

UNIVERSITY OF JAMMU

SYLLABI FOR BACHELOR DEGREE PROGRAMME IN PHYSICS (CBCS)

The Following Courses of Study are prescribed for 3rd and 4th Semester BACHELOR DEGREE PROGRAMME IN PHYSICS (CBCS):

Semester	Course No.	Title	Credits	Nature of Course
III	UPHTC301	Electronics, Thermodynamics and Statistical Mechanics	4	CORE
	UPHPC302	Practicals	2	CORE
	UPHSE303	Physics Workshop Skill	4	SKIL ENHANCEMENT
IV	UPHTC401	Waves and Optics	4	CORE
	UPHPC402	Practicals	2	CORE
	UPHSE403	Renewable Energy and Energy Harvesting	4	SKIL ENHANCEMENT

B.Sc. Semester-III

Syllabus for Examinations to be held in Dec. 2017, 2018, 2019

Subject : Physics (Theory)

Course Code/No.: UPHTC301

Title of the Course: Electronics, Thermodynamics and Statistical Mechanics

Duration: 2 ½ Hours

Total Marks: 100

No. of Credits: 4

End Semester Examination: 80 Marks

Internal Assessment Test: 20 Marks

Unit-I: ELECTRONICS-I

Review of intrinsic and extrinsic semiconductors, concept of energy bands and Fermi level, conductivity of a semiconductor, concept of drift and diffusion currents, PN junction diode, diode equation, applications of PN junction diode as half and full wave rectifiers, filter circuits, calculation of ripple factor and efficiency, avalanche and Zener breakdown, Zener diode: V-I characteristics and its application as voltage regulator, construction and working of LED, Photodiode, Solar cell, Schottky diode and tunnel diode; construction, working and V-I characteristics of SCR.

Unit-II: ELECTRONICS-II

Bipolar Junction Transistor (BJT), characteristics of CB and CE configurations of transistor, DC load line and Q point, transistor biasing (voltage divider method), BJT as an amplifier in CE configuration, various amplification parameters, fabrication of components on monolithic IC, Operational Amplifier and its applications as inverting and non-inverting amplifier, construction and working of UJT and FET, De-Morgan Laws of Boolean algebra, AND, OR, NOT, NAND and NOR gates using Diode Logic and Diode Transistor Logic, Half adder, Full adder and XOR Circuits.

UNIT-III: THERMODYNAMICS-I

Second law of thermodynamics, Carnot theorem, thermodynamic scale of temperature and its identity with gas scale, Entropy, Statistical definition of entropy, additive nature of entropy, entropy changes in reversible and irreversible processes, law of increase of entropy with examples, T-S diagram, entropy and disorder, heat death of the universe, impossibility of attaining absolute zero, Nernst heat theorem and third law of thermodynamics.

Adiabatic expansion, Joule-Thomson expansion, Boyle temperature, temperature of inversion and principle of regenerative cooling and of cascade cooling.

UNIT –IV: THERMODYNAMICS-II

Extensive and intensive thermodynamic variables, Maxwell's general relationships, Applications to Joule – Thomson cooling, Clausius- Clapeyron latent heat equation, Thermodynamic potentials and equilibrium of thermodynamic system, relation with thermodynamic variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

UNIT –V: STATISTICAL MECHANICS

Probability , macro and micro states , thermodynamics probability, effects of constraints on a system , deviation from the state of maximum probability, equilibrium state of dynamic system. Distribution of n distinguishable particles in k compartments of unequal sizes, Phase space , types of statistics, Boltzmann's distribution law , Maxwell's distribution of speeds and velocities , mean, r.m.s. and most probable speeds, Bose-Einstein (B.E.) statistics and distribution law , derivation of Planck's radiation law, Fermi Dirac (F.D) statistics and its distribution law, application of F-D statistics to electron gas in metals, Zero point energy.

Scheme for Internal Assessment Test

The internal assessment shall comprise of two parts :

Part A: Total weightage to this part shall be 50% of internal assessment marks i.e. 50 % of the total marks or 10 marks out of 20 marks reserved for internal assessment. It will have eight short questions selecting at least three from each of the two/three units (50% of syllabus) covered. A candidate has to attempt any five questions and each question carries 2 marks.

Part B: Total weightage to this part shall be 50% of the internal assessment marks i.e. 50 % of the total marks or 10 marks out of 20 marks reserved for internal assessment. It will have 2 Long questions, selecting one each from first two units/ 50% of the syllabus: A Candidate has to attempt any one question and the question shall carry 10 marks

Time duration : One hour

Note for examiners/paper setters

The External examination in theory shall consist of the following:

1. Five (5) short answers to the questions representing all units/syllabi i.e. at least one from each unit (without detail explanation having 70 to 80 words in approximately 6 minutes and having 3 marks for each answer to the question (All Compulsory).
2. Five (5) medium answers to the questions representing all units/ syllabi i.e. at least one from each unit (with explanation having 250-300 words in approximately 12 minutes and having 7 marks for each answer to the question (All Compulsory).
3. Five (5) long answers to the questions (two to be attempted) representing whole of the syllabi with detailed analysis/explanation/critical evaluation/solution to the stated problems within 500 - 600 words in approximately 30 minutes and having 15 marks each answer to the question.

Text and Reference Books

1. Principles of Electronics, V.K.Mehta (S.Chand & Co.)
2. Basic Electronics, B.L. Theraja (S.Chand & Co.)
3. Integrated Electronics, J. Millman and C.C. Halkias (Tata McGraw Hill)
4. Digital Principles and Applications, A.P.Malvino, D.P.Leach & Saha (Tata McGraw Hill)
5. Basic Electronics and Linear Circuits , Bhargava and Gupta (TataMcGraw Hill)
6. Thermal Physics, S.Garg, R.Bansal & C.Ghosh (Tata McGraw Hill)
7. Heat and Thermodynamics,M.W.Zeemansky and R. Dittman
8. Statistical and Thermal Physics, S.Lokanathan and R.S. Gambir
9. Introduction to Statistical Mechanics, B.B. Laud.

B.Sc. Semester-III

Syllabus for Examinations to be held in Dec. 2017, 2018, 2019

Subject : Physics (Practicals)

Course Code/No.:UPHPC302

No. of Credits: 2

Total Marks: 50

Internal Assessment: 25 Marks

External Practical Examination: 25 Marks

List of Practicals

1. To study V-I characteristics of PN junction diode
2. To study V-I characteristics of Zener diode
3. To find the ripple factor of half-wave rectifier with different filters
4. To find ripple factor of full-wave rectifier with different filters
5. To find refractive index of water by using hollow prism
6. To find refractive index of O-ray and E-ray
7. To find wavelength of sodium light by using diffraction grating
8. To find coefficient of thermal conductivity by Lee's method.
9. Half and Full adder circuits
10. Verification of De-Morgan's Laws
11. Realization of (i) OR-Gate (ii) AND Gate (iii) NAND and NOR Gates using Diode and Transistors.

Note: The students are required to complete at least 5 experiments.

Reference Books

1. B.Sc. Practical Physics by C.L.Arora
2. Practical Physics by G.L.Squires, Cambridge University Press
3. Advanced Practical Physics for Students by Worsnop and Flint
4. Practical Physics by R.K.Shukla
5. B.Sc. Practical Physics by Harnam Singh
6. A Text Book of Practical Physics by Indu Prakash and Ramakrishna

Instructions for Internal Assessment / External Examination

Practical Examination

50% Internal

50% External

Internal

- (a) 20 percent attendance
- (b) 20 percent Viva Voce
- (c) 40 percent practical Work/Book based on the practical done as per time table (Day to day performance)
- (d) 20 percent internal test (to be conducted by the class teacher or a committee of subject teachers constituted by principal of the College)

External

- (a) 80 percent for practical paper and
- (b) 20 percent for Viva Voce

Note : Total marks in practical shall be 50 only

B.Sc. Semester-III

Syllabus for Examinations to be held in Dec. 2017, 2018, 2019

Subject : Physics (Skill Enhancement Course) Course Code/No.: UPHSE303

Title of the Course: Physics Workshop Skill Duration: 2 ½ Hours

Total Marks: 100 (Minor Paper : 30 marks and Major Paper : 70 Marks)

No. of Credits: 04

Unit-I: Measuring Instruments

Measuring units, conversion to SI and CGS, Familiarization with meter scale, Vernier calliper, Screw gauge and their utility, Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

Unit-II: Mechanical Skill

Concept of workshop practice, Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects, Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood, Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothing of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

Unit-III: Electrical and Electronic Skill

Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

Unit-IV: Introduction to prime movers

Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever. Braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment.

Scheme for Minor Test (30 Marks; Internal Evaluation)

Setting of Question Paper and evaluation of answer scripts by the teacher concerned

The internal assessment shall comprise of two parts :

Part A: Test based on Practical knowledge of the candidate (Total weightage : 20 marks)

Part B: Test based on Theoretical knowledge of the candidate (Total weightage : 10 marks)

Scheme for Major Test (70 Marks; Internal Evaluation)

Setting of Question Paper by the concerned Subject Head of the College

The External examination in theory shall consist of the following:

1. Six (6) short answers to the questions representing all units/syllabi i.e. at least one from each unit (without detail explanation having 70 to 80 words in approximately 7 minutes and having 3 marks for each answer to the question (All Compulsory).
2. Four (4) medium answers to the questions representing all units/ syllabi i.e. at least one from each unit (with explanation having 200-250 words in approximately 12 minutes and having 7 marks for each answer to the question (All Compulsory).
3. Four (4) long answers to the questions (two to be attempted) representing whole of the syllabi with detailed analysis/explanation/critical evaluation/solution to the stated problems within 400 - 500 words in approximately 30 minutes and having 12 marks each answer to the question.

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn. 37
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

B.Sc. Semester-IV

Syllabus for Examinations to be held in May 2018, 2019, 2020

Subject : Physics (Theory)

Course Code/No.:UPHTC401

Title of the Course: Waves and Optics

Duration: 2 ½ Hours

Total Marks: 100

No. of Credits: 4

End Semester Examination: 80 Marks

Internal Assessment Test: 20 Marks

Unit-I : FOURIER SERIES

Periodic functions, even and odd functions, continuous and discontinuous functions, Dirichlet conditions, sine and cosine series, properties of Fourier series, complex form of Fourier series, extension of interval, Fourier solution of simple functions, Applications of Fourier theorem to square wave, rectangular wave, triangular wave, half wave rectifier and full wave rectifier.

Unit-II: WAVES

Wave equation in simple and differential form, general solution of wave equation, velocity of transverse waves in a string, velocity of longitudinal waves in a fluid, energy density and intensity of a progressive wave, phase and group velocity, characteristic impedance of a string, reflection and transmission coefficients, impedance matching, Superposition principle and linearity, stationary/standing waves on a string of fixed length, eigen functions, energy of a vibrating string, eigen frequencies.

Unit-III: INTERFERENCE

Conditions for interference, Young's double slit experiment, theory of interference fringes, Fresnel's biprism and its application to the determination of wavelength of sodium light, Phase change on reflection, thin films (reflected and transmitted cases), Newton's Rings: determination of refractive index of liquid and wavelength of monochromatic light, Michelson's interferometer and its applications to determine (i) Wave length of monochromatic light (ii) thickness of thin transparent plate (iii) resolution of spectral lines (iv) Determination of refractive index of glass.

Unit-IV: DIFFRACTION

Fresnel's diffraction , Fresnel's half –period zones , rectilinear propagation of light , Zone plate action of Zone plate , Diffraction at a straight edge , rectangular slit and thin wire, Fraunhofer diffraction, single slit diffraction, two slit diffraction, plane transmission grating, determination of wavelength of monochromatic light using grating, width of principal maximum, absent spectra, dispersive power of grating, limit of resolution, Rayleigh's criterion, resolving power of grating.

Unit-V: POLARIZATION

Polarization by reflection, Brewster's law, Malus Law, phenomenon of double refraction, Huygen theory of double refraction , Nicol prism, quarter wave plate and half wave plate; theory, production and detection of plane, circularly and elliptical polarized light, optical activity, specific rotation, Laurent's half shade polarimeter.

Scheme for Internal Assessment Test

The internal assessment shall comprise of two parts :

Part A: Total weightage to this part shall be 50% of internal assessment marks i.e. 50 % of the total marks or 10 marks out of 20 marks reserved for internal assessment. It will have eight short questions selecting at least three from each of the two/three units (50% of syllabus) covered. A candidate has to attempt any five questions and each question carries 2 marks.

Part B: Total weightage to this part shall be 50% of the internal assessment marks i.e. 50 % of the total marks or 10 marks out of 20 marks reserved for internal assessment. It will have 2 Long questions, selecting one each from first two units/ 50% of the syllabus: A Candidate has to attempt any one question and the question shall carry 10 marks

Time duration : One hour

Note for examiners/paper setters

The External examination in theory shall consist of the following:

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Text and Reference Books

1. Fourier Analysis, M.R.Spiegel (TataMcGraw Hill)
2. Mathematical Physics, Satya Prakash
3. Text Book of Vibrations and Waves, S.P.Puri (MacMillan India)
4. Physics of Vibrations and Waves, H.J.Pain (John Wiley, London)
5. Waves and Oscillations, N.Subrahmanyam & B.Lal (Vikas Publishers)
6. Fundamental of Optics, F.A.Jenkins and H,E.White (McGraw Hill)
7. Optics, Ajoy Ghatak (McMillan India)
8. Optics, Brijlal, Subrahmanyam and Avadhanulu (S.Chand & Co.)

B.Sc. Semester-IV

Syllabus for Examinations to be held in May 2018,2019,2020

Subject : Physics (Practical)

Course Code/No.:UPHPC402

No. of Credits: 2

Total Marks: 50

Internal Assessment: 25 Marks

External Practical Examination: 25 Marks

List of Practicals

1. To study input and output characteristics of common base PNP/NPN transistor
2. To study input and output characteristics of common emitter PNP/NPN transistor.
3. To study V-I characteristics of FET.
4. To find wavelength of sodium light by using Newton's rings.
5. To find specific rotation of sugar by using polarimeter.
6. To find values of Cauchy constants of material of a prism.
7. To find resolving power of a prism.
8. Characteristics of UJT.
9. Characteristics of SCR.
10. Use of OP-AMP as inverting and non-inverting amplifiers
11. Applications of OP-AMP as (a) Summer (b) Subtractor (c) Integrator and Differentiator

Note: The students are required to complete at least 5 experiments.

Reference Books

1. B.Sc. Practical Physics by C.L.Arora
2. Practical Physics by G.L.Squires, Cambridge University Press
3. Advanced Practical Physics for Students by Worsnop and Flint
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(d) 20 percent internal test (to be conducted by the class teacher or a committee of subject teachers constituted by principal of the College)

External

(a) 80 percent for practical paper and

(b) 20 percent for Viva Voce

Note : Total marks in practical shall be 50 only

B.Sc. Semester-IV

Syllabus for Examinations to be held in May 2018, 2019, 2020

Subject : Physics (Skill Enhancement Course) Course Code/No.: UPHSE403

Title of the Course: RENEWABLE ENERGY AND ENERGY HARVESTING

Duration: 2 ½ Hours

Total Marks: 100 (Minor Paper : 30 marks and Major Paper : 70 Marks)

No. of Credits: 04

Unit-I: Fossil fuels and Alternate Sources of energy

Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Unit-II: Solar Energy and Wind Energy harvesting

Solar energy : its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Unit-III: Ocean Energy, Geothermal Energy and Hydro Energy

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

Geothermal Energy: Geothermal Resources, Geothermal Technologies.

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Unit IV : Piezoelectric Energy and Electromagnetic Energy harvesting

Piezoelectric Energy Harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power

Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications.

Carbon captured technologies, cell, batteries, power consumption

Environmental issues and Renewable sources of energy, sustainability.

Demonstrations and Experiments

1. Demonstration of Training modules on Solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Scheme for Minor Test (30 Marks; Internal Evaluation)

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Reference Books:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
 2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
 3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
 4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
 5. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
 6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
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