hrs**
.

Superconductivity : Elementary ideas and experimental facts. Meissner effect. Critical magnetic field. Applications of superconductivity. A qualitative account of high temperature superconductors. BCS theory (qualitative) 4hrs

Liquid Crystals: Symmetry structure and classification of liquid crystals, polymorphism in thermotrophics, recent phenomena in liquid crystals. **2hrs**

PART -B

Mass spectrographs : Theory of Dempster's and Astons mass spectrograph **3hrs**

Nuclear Models: Liquid-drop model. Semi-empirical mass formula. Shell model and magic numbers **3hrs**

MODIFIED PAPERS FOR 5th SEMESTER
BSc PHYSICS
Paper 7.1 - ELECTIVE PAPER - I
Paper code:
Title of paper : SOLID STATE AND SEMICONDUCTOR PHYSICS
(Course duration : 14 weeks with TWO hours of instructions per week)

Liquid Crystals: Symmetry structure and classification of liquid crystals, polymorphism in thermotrophics, recent phenomena in liquid crystals. **3hrs**

Dielectric properties of solids : Electronic polarisability-classical theory, ionic polarizability, Dipolar polarisability, Total polarisability- frequency dependence Complex dielectric constant and dielectric losses, relaxation time, Classical theory of electronic and ionic polarization, optical absorption. **4hrs**

Magnetic properties of solids: Origin of magnetism, Response of a substance to magnetic field. Classification of magnetic materials. Dia magnetism: Classical and quantum theory of atomic dia magnetism, Para magnetism: quantum theory of Para magnetism, Ferro magnetism: Curie-Weiss law, Piezo electricity. **4hrs**

Defects and Diffusion in solids: Defects; Point defect (Schottky & Frenkel), Line defect/dislocations (Berger vector), Surface defects, Volume defects, colour centers-Types, Generation, Diffusion in solids, Classification of diffusion process, Mechanism of atomic diffusion, Ficks law, Factor affecting diffusion and applications, Kirkendal law **5hrs**

Semiconductors : Concept of bands in solids, intrinsic and extrinsic semi-conductor. depletion region, drift velocity, expression for electron and hole concentration in intrinsic semiconductor under thermal equilibrium, Derivation of the expression for electrical conductivity of intrinsic semiconductors, electron & hole mobilities, effective mass , Expression for the energy-gap, Variation of conductivity with temperature Fermi level,Expression for Fermi level in Extrinsic semiconductors- both P and N type. Expres-

Accelerators : , Betatron, Proton synchrotron , Electron Synchrotron. **3hrs**

Nuclear reactions: Q-values. Threshold energy of an endoergic reaction. Reactions induced by proton, deutron and α-particles. **2hrs**

Nuclear Fission & **Fusion :** Estimation of the fission energy on the basis of the liquid-drop model. . The four-factor formula. Nuclear reactors - Pressurized Heavy water reactor. Thermonuclear reactions-sources of stellar energy. The C-N cycle , Electric and magnetic confinement of plasma- Tokamak **5hrs**

Cosmic Rays : Discovery, Primary and secondary cosmic rays- their composition. Cosmic ray showers. Origin of cosmic rays **2hrs**

Elementary particles : Particles and antiparticles. Classification of particles. Mention of the basic interactions in nature and conservation laws. A qualitative introduction to quarks (quark model), Big bang theory - qualitative **3hrs**

Books for reference :

1. J.B. Blackmore: Introduction to solid state physics
2. Kaplan Irving : Nuclear Physics
3. A. J. Dekkar : Solid Sate physics
4. Arthur Beiser : Perspectives of Modern Physics
5. B.L. Cohen : Concepts of Physics .
6. Arthur Beiser : Concepts of Modern Physics ,6th edition ,Tata Mcgraw Hill, New Delhi.
7. K.S. Kranes : Modern Physics.

sion for Intrinsic carrier concentration, Diffusion current and total current, Life time of charge carriers- expression for rate of change of excess carrier concentration, Variation of Fermi level with temperature and impurity concentration.the continuity equation for charge carriers, Hall effect in semiconductors. **10hrs**

Semiconductor devices : Phenomena of Photo conductivity expression for Photo emf of P-N junction, Photo voltaic cells, LED and FET **2hrs**

Books for Reference:

1. R K Puri and V K Babbar, Solid State Physics and Electronics, S Chand & Co, New Delhi 1997.
2. B S Saxsena, R C Guptha and P N Saxsena, Fundamentals of Solid State Physics, 17th edition, P Prakashana, Meerut 2000
3. M A Wahab , solid state physics 2nd Edition , Narosa Publisjhing House, New delhi.2009.
4. M A Waheb, Narosa : Solid State Physics: Structure and properties of material - Publishing House, 3rd edition, 2015.
5. C. Kittel, Introduction to Solid State Physics, Wiley Eastern Limited New Delhi 2013.
6. M Ali Omar Elementary Solid State Physics: Principles and Applications, PEARSON, 2006
7. Charles Kittel : Introduction to Solid state Physics -, WILEY, 8th edition, Reprint 2015.
8. A K Saxena, Narosa: Principles of Modern Physics , Publishing house Pvt. Ltd., 4th edition, 2014.
9. S O Pillai : Solid State Physics, New Age Techno Press, 7th edition Reprint 2014.

FIFTH SEMESTER BSc Physics
ELECTIVE PAPER 2 : Paper 6.2
Paper code :
Title of paper : RENEWABLE ENERGY PHYSICS
(Course duration : 14 weeks with three hours of instructions per week)
PART -A

Sources of Renewable Energy: Solar, wind, Biomass availability, merits and demerits. Hydrogen as a source. **3hrs**

Energy storage : Sensible heat storage liquids and solids, latent heat storage, thermo chemical storage, storage through charged batteries. **4hrs**

SOLAR Energy & **its utilization:** Origin of Solar Energy, Spectral distribution of Solar radiation, Attenuation of beam radiation, Basic earth solar angle and derived solar angle, GMT, LCT, LST, Day length, Estimation of average solar radiation, sunshine recorder Principle of conversion of solar energy into heat, classification of solar collectors, Flat plate and concentrating collectors, construction, Thermal efficiency and coating, Heat losses, Solar cell and its efficiency , P.V. Panels, **14hrs**

PART -B

Photo thermal Devices: Solar cooker, Solar dryer, solar hot water systems- Principles and Working. **3hrs**

Photovoltaic Systems: Solar lantern, Water Pumps and Street lights- Principles and Working. **3hrs**

Wind Energy: Estimation of energy obtainable from wind, Velocity and power duration curves, energy pattern factors, Theory of power-Momentum transfer, power coefficients , Principle of Wind turbine, Types of wind driven Machine-Horizontal and vertical axis types. **10hrs**

Ocean energy : Energy from Sea waves, Ocean Thermal energy- temperature gradient in sea and their use for power generation **5hrs**

MODIFIED PAPERS FOR 5th SEMESTER
BSc PHYSICS
Paper 7.2 - ELECTIVE PAPER-II
Paper code:
Title of paper : RENEWABLE ENERGY PHYSICS
(Course duration : 14 weeks with TWO hours of instructions per week)

Solar Energy & **its utilization:** Origin of Solar Energy, Spectral distribution of Solar radiation, Attenuation of beam radiation, Basic earth solar angle and derived solar angle, GMT, LCT, LST, Day length, Estimation of average solar radiation, sunshine recorder Principle of conversion of solar energy into heat, classification of solar collectors, Flat plate and concentrating collectors, construction, Thermal efficiency and coating, Heat losses, Solar cell and its efficiency , P.V. Panels, Photo thermal Devices: Solar cooker, Solar dryer, solar hot water systems- Principles and Working.

Photovoltaic Systems: Solar lantern, Water Pumps and Street lights- Principles and Working

18hrs

Wind Energy: Estimation of energy obtainable from wind, Velocity and power duration curves, energy pattern factors, Theory of power-Momentum transfer, power coefficients , Principle of Wind turbine, Types of wind driven Machine-Horizontal and vertical axis types. **10hrs**

Books for Reference:

1. J.T. MacMillan, R. Morgan & R.B.Murray : Enregy Resources, 2nd edition, 2002.
2. S.P.Sukhatme: Solar Energy Principles &Thermal Collection & Storage, 2nd edition,Tata McGraw Hill ,New Delhi 2010.
3. G.D.Rai: Solar Energy Utilization , 5th edition, Khanna Publishers, New Delhi 2012.
4. G.D.Rai: Non-Conventional Energy sources, 4th edition, New Delhi 2010.
5. E.W.Golding: The Generation of Electricity(by wind) Prentice hall, NewYork 2007

References:

1. J.T. MacMillan, R. Morgan & R.B.Murray: Enregy Resources, 2nd edition
2. S.P.Sukhatme: Solar Energy Principles & Thermal Collection & Storage, 2nd edition,Tata McGraw Hill ,New Delhi.
3. G.D.Rai: Solar Energy Utilization , 5th edition, Khanna Publishers, New Delhi.
4. G.D.Rai: Non-Conventional Energy sources, 4th edition, New Delhi.
5. Green: Solar Cells.
6. E.W.Golding: The Generation of Electricity(by wind)
7. L L Freris : Wind energy conversion systems, Prentice hall, NewYork.
6. L L Freris : Wind energy conversion systems, Prentice hall, NewYork 2007.
7. S Rao and B B Prarulekar , Energy Technology-Non conventional, Renewable & Conventional,3rd Edition, Khanna Publishers NewDelhi.2009.

FIFTH SEMESTER BSc Physics
ELECTIVE PAPER 3 : Paper 6.3 : :Paper code :
*Title of paper : COMPUTATIONAL PHYSICS AND PROGRAMMING IN C
(Course duration : 14 weeks with three hours of instructions per week)
PART -A

Introduction Computer Algorithms, Definition and properties of Algorithms, writing pseudocodes, logical modules and algorithm development, flow charts, need for structured programming. **2hrs**

C Programming Variable names, data types and their declarations, operators - Arithmetic, logical, relational. conditional and assignment. **3hrs**

Library functions: Input / Output statements getchar, putchar, formatted output, file loading, errors handling. **4hrs**

Control Statements: if else, for, do, while loops, nested loops, break, switch, continue, go to, switch. **7hrs** .

Functions & **program structure:** Definition, Accessing ,passing arguments ,recursion ,scope rules external, static and Register variables ,Block structure. **5hrs**

PART -B

Introduction to Arrays & introduction to pointers
5Hrs Graphics Graphic commands and exercises to plot standard graphs and x y
plots 3 Hrs Numerical Methods and their applications in Physics

Iterative methods for finding roots of equation : Bisection method and Newton Rapson method. 4Hrs

Least square curve fitting straight line fitting and non-linear curve fitting 2Hrs

MODIFIED PAPERS FOR 5th SEMESTER
BSc PHYSICS
Paper.7.3 - ELECTIVE PAPER- III
Paper code:
Title of paper: MOLECULAR PHYSICS
(Course duration : 14 weeks with TWO hours of instructions per week)

MOLECULES: Potential between a pair of atoms, lennard jones potential .Molecular bond-Electron sharing in covalent bond-examples of H2+ molecular ion, hydrogen molecule, ionic bond , metallic bond, vanderwaal bonding with examples, Hydrgen bond, Brief mention of theories of Bonding Molecular orbitals. **8hrs**

Raman spectroscopy: Quantum theory of Raman effect, Structural determination from Raman and IR spectroscopy ,Laser Raman effect, Basic principles of Fourier spectroscopy **4hrs**

Spectroscopic techniques: Characterization of molecular spectra and elements of practical spectroscopy. Microwave spectrometer and its applications. IR spectroscopy-its applications , Photoelectron Spectroscopy - elementary ideas, X ray Photoelectron Spectroscopy - elementary ideas **8hrs**

NMR spectra: Principle of NMR , NMR spectrometer, chemical shift and coupling constant.-applications, Magnetic resonance imaging. **4hrs**

Molecular biophysics: Forces responsible for molecular conformation, Eg; Hydrogen bonds, The structure of water and ionic hydration, Interaction of water with Macromolecules, Molecular structure and mechanical properties of Biological membranes, Viscosity of biological fluids , viscoelastici ty of Biomaterials. **4hrs**

Books for Reference:

1. M A Wahab, solid state physics 2nd Edition, Narosa Publishing House, New delhi.2009.
2. White H. E., Introduction to Atomic Spectra, McGraw Hill (1934).

Numerical integration Trapezoidal rule Simpsons 1/3rd rule and Gaussian integration 2 Hrs

Applications : Writing programs to find solutions for simple problems in Physics 5Hrs.

References:

1. S S Sastry :Introductory methods of numerical analysis. 3Rd edition, Prentice hall of India ltd , NewDelhi
2. V Rajaraman :Computer programming in C , Prentice hall of India ltd , NewDelhi
3. V Rajaraman , Computer oriented Numerical Methods.
4. Yeshwanth Kanitkar : Let us C
5. Kerenininghamand Ritchie : C programming Language.
6. Schaum series: programming with C.

Note : * Computer science students are not eligible to opt this paper.

3. Banwell C. N. and McCash E. M., Fundamentals of molecular spectroscopy, Tata McGraw Hill (1994).
4. J Michel Hollas , Modern Spectroscopy, 4th Edition, John Wiley and Sons ,NJ, USA
5. Dinesh Sharma, A Hand Book of Spectroscopy,1st Edition, International Scientific Publishing academy ,Newdelhi.2005.
6. Andrew J Dingley &Steven M Pascal (Eds), Bio-molecular NMR Spectroscopy, IOS press Inc, 2011.
7. V Pattabhi and N Goutham: BioPhysics, Narosa Publishing House, New Delhi.2002.
8. Roland Glaser, Biophysics - An Introduction, 2nd Edition, Springer , NewYork.2011

FIFTH SEMESTER BSc Physics
ELECTIVE PAPER 4 : Paper 6.4 : :Paper code
Title of paper : Atmospheric Physics
(Course duration : 14 weeks with three hours of instructions per week)
Part-A

A Global view of the atmosphere; Introduction to the Atmosphere: descriptions of atmospheric behavior-Eulerian and Lagrangian descriptions-Advantage of Lagrangian description. Important mechanisms influencing the earth's atmospheric behavior: (i) Gravity and (ii) Earth's rotation. **2hrs**

Composition and Structure: Important constituents of the atmosphere. Description of air-Equation of state for a pure gas- partial pressure and partial volume-Dalton's law for the pressure and volume of a mixture of gases. Equation of state for a mixture of gases. Mass and volume mixing ratios and their importance. **2hrs**

Stratification of mass-Hydrostatic balance-Scale height: Distinction of the atmospheric region below 100 km from the region above 100 km altitude-meaning of the terms homosphere, turbopause, heterosphere and exosphere. Escape velocity of gas molecules-Boltzmann distribution of a molecular ensemble as a function of molecular velocity-Most probable velocity. **2hrs**

Discussion of the thermal height structure of the atmosphere. Explanation of the terms tropopause, troposphere, stratopause, stratosphere, mesopause, mesosphere, and thermosphere, and a brief discussion of the causes for the formation of these regions in the atmosphere. Trace Constituents: Brief discussion of the height distributions of CO2, H2O, O3, CH4, CFCs, nitrogen compounds and aerosol in the atmosphere. **2hrs**

Radiative equilibrium : Shortwave (SW) and longwave (LW) radiation-Equation for a simple estimation of planet's temperature. Difference between planet's temperature and global mean temperatures. Brief discussion about the green

MODIFIED PAPERS FOR 5th SEMESTER
BSc PHYSICS
Paper 7.4 - ELECTIVE PAPER-IV
Paper code:
Title of paper : ATMOSPHERIC PHYSICS
(Course duration : 14 weeks with TWO hours of instructions per week)

A Global view of the atmosphere ; Introduction to the Atmosphere: descriptions of atmospheric behavior-Eulerian and Lagrangian descriptions-Advantage of Lagrangian description. Important mechanisms influencing the earth's atmospheric behavior: (i) Gravity and (ii) Earth's rotation. **3hrs**

Composition and Structure: Important constituents of the atmosphere. Description of air-Equation of state for a pure gas- partial pressure and partial volume-Dalton's law for the pressure and volume of a mixture of gases. Equation of state for a mixture of gases. Mass and volume mixing ratios and their importance.

3hrs

Discussion of the thermal height structure of the atmosphere: Explanation of the terms tropopause, troposphere, stratopause, stratosphere, mesopause, mesosphere, and thermosphere, and a brief discussion of the causes for the formation of these regions in the atmosphere. Trace Constituents: Brief discussion of the height distributions of CO2, H2O, O3, CH4, CFCs, nitrogen compounds and aerosol in the atmosphere.

5hrs

Atmospheric Radiation : subsubsection*Shortwave and Longwave radiation: Blackbody radiation spectra for Sun and earth temperatures. Description of the absorption spectra of the atmosphere at the top (10 km) and at ground level. **3hrs**

Absorption, Emission: and Scattering: of radiation :Absorption - Mathematical discussion of Lambert's law. Emission: Statement of Planck's law, Wien's displacement law, Stefan-Boltzmann law and Kirchoff's law. Scattering: Meaning

house effect, global energy budget, global energy balance and general circulation of the atmosphere. **3hrs**

Thermodynamics of Gases Thermodynamic concepts: - Importance of thermodynamics in the study of atmospheres. Open and Closed systems-control surface. Intensive and extensive properties with examples. Heat transfer in the atmosphere- adiabatic and diabatic surfaces. State variables and thermodynamic process: State variables-Equation of state-Thermodynamic degree of freedom-Mechanical, Thermal and Thermodynamic equilibria-Thermodynamic process. **2hrs**

Specific heats of a gas: Specific heats of a gasat constant pressure and constant volume (cp and cV). Defnition for cp and cV in the differential form. Importance of these two parameters in the atmospheric studies. Statement of Poisson's equations for the adiabatic path of an ideal gas. Potential temperature and its importance in the atmospheric studies. Thermodynamic behavior accompanying vertical motion of air. Meaning of polytropic process. **2hrs**

Second law of thermodynamics & **its implications:** Statement of the second law of thermodynamics. Second law in terms of entropy-Statement of Carnot's theorem. Restricted forms of the second law. Derivation of Maxwell's thermodynamic relations. Conditions for thermodynamic equilibrium. Relation between entropy and potential temperature. Implications of the second law on the vertical motion of the atmosphere. **4hrs** Atmospheric Physics continued

PART-B

Atmospheric Radiation : subsubsection*Shortwave and Longwave radiation: Blackbody radiation spectra for Sun and earth temperatures. Description of the absorption spectra of the atmosphere at the top (10 km) and at ground level. **2hrs**

Absorption: Mathematical discussion of Lambert's law. Emission: Statement of Planck's law, Wien's displacement law, Stefan-Boltzmann law of scattering, scattering cross section, extinction cross section, multiple scattering and phase function. **2hrs**

Radiation transfer: Discussion about the equations for (i) variation of intensity with distance (ii) radiative transfer (iii) Optical thickness (no derivation). Schwartzchild equation and general equation for the monochromatic intensity at a point of observation in the atmosphere (no derivation). **3hrs**

Absorption characteristics of gases: Interaction of radiation with the molecules (detailed qualitative discussion to be made). The concept of broadening of spectral lines: natural broadening, Lorentz line shape, collision (or pressure) broadening and Doppler broadening. **3hrs**

Aerosol and clouds : Morphology of atmospheric aerosols: a brief discussion of the continental and marine aerosols. Aerosol size distribution-Aitkin nuclei. Mechanisms of secondary aerosol formation: (i) gas-to- particle conversion (ii) condensation of combustion particles and (iii) emission from liquid and solid particles. Microphysics of clouds: droplet growth by condensation-expression for the Gibb's free energy in the formation of a spherical droplet-Kelvin's formula-curvature effect-heterogeneous nucleation-cloud condensation nuclei (CCN)-concept of critical supersaturation. Kohler curve and its implication on the growth through condensation-expression for the radius of a growing drop as a function of time. Qualitative discussion of droplet growth by collision and growth of ice particles. **6hrs**

Books for Reference:

1. M.L. Salby ,Fundamentals of Atmospheric Physics, Academic Press, London (1996
2. Wallace, J. and P. Hobbs, Atmospheric Science: An Introductory Survey, Academic Press, San Diego (1977).
3. Landau, X., Y. Lifshitz, and Z. Pitaevskii : Statistical Physics, Pergamon Press, New York,3rd ed., Part 1,(1980).

and Kirchoff's law. Scattering: Meaning of scattering, scattering cross section, extinction cross section, multiple scattering and phase function. **2hrs**

Radiation transfer: Discussion about the equations for (i) variation of intensity with distance (ii) radiative transfer (iii) Optical thickness (no derivation). Schwartzchild equation and general equation for the monochromatic intensity at a point of observation in the atmosphere (no derivation). **2hrs**

Absorption characteristics of gases: Interaction of radiation with the molecules (detailed qualitative discussion to be made). The concept of broadening of spectral lines: natural broadening, Lorentz line shape, collision (or pressure) broadening and Doppler broadening. **2hrs**.

Radiation transfer in a plane parallel atmosphere: Qualitative discussion of the thermal equilibrium and radiative-convective equilibrium. Radiative heating, thermal relaxation and green house effect (qualitative treatment only). **3hrs**

Aerosol and clouds: Morphology of atmospheric aerosols: a brief discussion of the continental and marine aerosols.Aerosol size distribution-Aitkin nuclei. Mechanisms of secondary aerosol formation: (i) gas-to- particle conversion (ii) condensation of combustion particles and (iii) emission from liquid and solid particles.

Microphysics of clouds: droplet growth by condensation-expression for the Gibb's free energy in the formation of a spherical droplet-Kelvin's formula-curvature effect-heterogeneous nucleation-cloud condensation nuclei (CCN)-concept of critical supersaturation. Kohler curve and its implication on the growth through condensation-expression for the radius of a growing drop as a function of time. Qualitative discussion of droplet growth by collision and growth of ice particles. **6hrs**

Forms and classiffication of clouds: Stratiform, cumuliform and cirriform of clouds, microphys- ical properties of clouds, and cloud dissipation(qualitative discussion only).Role of

4. K. Liou, Radiation and Cloud Processes in the Atmosphere, Oxford University Press, New York (1990).
5. Liou Liou, K , An Introduction to Atmospheric Radiation, Academic Press, San Diego,(1980).
6. Denbigh, K., The Principles of Chemical Equilibrium, Cambridge University Press, London, (1971).

clouds and aerosols in climate: involvement in energy budget and involvement in chem- ical processes. **4hrs**

.

ELECTIVE PAPER- V

NIL

MODIFIED PAPERS FOR 5th SEMESTER
BSc PHYSICS
Paper 7.5 - ELECTIVE PAPER- V
Paper code:

Title of paper : LASERS AND FIBRE OPTICS

(Course duration : 14 weeks with TWO hours of instructions per week)

Laser Basics: Coherence Properties of Laser Light, Temporal Coherence, Monochromaticity, Spatial Coherence, Directionality, Linewidth, Brightness, Divergence, line shape broadening , Focusing Properties of Laser Radiation, laser modes-axial and Transverse, mode selection, single mode operation, Selection of Laser emission line. **4hrs**

Laser Oscillator: Pumping Schemes, Gain-threshold conditions, Optical feedback, Optical resonatar **4hrs**

Types of Lasers: Nd YAG, CO2 and Dye lasers, Semiconductor Laser construction and principles of working. **3hrs**

Laser Diodes: Lasing conditions and Gain in a semiconductor, selective amplification and coherence, Materials for laser diodes, quantum well lasers, surface emitting lasers, characterization and modulation of lasers **5hrs**

Fiber Optics and Dielectric wave guides: Wave Guide: Slab wave guide , Modes ,V number, Modal , material and waveguide dispersions.**4hrs**

Optical Fiber: Types, Optical fiber functions. Light propagation, Optical power, Velocity of Propagation, critical angle, acceptance angle, numerical aperture, mode of propagation. **2hrs**

Index profile: Single mode step-index optical fiber, multimode step- index fiber, graded index fibers advantages and disadvantages, **3hrs**

Energy losses in optical fiber: Bit rate, dispersion and optical bandwidth, Absorption and scattering, Block diagram of optical fiber communication. Construction of Optical cables. Optocoupler. **3hrs**

.

Books for Reference:

1. MN Avadhanulu, An Introductions to LASERS-Theory & Applications, S Chand & Co, (2001)
2. Thyagarajan K. and Ghatak A K, Lasers Theory and Applications, Macmillan India Limited, (1995)
3. A. K. Saxena: Atomic and Molecular Spectra and Lasers, 1st edition, CBS Publishers and Distributors, 2009.
4. B B Laud, Lasers and Non-linear optics,2nd Edition , New age International, New Delhi.2004
5. Ajoy Ghatak & K Thyagarajan, Introduction to Fibre Optics, Cambridge University Press, First Edition Reprint,2002
6. Gerd Keiser, Optical Fibre Communications, , McGraw Hill, 3rd Edition, 2000
7. DCAgarwal, Fibre Optic Communication, Wheeler Publications, Second Edition Reprint, 1996.
8. Sapna katiyar ,Optical Communication , I edition S K Kataria and Sons, New Delhi, 2010.
9. S O kasap, optoelectronics and photonics principles and practices, Prentice Hall, 2001.
10. Wilson J and Hawkes J F B, Optoelectronics, an introduction, Prentice hall of India private limited.(1993)
11. K R Nambiar, Lasers principles,Types and Applications, New age International, New Delhi.2010.

FIFTH SEMESTER BSc Physics PRACTICAL
(Course duration :14 weeks with 4 Hours of lab-work per week.)
PRACTICAL 5 (COMPULSORY PAPER EXPERIMENTS) Paper code:
Any **eight** of the following experiments.

1. Ionization potential of xenon..
2. The e/m of an electron using a bar magnet.
3. Rough Estimation of mass of an electron.
4. Determination of wavelength of laser light.
5. Verification of inverse square law for gamma-rays.
6. Absorption coefficient of gamma-rays
7. Cockroft-Walton Voltage multiplier.
8. .Determination of Planck constant using a photo cell.
9. Characteristics of a GM-tube
10. Study of Spectra of Hydrogen Using Gas Discharge tube Determination of Rydberg Constant

MODIFIED FIFTH SEMESTER BSc Physics PRACTICAL
(Course duration :14 weeks with 03 Hours of lab-work per week.)
PRACTICAL - 5 (COMPULSORY PAPER EXPERIMENTS)
Paper code:
Any **eight** of the following experiments.

1. Ionization potential of xenon.
2. The e/m of an electron using a bar magnet.
3. Estimation of mass of an electron.
4. Determination of Planck constant using a photo cell/ Solar cell.
5. Basic logic gates.
6. Hartley Oscillator
7. Cockroft-Walton Voltage multiplier.
8. Transistor characteristics -CB mode
9. Verification of Thevinin's theorem.
10. Study of Spectra of Hydrogen Spectra using Gas Discharge tube Determination of Rydberg Constant.
11. The e/m of an electron by helical coil method or Helmholtz coil method.

PRACTICAL-6 (COMBINATION OF COMPULSORY AND ELECTIVE PAPERS)
Paper code:Any seven of the following experiments
(Four expt from compulsory part and Three from elective Part)
Compulsory part

1. Triode Characteristics
2. Phase measurement in LCR circuit using CRO.
3. Verification Maximum power transfer theorem.
4. Conversion of a moving coil galvanometer into ammeter.
5. The logic gates- AND, OR, NOT and NAND using IC 7400

Elective part
Elective -1 (NUCLEAR AND CONDENSED MATTER PHYSICS)

1. Half-life of K 40.
2. Determination of Dielectric constant of liquid
3. Study of X-ray photograph determination of interplanar distance
4. Study of Hall effect
5. Determination of range of electron in Al using GM counter.
6. Study of solar cell-I V Characteristics , F F & efficiency

Elective -2 (: RENEWABLE ENERGY PHYSICS)

1. Spectral response of a solar cell
2. Study of effect of intensity variation on efficiency of solar cell
3. Wind data analysis, velocity and power duration curves
4. Study of box type solar cooker
5. Study of solar dryer.(loss of moisture and drying efficiency)

MODIFIED FIFTH SEMESTER BSc Physics PRACTICALS
PRACTICAL -6 (COMBINATION OF COMPULSORY AND ELECTIVE PAPERS)
Paper code:
(03 Hours of Lab- Work per week)
Any **seven** of the following experiments and **project work**
Compulsory part (Any **FOUR** experiments)

1. Determination of wavelength of Laser light
2. RC coupled amplifier Two stage
3. Bridge rectifier with C and Pi filter
4. Zener diode: To study the Characteristics and To study as a Voltage regulator.
5. Energy gap of a semiconductor.

Elective part (Any **Three** Experiments)
Elective -1 SOLID STATE AND SEMICONDUCTOR PHYSICS

1. Study of Hall effect in semiconductors
2. FET Study of characteristics
3. Study of variation of resistivity using Four probe.
4. Study of Photocondutivity

Elective -2 RENEWABLE ENERGY PHYSICS

1. Spectral response of a solar cell
2. Study of effect of intensity variation on efficiency of solar cell
3. Wind data analysis, velocity and power duration curves
4. Study of box type solar cooker
5. Study of solar dryer.(loss of moisture and drying efficiency)

Elective -3 MOLECULAR PHYSICS

1. To measure the viscosity of a biomaterial (gelatin) at various concentrations of gelation.
2. Protein molecular weight determination using electrophoresis

Elective -3 (COMPUTATIONAL PHYSICS AND PROGRAMMING IN C)

1. Programming Excercises -Matrix multiplication
2. Programming Excercises to calculate Standard deviation, Transpose of a matrix
3. Programming Excercises-To write a program for least square fitting a function for given data points.
4. Programming Excercises To write a function sub program to calculate Sin X or Cos X using series expansion.
5. Programming Excercises -
6. To find the roots of polynomial using Newton Raphson method.
7. To integrate a given function using trapezoidal and Simpsons rule.

Project work equivalent to two experiments is compulsory. A report must be submitted for internal evaluation IA marks(Max10). The wok must emphasize significant ideas & concepts and should address the questions why it is important, where it is applied, what are its key features & limitations. A list of Suggestive ideas for project work is appended at the end.

3. Characterization of given molecular spectra.
4. Spectroscopic investigation of the sample material. using UV/ visible /IR spectroscopy. (The thermodynamic properties such as zero-point vibrational energy, thermal energy, specific heat capacity, rotational constants, entropy, and dipole moment of the studied compound to be calculated.)

Elective -4 ATMOSPHERIC PHYSICS

1. γ by Clement and Desorme's method.
2. Verification of Stefan's law of radiation.
3. Fraunhofer lines of solar spectrum.
4. Study of solar emission spectrum.
5. Determination of wavelength of spectral lines using comparator.
6. .Study of the photoelectric effect

Elective -5 LASERS AND FIBRE OPTICS

1. Characteristics of Diode Laser Measurement of output power, L I curves
2. Study of Divergence of Diode laser
3. To Study the Gaussian Beam parameters
4. To Study the operation of an Optocoupler
5. Measurement of Numerical aperture of Optical fibre
6. To study the various losses / attenuation in an optical fibre
7. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid state laser

Project work: Project work is compulsory. A report must be submitted for internal evaluation IA marks. The wok must emphasize significant ideas &concepts and should address the questions why it is important, where it is applied, what are its key features &limitations. A list of Suggestive ideas for project work is appended at the end.

SIXTH SEMESTER BSc Physics
COMPULSORY PAPER : Paper 7
paper code
Title of paper : RELATIVITY ,SOLID STATE AND ELECTRONICS
(Course duration : 14 weeks with three hours of instructions per week)
PART -A

Special theory of Relativity: The Michelson-Morley experiment. Basic postulates of theory of relativity. Lorentz transformation (no derivation). The Lorentz-Fitzgerald contraction. Time dilation, Velocity addition Theorem, The relativity of simultaneity. Einsteins Mass variation formula and the energy equation E= mc2. The energy-momentum relation. The principle of equivalence. **10hrs**

Statistical ideas in physics : The Maxwell-Boltzmann. Bose-Einstein and Fermi-Dirac energy distribution formulae (no derivation). A qualitative comparison of the three distribution formulae **2hrs**

Free electron theory of metals : Classical theory. Expression for electrical conductivity-Ohm's law. Weidman Franz law, Statement of number of the available energy states between E and E+dE. Expression for the Fermi-energy. **4hrs** .

Band theory of solids: Concept of bands in solids ,intrinsic and extrinsic semi-conductor. Derivation of the expression for electrical conductivity , Derivation of expression for carrier concentration and electrical conductivity of intrinsic semiconductors , Expression for the energy-gap. hfill**5hrs**

PART B

Semiconductor Devices : P-N Junction diode. Bridge rectifier. Expression for Ripple factor and efficiency. Filters. Zener diode and its use as a voltage regulator, LED-characteristics, Photo diode. **5hrs**

MODIFIED PAPERS FOR 6th SEMESTER
BSc PHYSICS
Paper 8 - COMPULSORY PAPER I
Paper code:
Title of paper: RELATIVITY AND QUANTUM MECHANICS
(Course duration : 14 weeks with TWO hours of instructions per week)

Special theory of Relativity: Laws of Newtonian Mechanics and Galilean principle of relativity. The notion of absolute frame and the concept of ether. The Michelson-Morley experiment as a search for the absolute frame. Basic postulates of theory of relativity. The relativity of simultaneity, Derivation of Lorentz transformation. The Lorentz-Fitzgerald contraction. Time dilation, Velocity addition Theorem, Einstein's Mass variation formula and the energy equation $E=mc^2$. The energy-momentum relation. Conservation laws and relativistic kinematics. **13hrs**

General theory of relativity: Accelerated frames, Falling lift, Inertial and gravitational mass. The principle of equivalence. Mention of famous tests of General theory. **3hrs**

Wave mechanics: Failure of classical mechanics in the microscopic domain. Black body radiation, Hydrogen atom, Specific heats of solids, Fine structure of spectral lines, Particle and wave nature in classical mechanics. Young's double slit experiment with bullets, light and electrons. de Broglie's concept of matter waves. Phase and group velocity, Experiments of Thomson and of Davisson and Germer. Heisenberg's uncertainty principle the gamma ray microscope thought experiment. Setting up the time-independent and time dependent Schroedinger equation. The notion of probability and Born's interpretation of the wave function. Solution of the time-independent Schroedinger equation for particle in one-dimensional infinite potential and its energy eigenvalues. Mention of energy eigenvalues for the one-dimensional simple harmonic oscillator, the zero-point energy. **12hrs**

Transistors : Type and configuration: Transistor action & characteristics for the CE configuration. DC and AC current gain. Operating point. DC load line and self-biasing (potential divider type) in transistors. **4hrs**

Amplifiers: Single stage CE amplifier. Expressions for voltage gain. Current gain, power-gain. Input resistance and output resistance (No derivation) , Mention of CB and CC amplifiers and their special properties in comparison with the CE amplifier. **3hrs**

Oscillators : The feed back concept-positive and negative feed back. Mention the Barkhausen criteria. Types of oscillator - Hartley oscillator. **2hrs**

Logic circuits: Construction of AND, OR gates using diodes & NOT logic gates using Transistor. Symbols and truth table for NOR, NAND and XOR logic gates **2hrs**

Radio communication.: Role of ionosphere in radio-communication. Need for modulation. Amplitude modulation. Modulation index, side bands, band width, and the power of an amplitude-modulated wave. The block diagram description of super heterodyne AM receiver.**5hrs**

References.

1. Resnick : Special theory of relativity
2. A.P French : Special relativity
3. Malvino : Electronic principles , Fifth edition
4. C. Kittel :Introduction to solid state physics
5. A. J. Dekkar : Solid Sate physics
6. J.B. Blackmore : Introduction to solid state physics
7. V.K. Mehta : Electronics

Books for Reference:

1. H. S. Mani and G. K. Mehta, Introduction to Modern Physics, Affiliated East-West Press, 1988.
2. Robert Resnick, Introduction to Special Relativity, Wiley Eastern Limited, New Delhi 1986
3. A. P. French, Special Relativity, W W Norton & Company, New York, 1968
4. David Griffiths, Introduction to Elementary Particles (2nd Edition) John Wiley & Sons, 2008.
5. F. K. Richtmyer, E. H. Kennard and J. N. Cooper, Introduction to Modern Physics, 6th Edition Tata McGraw Hill, 1976.
6. M. R. Wehr, J. A. Richards Jr and T. W. Adair, Physics of the atom, 4th Edition, Narosa Publishing House, (1985).
7. Arthur Beiser, Concepts of Modern Physics, Tata Mcgraw Hill, 2009
8. Robert Martin Eisberg, Fundamentals of modern physics, Wiley, 1961
9. Richard P Feynman, Robert B. Leighton, Matthew Sands, The Feynman Lectures on Physics: Quantum Mechanics (Volume - 3), Pearson India, 2012
10. M. C. Jain: Quantum Mechanics: A textbook for undergraduates, PHI India, 2007
11. V K Thankappan Quantum Mechanics :, New Age International Pvt. Ltd., Reprint 2015.
12. G Aruldas :Quantum Mechanics , Prentice Hall of India, New Delhi, 2nd edition, 2014.

COMPULSORY PAPER - II

NIL

MODIFIED PAPERS FOR 6th SEMESTER
BSc PHYSICS
Paper 9 - COMPULSORY PAPER II
Paper code:
Title of paper: NUCLEAR PHYSICS
(Course duration : 14 weeks with TWO hours of instructions per week)

The Nucleus : Properties of nucleus, Neutron discovery and Properties. The proton-neutron hypothesis. Nuclear forces and their characteristics. Yukawa's theory (qualitative). **2hrs**

Radioactive decay: Successive disintegration, Radioactive equilibrium radioactive series, Range and energy of alpha-particle and their measurement. Theory of alpha-decay(qualitative). Geiger-Nuttal law. Beta Decay - Paulis neutrino hypothesis K-electron capture, Internal conversion, Nuclear isomerism. Mirror nuclei. **4hrs**

Mass spectrographs: Theory of Dempster's and Astons mass spectrograph **2hrs**

Accelerators: Cockroft-Walton voltage multiplier. LINAC, Cyclotron, Betatron **4hrs**

Nuclear Detectors : Bubble chamber. G.M. counter, Principle of semiconductor detector

2hrs

Nuclear Models: Liquid-drop model. Semi-empirical mass formula. Shell model and magic numbers **2hrs**

Nuclear reactions: Q-values. Threshold energy of an endoergic reaction. Reactions induced by proton, deutron and -particles. **2hrs**

Nuclear Fission,Fusion and reactors : Estimation of the fission energy on the basis of the liquid-drop model,Thermo-nuclear reactions-sources of stellar energy. The C-N cycle , Electric and magnetic confinement of plasma- Tokamak , Nuclear reactors-types , The four-factor formula, Pressurized Heavy water reactor. **5hrs**

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Particle Physics and Cosmic Rays: Mention of the basic interactions in nature ,Particles and anti-particles. Types of interaction between elementary particles, Classification of particles. conservation laws. A qualitative introduction to quarks (quark model),standard model qualitative, Big bang theory qualitative Cosmic ray Discovery, Primary and secondary cosmic rays- their composition. Cosmic ray showers. Origin of cosmic rays **5hrs**

Books for Reference:

1. A. Beiser: Concepts of modern physics, 6th edition, TMH, New Delhi.2008.
2. Irving Kaplan: Nuclear Physics, 2nd edition, Narosa Publishing House, 1987 (Reprint2002).
3. K. S. Kranes: Introductory Nuclear Physics, Wiley India, 2008.
4. S. N. Ghoshal: Nuclear Physics, 1st edition, S. Chand and Co, 1994(Reprint 2002) .
5. D.C.Tayal : Nuclear Physics, 5th edition, Himalaya Publishing House, 2008
6. Robert Eisberg, Quantum Phyiscs of Atoms molecules , solids nuclei and particles, second edition, 1999
7. A K Saxena, Narosa : Principles of Modern Physics Publishers, 4th edition, 2014
8. H. Semat and I.R. Albright : Introduction to atomic and nuclear physics.
9. K. S. Kranes: Introductory Nuclear Physics , Wiley India, 2008
10. M K PAL , Theory of Nuclear Structure, East-West Press Delhi (1983).
11. Roy and Nigam , Nuclear Physics, New Age international New Delhi 2001.
12. Khanna M.P., Introduction to Particle Physics, Prentice Hall of India Pvt. Ltd (2004).
13. Jearl Walker/David Halliday /Robert Resnick :Principles of Physics , WILEY, 10th edition, Reprint 2015.

SIXTH SEMESTER BSc Physics
ELECTIVE PAPER -1 : Paper 8.1 : paper code
Title of paper : ANALOG AND DIGITAL ELECTRONICS **
(Course duration : 14 weeks with three hours of instructions per week)
PART -A

Network Theorems : Thevenins theorem, Norton's Theorem, application to the analysis of DC circuits **3hrs**

Transistor devices : FET ,UJT working & its characteristics. **2hrs**

Amplifiers: h-parameters. A.C. equivalent circuit of a transistor in terms of the h-parameters. Derivation of the expressions for voltage gain. Current gain, powergain. Input resistance and output resistance for CE mode**3hrs** ,

Operational amplifiers : Basic differential amplifier, Opamp and its characteristics, inverting ,non inverting amplifiers, concept of virtual ground, adder, integrator and differentiator with expressions for output.(derivations). **4hrs**

Oscillators: Phase-shift and Wien-bridge oscillators,Crystal oscillator (qualitative). Expression for frequency and condition for oscillation (no derivation). **3hrs**

Radio and TV Communication: Frequency Modulation, expression for frequency modulated wave for a single sinusoidal modulating signal, Band width of FM, Elements of TV transmission, scanning types, composite video signal and its components, Vidicon camera-working. TV standards. Elements of TV reception-Block diagram(Monochrome). **3hrs**

PART B

Use of Binary number in logic circuits , EX OR gate. **1hrs**

Combinational &**sequential circuits** Half adder ,Full adder, using basic gates & ExOR gates ,RS and JK flip flop(clocked version). **3hrs**

MODIFIED PAPERS FOR 6th SEMESTER
BSc PHYSICS
Paper 10.1 - ELECTIVE PAPER- I
Paper code:
Title of paper: ANALOG AND DIGITAL ELECTRONICS**
(Course duration : 14 weeks with TWO hours of instructions per week)

Transistor devices : FET, UJT working and its characteristics. **2hrs**

Amplifiers: h-parameters A.C. equivalent circuit of a transistor in terms of the h-parameters. Derivation of the expressions for voltage gain. Current gain, power gain. Input resistance and output resistance for CE mode. **3hrs**

Operational amplifiers : Basic differential amplifier, Opamp and its characteristics, inverting, non inverting amplifiers, concept of virtual ground, adder, integrator and differentiator with expressions for output.(derivations). **4hrs**

Oscillators: Phase-shift and Wien-bridge oscillators, derivation of Expression for frequency and condition for oscillation . **3hrs**

Combinational & **sequential circuits:** Half adder ,Full adder, using basic gates & Ex-OR gates, RS and JK flip flop(clocked version).**3hrs**

Analog to Digital Converters: counter comparator ADC, successive approximation type ADC **3hrs**

Digital to Analog Converters: Weighted resistor DAC, Resistor ladder DAC **3hrs**

Memory devices: Volatile and non volatile memory, static and dynamic RAM, magnetic and optical memory. **2hrs**

Radio Communication: Role of ionosphere in radio-communication Need for modulation, Amplitude modulation. Modulation index, side bands, band width and the power of an amplitude-modulated wave. The block diagram description of super heterodyne AM receiver, Frequency Modulation, expression for frequency

IC logic gates TTL and CMOS gates: their characteristics, **3hrs**

Intergrated Circuits Types and Fabrication **4hrs**

Analog to Digital Converters counter comparator ADC, successive approximation type ADC **3hrs**

Digital to Analog Converters Weighted resistor DAC, Resistor ladder DAC **3hrs**

Memory devices; Memory terminologies, Volatile and non volatile memory, static and dynamic RAM, magnetic, optical and ferroelectric memory. **4hrs**

Books for reference

1. Malvino : Electronic principles , Fifth edition
2. Malvino and Leach : Digital principles and applications
3. Gulati RR : Monochrome and Colour Television ,Wiley eastern Ltd, New Delhi.
4. V.K. Mehta : Electronics
5. Bapat YN : Electronic circuits and Systems, TMH , New Delhi.
6. Alan Motttershead :Electronic devices and circuits , Prentice hall of India ltd , New Delhi .
7. R P Jain. : Modern Digital Electronics -
8. S V Subramanyam : Experiments in Electronics .

Note: electronics students are not eligible to opt this papers**

modulated wave for a single sinusoidal modulating signal, Band width of FM. **5hrs**

Books for Reference:

1. Albert P Malvino, Electronic principles , Fifth edition, Tata Mc-Graw Hill,2008.
2. Donal P Leach, Albert Paul Malvino and Goutam Saha: Digital Principles and Applications McGraw Hill Education, 8th edition, 2nd Reprint 2015.
3. B L Theraja, Dr. R S Sedha : Principles of Electronics Devices and Circuits (Analysis and Digital) , S Chand & Co., Revised edition, Reprint 2015
4. Bapat YN: Electronic circuits and Systems, TMH, New Delhi 2012.
5. Alan Motttershead : Electronic devices and circuits , Prentice hall of India ltd , New Delhi 2013
6. R P Jain. : Modern Digital Electronics. McGraw Hill Education, 4th edition, 14th Reprint 2015
7. B.Zbar, A.P.Malvino, M.A.Miller, Basic Electronics: A text lab manual, Mc-Graw Hill. 1994.
8. J.D. Ryder, Electronics: Fundamentals and Applications, Prentice Hall.2004.
9. R. A. Gayakwad, OP-Amps and Linear Integrated Circuit, 4th edition, Prentice Hall ,2000.

Note: electronics students are not eligible to opt this papers**

SIXTH SEMESTER BSc Physics
ELECTIVE PAPER -2 : Paper 8.2 : paper code
Title of paper: PHOTONICS
(Course duration: 14 weeks with three hours of instructions per week)
PART A

Lasers Basic Principles, Properties of Laser light,coherence-spatial & temporal, Divergence, line shape broadening ,cavity laser modes, mode selection, single mode operation, Selection of Laser emission line **2hrs**

Laser Oscillator: Pumping Schemes, Gain-threshold conditions, Optical feedback, Optical resonator. **4hrs**

Types of Lasers: Nd YAG., CO2 and Dye lasers construction and principles of working . **3hrs**

Laser Diodes: Lasing conditions and Gain in a semiconductor, selective amplification and coherence, Materials for laser diodes, quantum well lasers, surface emitting lasers, characterization and modulation of lasers. **5hrs**

Optoelectronics : Introduction: Optoelectronics in the information technology, Optoelectronic devices, Optoelectronic materials - liquid crystals, semiconductors, ceramics, polymers and optical fibers, Fabrication of Optoelectronic devices. **2hrs**

Light Emitting Diodes: The electroluminescence process, Materials for light emitting diodes, LED Structures and efficiency, light output from LED, performance characteristics, manufacturing process. **5hrs**

PART-B

Photo Detectors : Specifications ,Types Junction photodiodes , avalanche photodiodes, CCD Photo detectors, Comparison of different detectors , performance characteristics and Fabrication. **6hrs**
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MODIFIED PAPERS FOR 6th SEMESTER
BSc PHYSICS
Paper 10.2 - ELECTIVE PAPER- II
Paper code:
Title of paper: OPTOELECTRONICS
(Course duration : 14 weeks with TWO hours of instructions per week)

Optical process in semiconductor: Electron hole pair formation and recombination, absorption in semiconductor direct and indirect band gap semiconductors, effect of electric field on absorption, Franz-keldysh effect in semiconductors. **4hrs**

Optoelectronic materials: Basic concepts on interaction of light with solids, optical constants, absorption and emission properties, electroluminescence, photoluminescence **3hrs**

Optoelectronic devices

Light Emitting Diodes: Materials for light emitting diodes, Principle of action of LED-expression for light power in terms of photon energy, homostructured LED & Heterojunction LED, drawbacks of homostructured LED. Types of LED Structures planar, Dome type, Surface emitter, edge emitter, superluminescent structure. performance characteristics of LED- Optical output power-current characteristics, forward current voltage characteristics, Modulation band width, Power band width product, Life time, Rise time/fall time, reliability, Internal quantum efficiency. advantages/ disadvantages of using LED. **7hrs**

Photo Detectors : Important parameters of photodetectors-Detector responsivity, Spectral response range, Response time, quantum efficiency, capacitance, noise characteristics. Absorption of radiation-absorption coefficient, mention of expression for photocurrent, long wavelength cut off, . Direct and indirect absorption. Types of photodiodes Junction photodiodes, pin diode, avalanche photodiodes, Schottky barrier photodiode, CCD Photo detectors, Comparison of different detectors, ,Photomultiplier tubes. Phototransistors-characteristics. photo-

Photovoltaics solar cell I -V characteristics , materials and device fabrication. **1hrs**
1Hrs Fiber Optics and Dielectric wave guides Wave Guide:Slab wave guide , Modes ,V number, Modal , material and waveguide dispersions. **3hrs**

Optical Fiber - Types, Optical fiber functions. Light propagation, Optical power, Velocity of Propagation, critical angle, acceptance angle, numerical aperture, mode of propagation, Index profile. Single mode step-index optical fiber, multimode step- index fiber, graded index fibers advantages and disadvantages, energy losses in optical fiber, Bit rate, dispersion and optical bandwidth, Absorption and scattering, Block diagram of optical fiber communication. Construction of Optical cables. Optocoupler. **11hrs**

References.

1. John Wilson and John Hawkes, Optoelectronics, an introduction - 3rd Edition, Prentice Hall 1998,
2. J Singh ,Optoelectronics : an introduction to materials and devices, McGraw Hill New York
3. P Bhattacharya ,Semiconductor optoelectronic devices, Prentice hall international ,1997.
4. KR Nambiar, Lasers principles, Types and applications, New age international, New Delhi.
5. Wayne Tomaal, Electronic Communication Systems-Fundamentals through advanced-5th edition Pearson education, New Delhi
6. Dennis Roddy and John Coolen , Electronic Communication ,4th edition, Pearson education, New Delhi

conductive detectors- expression for photoconductive gain (as in the book of S O kasap) **9hrs**

photovoltaic devices: solar cell, I -V characteristics, materials and device fabrication. Organic photovoltaic diodes (OPVD)fundamental process, exciton absorption, exciton dissociation, charge collection characterisation, performance parameters. **3hrs**

Organic Optoelectronic devices: organic light emitting diodes (OLED), The principle of OLED, characterisation, structure, efficiency, multilayer OLED **2hrs** .

Books for Reference:

1. S O kasap, optoelectronics and photonics principles and practices, Prentice Hall, 2001.
2. Jasprit Singh, semiconductor optoelectronics, McGraw hill, 1995.
3. Wilson J. and Hawkes J.F.B., Optoelectronics, An Introduction, Prentice-Hall of India Private Limited (1993).
4. S C Gupta :Optoelectronic Devices and Systems, PHI learning Pvt. Ltd., Eastern Economy Edition, 2nd edition, 2015.
5. Wilson J and Hawkes : Optoelectronics-An introduction JFB, 2nd edition, Prentice Hall of India, New Delhi, 1996.
6. J Singh :Optoelectronics- An introduction to materials and devices, McGraw Hill, New York 2010.
7. P Bhattacharya :Semiconductor Optoelectronic devices, Prentice Hall International, 1997.
8. Anil K Maini, Varsha Agarwal :Electronic Devices and Circuits , WILEY, Reprint 2015.
9. P R Sasikumar :Photonics - An Introduction, PHI, Eastern Economy Edition, 2012.
10. M K Ghosh: Optoelectronics- Sensors and Instrumentation, MEDTEC, 1st edition, 2014.

SIXTH SEMESTER BSc Physics
ELECTIVE PAPER 4: Paper 8.4
paper code
Paper 8.4 ELECTIVE PAPER -4
Title of paper : Astrophysics
(Course duration : 14 weeks with three hours of instructions per week)
PART -A

Astrophysical Co-ordinates : Celestial coordinate systems. The right Ascension and Declination. Annual motion of the Sun across the sky. The ecliptic and the Signs of Zodiac. Constellations and identifications of the bright stars. Absolute or intrinsic luminosity, apparent brightness, apparent magnitude scale of Hipparchus, distinction between visual and bolo metric magnitudes, distance-modulus relationship.The Altitude-Azimuth coordinate system. Problems. **7hrs**

Stellar parallax and units of stellar distances : Definition of arced and parsec (pc). Relation between distance of a star and its parallax. Definitions of astronomical unit (AU) and light year (ly) and equations relating AU, ly and pc. **5hrs**

Concept of time : Sidereal Time, Sidereal time and solar time; Greenwich Mean Time; Standard time and local time; The Julian date and its importance in Astronomical observation. Problems. **5hrs**

Surface or effective temperature and color of a star : Definitions, wiens displacement law. Intrinsic temperature of a star. Expression for average temperature, core temperature and core pressure of a star based on the linear density model of a star. **4hrs**

Section B

Spectral Classification, their chemical composition and Hertz rung Russel (HR) diagram Spectral classification, Edward Charles Pickering classification (ie OBAFGKM), Harvard sequence and Yerkes luminosity classification. Size (radius) of a star. Expression for radius using Stefan Boltzman law. Spectral signature of elements present in the stellar atmosphere. Mass

MODIFIED PAPERS FOR 6th SEMESTER
BSc PHYSICS
Paper 10.3 - ELECTIVE PAPER- III
Paper code:
Title of paper: ASTROPHYSICS
(Course duration : 14 weeks with TWO hours of instructions per week)

Astrophysical Co-ordinates: Celestial coordinate systems. The right Ascension and Declination. Annual motion of the Sun across the sky. The ecliptic and the Signs of Zodiac. Constellations and identifications of the bright stars. Absolute or intrinsic luminosity, apparent brightness, apparent magnitude scale of Hipparchus, distinction between visual and bolo metric magnitudes, distance-modulus relationship. The Altitude-Azimuth coordinate system. Problems. **6hrs**

Stellar parallax and units of stellar distances: Definition of arced and parsec (pc). Relation between distance of a star and its parallax. Definitions of astronomical unit (AU) and light year (ly) and equations relating AU, ly and pc. **4hrs**

Concept of time : Sidereal Time, Sidereal time and solar time; Greenwich Mean Time; Standard time and local time; The Julian date and its importance in Astronomical observation. Problems. **4hrs**

Surface or effective temperature and color of a star: Definitions, wiens displacement law. Intrinsic temperature of a star. Expression for average temperature, core temperature and core pressure of a star based on the linear density model of a star **4hrs**

Spectral Classification, their chemical composition and Hertz rung Russel (HR) diagram: Spectral classification, Edward Charles Pickering classification (ie OBAFGKM), Harvard sequence and Yerkes luminosity classification. Size (radius) of a star. Expression for radius using Stefan Boltzman law. Spectral signature of elements present in the stellar atmosphere. Mass luminosity relationship and expression for lifetime of a star. Color index H-D classification and

luminosity relationship and expression for lifetime of a star. Color index H-D classification and H-R Diagram. Main sequence stars and their general characteristics. The steller evolution. The evolutionary track of stars, Protostars, Premain sequence stars, Main Sequence stars. Evolution of a star to white dwarf stage through red giant stage. Supernova explosion. Formation of a pulsar or neutronstar and blackhole (qualitative) with mention of typically required temperature and the corresponding densities. Event horizon, singularity and Schwarzchilds radius (qualitative), Problems **8hrs**

Source of energy: The Energy sources of the Stars, the thermonuclear reactions. P-P chain and The CNO cycle. Problems. **4hrs**

Gravitational potential energy or self energy of a star : Statement and explanation of Virial theorem.Expression for gravitational potential energy or self-energy of a star based on the linear density model. **3hrs**

Cosmology : Basic assumptions and limitations of cosmology; Expansion of the Universe and its evidence; Hubble's Law: Big bang theory and thermal history of the Universe. Size and age of the Universe. **6hrs**

H-R Diagram. Main sequence stars and their general characteristics. The steller evolution. The evolutionary track of stars, Protostars, Premain sequence stars, Main Sequence stars. Evolution of a star to white dwarf stage through red giant stage. Supernova explosion. Formation of a pulsar or neutronstar and blackhole (qualitative) with mention of typically required temperature and the corresponding densities. Event horizon, singularity and Schwarzchilds radius (qualitative),Problems **10hrs**

Books for Reference:

1. K S Krishnaswamy :Astrophysics: A Modern Perspective , New age International Publishers, 1st edition, Reprint 2011.
2. Baidyanath Basu, Tanuka Chattopadhyay, Sudhindra Nath Biswas :An Introduction to Astrophysics, PHI Learning Private Limited, 2nd edition, 2014.
3. B Basavaraju, P Sadashiv : Astrophysics, Solid State and Semiconductor Physics, 1st edition, Reprint 2013-2014.
4. A K Saxena, Narosa: Principles of Modern Physics - Publishers, 4th edition, 2014.
5. Krishna Mohan R, Narayana Sharma H D, Sarmistha Sahu CONCISE PHYSICS: Astrophysics, Solid State Physics & Semiconductors Physics, Subhas Stores, Bengaluru, 1st edition, 2013.

SIXTH SEMESTER BSc Physics
ELECTIVE PAPER 3: Paper 8.3
paper code
Title of paper: COMMUNICATION SYSTEMS**
(Course duration: 14 weeks with three hours of instructions per week)
PART A

Signal & **Noise:** Distinction between Signal and Noise. Signal to noise and its importance in communication. 2Hrs

Electro Acoustic transducers : Microphone types- Carbon, Moving coil, condenser and ribbon microphones, sensitivity, directivity, phasing and testing. 4Hrs.

Loud Speakers : Direct radiator dynamic type, expression for efficiency,radiated output power, Horn Loudspeaker, cutoff frequency, measurement of acoustic power and pressure response of a speaker 5Hrs

Modulation : Types of Modulation, Frequency Modulation, expression for frequency modulated wave for a single sinusoidal modulating signal FET method to produce FM, Distinction between analog and digital methods of modulation, PAM, PWM, PCM and Delta modulation 6Hrs

Multiplexing: Types of multiplexing and methods of grouping 2Hrs

Demodulation: Detection and demodulation of FM signal using foster seely discrimination 2Hrs

PART B

Amplifiers used in communication: Classes and types of amplifiers, AF, IF , RF and power amplifiers 6Hrs

Other Communication systems; Principles of : Microwave and satellite communication, wire telephone, simplex and duplex systems, facsimile transmission, Mobile communication-cellular telephony. 8Hrs Antennas

MODIFIED PAPERS FOR 6th SEMESTER
BSc PHYSICS
Paper 10.4 -ELECTIVE PAPER- IV
Paper code:
Title of paper: COMMUNICATION SYSTEMS**
(Course duration : 14 weeks with TWO hours of instructions per week)

Signal and Noise: Distinction between Signal and Noise, Signal to noise ratio and its importance in communication. **2hrs**

Antennas' : Types of antenna elementary ideas of Resonant antenna, High frequency antenna, Yagi antenna, Microwave antenna-geometry and properties of parabolic antenna, wide band and special purpose antenna-Horn, Discone and helical and Dielectric antenna, Current and voltage distribution in antenna, expression for energy radiated by a short doublet (dipole), Impedance matching. **8hrs**

Amplifiers used in communication: Classes and types of amplifiers, AF, IF, RF and power amplifiers **6hrs**

Multiplexing: Types of multiplexing and methods of grouping **2hrs**

Modern Communication systems: Principles and working of a) Microwave communication b) satellite communication, c) wire telephone-simplex and duplex systems, b) facsimile transmission e) Mobile communication-cellular telephony **10hrs**

Books for Reference:

1. Dennis Roddy and John Coolen , Electronic Communication ,4th edition, Pearson education, New Delhi 2006

2. Wayne Tomaal, Electronic Communication Systems-Fundamentals through advanced-5th edition Pearson education, New Delhi 2010

Types of antenna elementary ideas of Resonant antenna,Hign frequency antenna,Yagi antenna, Microwave antenna-geometry and properties of parabolic antenna,wideband and special purpose antenna-Horn,Discone and helicaland Dielectric antenna,Current and voltage distribution in antenna, expression for energy radiated by a short doublet (dipole),Impedence matching 7Hrs

References.

1. Dennis Roddy and John Coolen , Electronic Communication ,4th edition, Pearson education, New Delhi
2. Wayne Tomaal, Electronic Communication Systems-Fundamentals through advanced-5th edition Pearson education, New Delhi
3. Kennedy George :Electronic communication Systems,3rd edn, Tata Mcgraw Hill, New Delhi.
4. Deshpande Etal, Communication electronics,Tata Mcgraw Hill, New Delhi.
5. Fundamentals of Acoustics Kinsler and Frey
6. Acoustics Schaum series (Seto) Wayne Tomaal, Electronic Communication Systems-Fundamentals through advanced-5th edition Pearson education, New Delhi

Note: electronics students are not eligible to opt this papers**

3. Kennedy George :Electronic communication Systems, 3rd edition, Tata Mcgraw Hill, New Delhi.2012
4. Deshpande Etal, Communication Electronics, Tata Mcgraw Hill, New Delhi.2013

Note: electronics students are not eligible to opt this papers**

ELECTIVE PAPER -V

NIL

MODIFIED PAPERS FOR 6th SEMESTER
BSc PHYSICS
Paper 10.5 - ELECTIVE PAPER- V
Paper code:
Title of paper: ELEMENTS OF MATERIAL SCIENCE
(Course duration : 14 weeks with TWO hours of instructions per week)

Properties of Materials: Mechanical properties Hardness, toughness, Malleability, creep, fatigue, plasticity Electrical and Magnetic Properties - Resistivity, Conductivity, Dielectric Strength Thermal Properties - Sp. heat, Thermal expansions and Thermal conductivity Elastic properties - tensile properties yielding & yield strength, Stress strain behaviour, Ductility, Resilence. **6hrs**

Atomic Disorder in Materials-Imperfection in solids: Point defects vacancies and self interstitials, Impurities, imperfections- dislocations and linear defects, characteristics of dislocations, Volume defects, Microscopic examination -surface defects, grain size determination, non-crystalline materials. **6hrs**

Single Phase Metals: Elastic and Plastic deformation, deformation by slip, Work hardening, Annealing of cold worked metal, Variation of Mechanical properties in Annealing, Mechanical working of metals, cold working, fracture and fatigue. **4 hrs**

Phase Diagrams: Importance and objectives, the phase rule, Single component system, Binary phase diagram, Microstructural changes during cooling, qualitative phase relationships, construction, isothermal cuts, typical phase diagrams for (i) Cu-Ni,(ii) Pb-Sn **4hrs**

Nanomaterials : Nano Structures Nanocrystals, Nano clusters (quantum dots), Nanowire, Nanotube, Nano biological systems. synthesis of Nanolusters mentor of the methods, study of structure and properties of nanomaterials using TEM & AFM. Applications in Nanoelectronics, biological diagnostics. **8hrs**

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Books for Reference:

1. V Raghavan , A first course in material science and Engineering, 6th Edition ,PHI learning New Delhi,2015.
2. R S Sedha, Materials Science, S Chand , New Delhi 2008.
3. William D Callister JR,Material Science and Engineering an introduction, 6th Edition,Jhon Wiley and Sons.2009.
4. Jain K.P., Physics of Semiconductor Nanostructures, Narosa Publishing House (1997).
5. Cao, G., Nanostructures and Nanomaterials: Synthesis, Properties and Applications, Emperial College Press (2004).
6. Charles P Poole Jr, Frank J Owens : Introduction to Nanotechnology , John Wiley & Sons, INC, Reprint 2013.
7. C-De lerue & M. Lannoo :Nanostructures-Theory and modelling– (Springer Publishers) 2009.
8. Chow G-M & Gonsalves K.E., Nanotechnology - Molecularly Designed Materials, American Chemical Society 2012
9. Manasi Karkare : Nanotechnology: Fundamentals and Applications, I K International Publishing House Pvt. Ltd. New Delhi, Reprint 2013.
10. Fulekar :Nanotechnology Importance and Applications, I K International Publishing House Pvt. Ltd. New Delhi, Reprint 2013.

SIXTH SEMESTER BSc Physics PRACTICAL
PRACTICAL PHYSICS
(Course duration: 14 Weeks with 4 Hours of lab-work per week.)
Practical-7 (COMPULSORY PAPER EXPERIMENTS) Paper code:
Any eight of the following experiments

1. Energy gap of a semiconductor.
2. Zener diode as a voltage regulator.
3. CE amplifier
4. The logic gates AND, OR and NOT using transistors.
5. Characteristics of Transistor in CE mode.
6. Characteristics of Transistor in CB mode.
7. Characteristics of LED.
8. Hartley oscillator.
9. Bridge Rectifier - Without & with C and pi section filters.
10. Photo-diode characteristics.
11. Verification of Richardson Dushman equation.

MODIFIED SYLLABUS FOR 6th SEMESTER
BSc PHYSICS - PRACTCALS
PRACTICAL -7 (compulsory paper)
Paper code:
(03 Hours of Lab- Work per week)

Any **EIGHT** of the following experiments

1. Verification of inverse square law for gamma-rays
2. Half-life of K 40
3. Absorption coefficient of gamma-rays
4. Study of solar cell-I V Characteristics, F F & efficiency
5. Phase measurement in LCR circuit using CRO
6. Four probe- Resistivity measurements
7. Verification of Maximum power transfer theorem.
8. Negative feed-back amplifier.
9. Study of X-ray photograph - determination of interplanar distance
10. Characteristics of a GM-tube

Practical-8 (COMBINATION OF COMPULSORY AND ELECTIVE PAPERS)
Paper code:
Any seven of the following experiments
(Four expt from compulsory part and Three from elective Part)
Compulsory part

1. Negative feed-back amplifier.
2. A study of Amplitude Modulation and Amplitude Demodulation
3. A study of Characteristics of FET
4. Thevenin Theorem-verification
5. Characteristics of Zener diode

Elective part

Elective -1 (ANALOG AND DIGITAL ELECTRONICS)

1. Phase shift Oscillator
2. Wein Bridge Oscillator
3. UJT characteristics
4. Full Adder
5. Study of opamp characteristics.

Elective -2 (PHOTONICS)

1. Measurement of efficiency and output power of LED
2. Characteristics of Diode Laser Measurement of output power, LI curves
3. Verification of inverse square law for light intensity using a photo-diode.
4. . Study of Optocoupler.
5. Study of Divergence of Diode laser.

Elective -3 (COMMUNICATION SYSTEMS)

1. Diode detector
2. Digital multiplexing using IC555 & IC 7400 (observe multiplexing on CRO)
3. PAM using IC 555
4. Study of demultiplexer using IC 555 & IC 7400.
5. A study of IF amplifier Frequency response.

MODIFIED SIXTH SEMESTER BSc PHYSICS PRACTICALS
PRACTICAL -8 (COMBINATION OF COMPULSORY AND ELECTIVE PAPERS)
(03 Hours of Lab- Work per week)
Any **SEVEN** of the following experiments and project work
Compulsory part (Any **FOUR** experiments)

1. Determination of range of electron in Al using GM counter
2. Determination of Dielectric constant of liquid
3. Logic gates- AND, OR, NOT NOR and X-OR using IC 7400& 7402
4. To determine value of Boltzmann constant using V-I characteristic of PN diode.
5. Fermi energy of copper

Elective part (Any THREE Experiments)
Elective -1 ANALOG AND DIGITAL ELECTRONICS

1. Phase shift Oscillator .
2. Wein Bridge Oscillator
3. UJT characteristics
4. Study of opamp characteristics
5. Full Adder

Elective -2 OPTOELECTRONICS

1. To study Phototransistor characteristics
2. Measurement of efficiency and output power of LED
3. Photo-diode : Study of characteristics and verification of inverse square law of light
4. Characteristics of LED

Elective -3 ASTROPHYSICS

1. Analysis of stellar spectra
2. Analysis of sunspot photographs
3. Determination of the temperature of an artificial star.

Project work equivalent to two experiments is compulsory. A report must be submitted for internal evaluation and IA marks(Max10). The wok must emphasize significant ideas &concepts and should address the questions why it is important, where it is applied, what are its key features & limitations? A list of suggestive ideas for project work is appended at the end.

4. Calculation of physical properties of stars and plotting of H-R diagram

Elective -4 COMMUNICATION SYSTEMS

1. Diode detector
2. Digital multiplexing using IC555 & IC 7400 (observe multiplexing on CRO
3. PAM using IC 555
4. Study of demultiplexer using IC 555 & IC 7400..
5. A study of IF amplifier Frequency response

Elective -5 ELEMENTS OF MATERIAL SCIENCE

1. To measure the Magnetic susceptibility of Solids.
2. Measurement of Magnetoresistance of semiconductors
3. Energy band gap of a semiconductor by four probe method
4. Measurement of susceptibility of paramagnetic solution

Project work: Project work is compulsory. A report must be submitted for internal evaluation IA marks. The wok must emphasize significant ideas &concepts and should address the questions why it is important, where it is applied, what are its key features &limitations. A list of Suggestive ideas for project work is appended at the end.

PATTERN OF QUESTION PAPER
B.Sc. 5^{th} and 6^{th} SEMESTER PHYSICS

Time: **3 hrs** Max Marks **60**

Part-A

Answer any **three** questions out of four questions $3 \times 12 = 36$
(Short answer/long answer/ derivation based questions to be set)

Part-B

Answer any **three** questions out of four questions $3 \times 4 = 12$
(Numerical problems/ application oriented questions to be set)

Part-C

Answer any **six** questions out of eight questions $6 \times 2 = 12$
(Concept/understanding/ application based questions to be set)

Internal Assessment (IA) and Semester End Examination Marks Distribution Table :
(for 5^{th} and 6^{th} semester from 2016 -17 onwards)
Course: BSc PHYSICS

Semester	Paper	End Semester Examination marks	IA	REMARKS for IA
First Semester	Paper I	60	10	05 marks for class tests and 05 marks for home assignments.
	Practical -1	20	10	Test / Record
Second Semester	Paper II	60	10	05 marks for class tests and 05 marks for home assignments.
	Practical -2	20	10	Test / Record
Third Semester	Paper III	60	10	05 marks for class tests and 05 marks for home assignments.
	Practical -3	20	10	Test / Record
Fourth Semester	Paper IV	60	10	05 marks for class tests and 05 marks for home assignments.
	Practical -4	20	10	Test / Record
Fifth Semester	Paper V - Compulsory paper I	60	10	05 marks for class tests and 05 marks for home assignments.
	Paper VI - Compulsory paper II	60	10	05 marks for class tests and 05 marks for home assignments.
	Paper VII- Elective papers	60	10	05 marks for class tests and 05 marks for home assignments.
	Practical -5	30	15	05 Marks for Class record and 10 Marks for test
	Practical -6	30	15	05 Marks for Class record and 10 Marks for project work and test
Sixth Semester	Paper VIII - Compulsory paper I	60	10	05 marks for class tests and 05 marks for home assignments.
	Paper IX - Compulsory paper II	60	10	05 marks for class tests and 05 marks for home assignments.
	Paper X - Elective papers	60	10	05 marks for class tests and 05 marks for home assignments.
	Practical -7	30	15	05 Marks for Class record and 10 Marks for test
	Practical -8	30	15	05 Marks for Class record and 10 Marks for Project work and test

M0DIFIED PAPERS FOR 5^{th} SEMESTER BSc PHYSICS
Title of paper

Paper 5	COMPULSORY PAPER I	:	SPECTROSCOPY AND ELECTRONICS
Paper 6	COMPULSORY PAPER II	:	CONDENSED MATTER PHYSICS
Paper 7.1	ELECTIVE PAPER-I	:	SOLID STATE AND SEMICONDUCTOR PHYSICS
Paper 7.2	ELECTIVE PAPER-II	:	RENEWABLE ENERGY PHYSICS
Paper 7.3	ELECTIVE PAPER-III	:	MOLECULAR PHYSICS
Paper 7.4	ELECTIVE PAPER-IV	:	ATMOSPHERIC PHYSICS
Paper 7.5	ELECTIVE PAPER- V	:	LASERS AND FIBRE OPTICS

M0DIFIED PAPERS FOR 6^{th} SEMESTER BSc PHYSICS
Title of paper

Paper 8	COMPULSORY PAPER I	:	RELATIVITY AND QUANTUM MECHANICS
Paper 9	COMPULSORY PAPER II	:	NUCLEAR PHYSICS
Paper 10.1	ELECTIVE PAPER- I	:	ANALOG AND DIGITAL ELECTRONICS**
Paper 10.2	ELECTIVE PAPER- II	:	OPTOELECTRONICS
Paper 10.3	ELECTIVE PAPER- III	:	ASTROPHYSICS
Paper 10.4	ELECTIVE PAPER- IV	:	COMMUNICATION SYSTEMS**
Paper 10.5	ELECTIVE PAPER- V	:	ELEMENTS OF MATERIAL SCIENCE

**Electronics students are not eligible to opt these papers

Teaching Hours : Each paper 2 hrs per week

Max marks for each Theory Paper: 70

Total marks for Theory	**=**	**3×70**	**=**	**210**
Total marks for Practicals	**=**	**2×45**	**=**	**90**