FACULTY OF SCIENCE & TECHNOLOGY

KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

'A' Grade
NAAC Re-Accredited
(3rd Cycle)

SYLLABUS
FOR
S. Y. B. Sc. (PHYSICS)

(AS PER CHOICE BASED CREDIT SYSTEM PATTERN OF UGC)

(With effect from June - 2019)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process and examination and evaluation systems.

In that context in the last decade, North Maharashtra University, Jalgaon has taken several initiatives to upgrade and enhance the academic excellence, examination reforms and developing the skilled minds and skilled hands. As per the directions of UGC, from last year our KBC North Maharashtra University, Jalgaon has implemented the Choice Based Credit (CBCS) pattern to undergraduate programs run by various colleges affiliated to NMU, Jalgaon. As per the directions given by the Honorable Vice Chancellor, Pro-Vice Chancellor and Dean of the Faculty of Science and Technology of our university, one day workshop was organized for syllabus framing. The teachers of the affiliated colleges and university department were participated in the workshop of re-structuring the syllabi of S.Y.B.Sc. (Physics) as per the CBCS pattern and it has been finalized during the workshop and the same will be effectively implemented from the academic year 2019-20.

The main objective of the re-structuring the syllabus of S.Y.B.Sc. (Physics) is to create skilled minds and therefore expectation is to equip the students with the knowledge and understanding of concepts of physics rather than the ability to remember facts so that they may have a reasonable comprehensive and complete grasp of principles of physics. It is expected that the students should study physics with keen interest, develop their experimental skill and problem solving ability. The students should communicate their knowledge of Physics to the Society, to make them to understand physics around us. The students should use their knowledge of Physics for betterment of our Society, our nation and the World.

Board of Studies (Physics),
North Maharashtra University, Jalgaon

OBJECTIVES

1. To provide education in physics of the highest quality at the undergraduate level and generate graduates of the caliber sought by industries and public service as well as academic teachers and researchers of the future.
2. To acquire deep knowledge in fundamental aspects of Physics and basic knowledge in the specialized thrust areas like Thermodynamics, Basic electronics, Waves, Sound, Optics, LASERS, Energy harvesting and electrical circuit skills.
3. To develop ability among the students to identify, remember and grasp the meaning of basic facts, concepts and principles of Physics.
4. To develop observational skills, confidence in using scientific equipment and relate the knowledge of scientific concepts to quantitative and physical measurement.
5. Acquire knowledge, skills, working methods and ways of expression which will reflect on all round development of the students' attitudes towards scientific thinking and its applications.
6. To develop attitudes such as concern for accuracy and precision, objectivity, and Enquiry.
7. The overall aim is to provide comprehensive knowledge and understanding in the relevant fields and enable students to pursue the physics subject at an advanced level later and to attract outstanding students from all back grounds.

BOS (PHYSICS)-Faculty of Science & Technology

Kavayitri bahinabai Chaudhari
North Maharashtra University, Jalgaon

Class: **S. Y. B. Sc.** Subject: **Physics**

Choice Base Credit System (With effect from June 2019)

The Board of Studies in Physics in its meeting held on **4th July 2018** has unanimously accepted the revised syllabus (as per CBCS pattern) prepared by different committees, discussed and finalized in workshop restructuring of S.Y.B.Sc. Syllabus.

The titles of the papers for S.Y.B.Sc. (Physics) are as given below:

Semester	Course		No. of Credits	Hours per semester	Marks	
	Course code	Course Title			Internal marks	External marks
III	PHY 301	Thermodynamics and Kinetic theory of gases	02	30	40	60
	PHY 302(A) OR PHY 302(B)	Electronics-I OR Instrumentation	02	30	40	60
	PHY 303	LAB-III	02	60	40	60
	PHY 304: (Skill Enhancement course I)	Renewable energy and Energy Harvesting	02	30	40	60
IV	PHY 401	Waves, Oscillations and acoustics	02	30	40	60
	PHY 402	Optics and LASERS	02	30	40	60
	PHY 403	Lab IV	02	60	40	60
	PHY 404: (Skill Enhancement course II)	Electrical Circuits and Network Skills	02	30	40	60

Note: The industrial/study tour is compulsory for students of S. Y. B. Sc. (Physics).

Semester III: Physics paper I

PHY 301: Thermodynamics and Kinetic theory of gases

(Credits: 02) :(30 Lectures 60 Marks)

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Course description:

This course is aimed at introducing the fundamentals of Thermodynamics and kinetic theory of gases to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Thermodynamics and kinetic theory of gases.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept of use of knowledge of Thermodynamics and kinetic theory of gases to real life problems.
2. Understanding of the course will create scientific temperament.

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Unit 1: Basics of thermodynamics and its First Law: (08 L, 15 M)

Thermodynamic Description of system, Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes.

Unit 2: Second and Third Law of Thermodynamics and Entropy: **(08 L, 15 M)**

Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible and irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero, Enthalphy.

Unit 3: Heat Engines: (07 L, 15 M)

Carnot's Engine, Otto Engine and Cycle, Diesel Engine and Cycle, Efficiencies of all heat engines.

Unit 4: Kinetic Theory of Gases: (07 L, 15 M)

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

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Reference Books:

- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Heat and Thermodynamics, M. W. Zemasky and R. Dittman, 1981, McGraw Hill 13
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W. Sears & G. L. Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications

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Semester III: Physics paper II
PHY 302 (A): Electronics –I
(Credits: 02) :(30 Lectures 60 Marks)

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Course description:

This course is aimed at introducing the fundamentals of Electronics of gases to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Electronics.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept of use of knowledge of Electronics to real life problems.
2. Understanding of the course will create scientific temperament.

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Unit 1 Semiconductor diodes **(07 L, 14 M)**

(Revision on metal, insulator and semiconductors, Intrinsic and Extrinsic semiconductor), Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle, Construction, Working and Characteristics of (1) LEDs (2) Photodiode (3) Solar Cell (P-N Junction), (4) Zener Diode

Unit 2: **Rectifiers and Power Supplies** **(05 L, 10M)**

Introduction to Rectifiers, Types: Half-wave & Full-Wave Rectifiers (Centre-tapped and Bridge Rectifiers), Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, D.C. power Supply (unregulated and regulated), Zener Diode as a voltage regulator.

Unit 3: Bipolar junction transistor **(06L, 12M)**

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC configurations. Active, Cutoff, and Saturation Regions. Current gains α and β. Relations between α and β. Load Line analysis of Transistors. DC Load line and Q point.

Unit 4: Digital Electronics **(12 L, 24 M)**

Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, Binary Addition, Binary Subtraction using 2's Complement Method, AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gates,

De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Fundamental Products, Min terms and Max terms, Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh's Map,

Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor.

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Reference Books:

1. Electronic Principles – A. P. Malvino, Mc Graw-Hill Publishing House
2. Electronic fundamentals and applications – J. D. Ryder, Prentice Hall 4th Edition
3. Principles of Electronics – V. K. Mehta, S. Chand Publications, New Delhi
4. Electronic Devices and Circuits – Allen Mottershead, Good year Publishing Company
5. Digital Principles and Applications – Malvino and Leach, Mc Graw-Hill Publication.
6. Modern Digital Electronics – R. P. Jain, Tata Mc Graw-Hill Pvt. Ltd., New Delhi
7. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
8. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
9. Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
10. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
11. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.

Semester III: Physics paper II

PHY 302 (B): Instrumentation

(Credits: 02) :(30 Lectures 60 Marks)

[Note: For students opting electronics as one of the subjects at F. Y. B. Sc. Class]

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Course description:
This course is aimed at introducing the fundamentals of Instrumentation to Under Graduate students.

Course objectives:
1. To impart knowledge of basic concepts in Instrumentation.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:
Learner will be able to ….

1. Apply the concept of use of knowledge of Instrumentation to real life problems.
2. Understanding of the course will create scientific temperament.

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Unit-I Fundamentals of Measurements: (04L, 8M)

Functional elements of typical measurement system, Standards of measurements and calibration, Static performance characteristics: Accuracy, Precision, Accuracy versus precision, Sensitivity, Linearity, Concept of Errors and their types.

Unit-II Measurement of Temperature: (10L, 20M)

Non - electrical Methods : Liquid- in-glass Thermometer, Pressure Thermometer construction and their types: constant volume gas thermometer and Vapour pressure Thermometer, **Electrical Methods :** Thermo-electric Sensors (Thermocouple), Metallic resistance Thermometer (Platinum resistance thermometer), Semiconductor resistance sensors (Thermistor).

Radiation Methods (Pyrometry) : Total Radiation Pyrometer, Selective Radiation Pyrometer.

Unit-III: **Measurement of Pressure: (08L, 16M)**

High pressure Measurement, Measurement of low pressure (Vacuum): McLaud Guage, Pirani Gauge, Calibration & Testing (Dead - weight tester)

Unit-IV: Acoustics (Sound) Measurement: (08L, 16M)

Characteristics of sound, Sound pressure level, Sound power level, Variation of intensity of sound with distance, Typical sound measuring system (Sound level Meter), Microphones : Condenser or capacitor type Microphone, Electrets Microphone, Electrodynamics types of Microphone, Carbon granules type Microphone

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Reference Books :

1. Instrumentation, Measurement & Analysis by (Nakra and Chaudhary), 2nd Edition
2. Instrumentation : Devices & Systems by (Rangan, Mani & Sarma), 2nd Edition
3. Basic Electronics by B. L. Thereja.
4. A Course In Electrical & Electronics Measurement & Instrumentation by A. K. Sawhney
5. Modern electronic instrumentation and Measurement Techniques by Helfrick & Cooper.

Semester III: Physics paper III:

PHY 303: Lab III

(Credits: 02): (60 L, 100M (40 Internal + 60 External))

(Note: Total 10 experiments should be performed. Minimum 05 experiments from both sections should be performed.)

Section A: General Physics-I

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the mechanical equivalent of heat (J) with the help of Joules calorimeter.
3. To determine the coefficient of thermal conductivity of a bad conductor by Lee's method and Charlton's disc method.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine thermal conductivity of rubber by tubing method.
7. To determine thermal conductivity of metal by Forbe's method.
8. To Verify Clausius-Clapeyron equation.
9. Jolly's steam calorimeter.
10. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
11. To study the variation of thermo e. m. f. across two junctions of a thermocouple with temperature.
12. Stefan's fourth power law using bulb.
13. To determine angle of prism and familiarization with Schuster`s focusing.
14. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
15. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
16. To determine Stefan's constant.

Section B: Electronics

1. Study of full wave rectifier with capacitor filter and to calculate its ripple factor.
2. Study of zener diode as a voltage regulator.
3. Study of CE transistor characteristics to find out 'β' of the transistor.
4. Study of logic gates (AND, OR and NOT) using diodes and transistors.
5. Verification of De Morgan's Theorems (using ICs).
6. To study the characteristics of Light Emitting Diode (LED).
7. Experimental verification of NAND gate as a universal building block.
8. Experimental verification of NOR gate as a universal building block.
9. To study I – V characteristic of (i) a resistor and (ii) a p–n junction diode and compare it.
10. Frequency response of CE single stage transistor amplifier and to calculate its bandwidth.
11. To determine fill factor and efficiency of solar cell.
12. Comparison of luminous intensities of two light sources by using photo voltaic cell.

OR Section B: Instrumentation

1. Use of C.R.O as a measurement tool for different electrical parameters (frequency, a.c. /d.c. voltage, pulse height, pulse width, rise time and fall time).
2. To obtain Lissajous figures using C.R.O.
3. To determine characteristics of Thermistor and to find an unknown temperature by using thermistor.
4. Use of thermocouple for measurement of temperature.
5. Measurement of errors.
6. Directional characteristics of a microphone.

7. Platinum resistance thermometer. (Determine the melting temperature of Wax)
8. Velocity of sound by phase shift method.
9. Measurement of Noise by Using Sound Pressure level Meter.

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Reference Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.
5. A text Book of Experimental Physics – Dr. V.Y. Rajopadhye, V.L.Purohit and A. S. Deshpande (Continental Prakashan, Poona-30).
6. AN ADVANCED COURSE IN PRACTCIAL PHYSICS- D. Chattopadhyay and P.C. Rakshit.
7. Practical Physics by R. K. Shukla, Anchal Srivastava (New Age International).
8. B.Sc. Practical Physics by Harnam Singh and Dr. P.S. Hemne (S. Chand).
9. Advance Practical Physics by S.P.Singh (Pragati).
10. College Practical Physics: Khanna and Gulati (S. Chand and Co. Ltd , Delhi)
11. Practical Physics: Gupta and Kumar (Pragati Prakashan Meerat)
12. Advanced Level Practical Physics: J. M.Nelkon, J.M.Ogloom (EIBS)
13. A Text book of practical Physics: Shrinivasan and Balasubranian
14. A Text book of practical Physics: Indu Prakash and Ramkrishna.
15. B.Sc. Practical Physics by C.L. Arora (S. Chand and Co. Ltd , Delhi)
16. Practical Course in Electronics by Prof. J.R.Patil and other (Jaydeep Prakashan).

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Semester III: Physics paper IV

PHY 304: Skill Enhancement Course I (SEC-I)

Renewable energy and Energy Harvesting (Credits: 02) Theory: (30 L, 60M)

[The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible]

Unit 1.Conventional and Non-conventional energy Sources: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. (**02L, 04M**)

Unit 2 . Solar Energy

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. Solar energy utilization by Solar roof panels. **(06 L,12 M)**

Unit 3. Ocean, geothermal, Hydro and Biomass energy resources.

a. **Ocean Energy**: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(03 L,06M)**
   Tidal energy,Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power. **(02 L,04M)**
b. **Geothermal Energy**: Geothermal Resources, Geothermal Technologies. **(02 L,04M)**
c. **Hydro Energy**: Hydropower resources, hydropower technologies, environmental impact of hydro power sources. **(02 L, 04M)**
d. **Biomass energy:** biomass, biochemical conversion, biogas generation, Ocean biomass **(02L,04M)**

Unit 4. Energy Harvesting:

a. **Wind Energy harvesting**: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies **(03 L,06M)**
b. **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 **(04 L,08M)**
c. **Electromagnetic Energy Harvesting**: Linear generators, physics mathematical models, recent applications, **(02 L,04M)**
d. Carbon captured technologies, cell, batteries, power consumption **(01 L,02M)**
e. Environmental issues and sustainability of renewable energy sources,. **(01 L,02M)**

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Demonstrations and Experiments

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

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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 Sukhatme 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).
7. http://en.wikipedia.org/wiki/Renewable_energy

Semester IV: Physics paper V

PHY 401: Waves, Oscillations and Acoustics

(Credits: 02) : (30 Lectures 60 Marks)

Course description:

This course is aimed at introducing the fundamentals of Waves and Sound to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Waves and Sound.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept of use of knowledge of Waves and Sound to real life problems.
2. Understanding of the course will create scientific temperament.

Unit I: Composition of two S. H. M.'s

Composition of two S.H.M.s of equal frequencies along same line (co-linear) of vibration (analytical method only), Composition of two S.H.M.s of equal frequencies acting at right angles (analytical method with different cases), Composition of two S.H.M.'s right angles to each other (time period in the ratio 1:2), Lissajous figures- demonstration by mechanical, optical and electrical methods, applications of Lissajous figure (list only). **(06L, 16M)**

Unit II: Waves Motion

General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Plane waves, Spherical waves, Wave intensity. **(05L, 8 M)**

Unit - III: Forced oscillations

Idea of forced oscillations, Resonance and its types- Mechanical resonance (Barton's pendulum), Acoustic resonance (resonance tube), Electrical resonance (LCR circuit) and Optical resonance (sodium vapour lamp), Differential equation of forced oscillations and its solution, Amplitude of forced oscillations, Amplitude resonance, Application to series L-C-R circuit. **(08L, 16M)**

Unit IV: Sound:

Parameters of Sound: Sound intensity, Loudness, Pitch, Quality and timber, Acoustic intensity level measurement, Acoustic pressure and its measurement. Reverberation and time of reverberation.

Ultrasonics: Classification of sound frequencies, Piezoelectric effect, Generation of ultrasonic waves by Piezoelectric oscillator (using transistor), Application of ultrasonic waves (list only).

Doppler effect: Doppler effect in sound, Expression for apparent frequency (no derivation), discussion of different cases when source, observer and medium are in relative motion, Asymmetric nature of Doppler effect in sound, Doppler effect in light, Symmetric nature of Doppler effect in light, Applications of Doppler effect in sound and light. **(11L, 20M)**

Reference Books:

1. Waves and oscillations- Brijlal and Subramaniyam (Vikas Publishing House)
2. Waves and Oscillations- R.N. Chaudhari, New Age International (Pvt.) Ltd.
3. Conceptual Physics- A. P. Taggarase, Jivan Sheshan (Himalaya Publishing).
4. The Physics of Waves and Oscillations- N. K. Bajaj (Tata McGraw Hill).
5. Oscillations and Waves- B. S. Agarwal (KedarNath, Ram Nath Publishers)
6. Sound- Mee and Heinmann, London Edition

Semester IV: Physics paper VI

PHY 402: Optics and LASERS

(Credits: 02) : (30 Lectures 60 Marks)

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Course description:

This course is aimed at introducing the fundamentals of Optics and LASERS to Under Graduate students.

Course objectives:

1. To impart knowledge of basic concepts in Optics and LASERS.
2. To provide the knowledge and methodology necessary for solving problems in Physics.
3. The course also involves the related experiments based on the theory.

Course outcome:

Learner will be able to ….

1. Apply the concept of use of knowledge of Optics and LASERS to real life problems.
2. Understanding of the course will create scientific temperament.

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Unit I: Geometrical Optics: Deviation produced by thin lenses, equivalent focal length of two thin lenses separated by a distance and when in contact. Power of lens, Spherical aberration in lens, reduction of spherical aberration (without derivation), Chromatic aberration, Achromatism; (two lenses in contact and separated by finite distance without derivation). **(04L, 10M)**

Unit II: Interference: Principle of superposition of two, Concept of interference, Intensity distribution in the interference pattern, Division of amplitude and division of wavefront. Young's Double Slit experiment, Expression for fringe width, Fresnel's Biprism and Lloyd's Mirror. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). fringe width in case of fringes of equal thickness. Newton's rings-experimental setup, theory and its application to determine wavelength of source and refractive index of liquids **(10L, 20M)**

Unit III : Diffraction: Definition of diffraction, Concept of diffraction, Types of diffraction, Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis, Fraunhofer diffraction: Single slit; Double Slit. Multiple slits and Diffraction grating. **(08L, 14M)**

Unit IV: Polarization: Polarization, Polarization by reflection, Brewster's law, Polarization by double refraction in uniaxial crystals, Maluss Law Double refracting crystals, Positive and negative crystals, Production and detection of circularly and elliptically polarized light, Nicol prism, Optical activity, Rotation of the plane of polarization, Specific rotation, Polarimeter or Sacherimeter, (Principle and working). **(04L, 10M)**

Unit V: Non-linear optics: Principle of LASER, Characteristics of LASER, Basic steps required to form a LASER: absorption, spontaneous emission, stimulated emission, Metastable state, population inversion, optical pumping, Types of LASER- He-Ne LASER, Applications of LASER (list only) **(04L, 06M)**

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Reference Books:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
4. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986.Addison-Wesley
5. Lasers and nonlinear optics – B. B. Laud
6. An Introduction to Laser – Theory and applications – M. N. Avadhanale
7. A textbook of Optics: Dr. N. Subrahmanyam, Brijlal and Dr. M.N.Avadhanulu, S.Chand Publishing,Co.Ltd.
8. Optics: Singh and Agrwal, Pragati Prakashan, Meerut.
9. Optics and Thermodynamics- Sarkar and Sharma, Himalaya Publishing House

Semester IV: Physics paper VII:

PHY 403: Lab IV - General Physics II

(Credits: 02): (60 L, 100M (40 Internal + 60 External))

(Note: Total 10 experiments should be performed.)

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law.
3. To study Lissajous Figures and demonstration of Lissajous figures by using C.R.O.
4. Study of acoustic resonance by using bottle as a resonator.
5. Determination of velocity of sound by using Kundt's tube.
6. Study of resonance using Kater's pendulum.
7. Log decrement
8. Damping coefficient
9. Study of acoustic resonance by using resonance tube.
10. To determine the Resolving Power of a Prism.
11. To determine the value of Cauchy Constants of a material of a prism.
12. To determine wavelength of sodium light using Fresnel Biprism.
13. To determine wavelength of sodium light using Newton's Rings.
14. To determine the refractive index of a liquid by using Newton's rings apparatus.
15. Determination of specific rotation α of optically active substance using Polarimeter.
16. Measurement of beam size of a LASER beam.
17. Measurement of beam divergence of a LASER beam.
18. To determine the wavelength of light from LASER source using Diffraction grating.
19. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating
20. To determine the Resolving Power of a Plane Diffraction Grating.
21. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

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Reference Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. B.Sc. Practical Physics: C. L. Arora, S. Chand Publishing Co. Ltd., New Delhi

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Semester IV: Physics paper VIII

PHY 404: Skill Enhancement Course II

Electrical Circuits and Network Skills

(Credits: 02) : (30 Lectures 60 Marks)

[The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode]

Unit 1. Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. **(03 L, 06 M)**

Unit 2. Understanding Electrical Circuits: Main electric circuit elements (R,L,C) and their combination. Rules to analyze DC sourced electrical circuits (KCL, KVL) Current and voltage drop across the DC circuit elements, Diode and rectifiers, . Response of inductors and capacitors with DC or AC sources Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components AC source. Power factor. Saving energy and money. **(07 L, 14 M)**

Unit 3. Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. **(04L, 08M)**

Unit 4.Generators and Transformers: Types of DC Power sources. Principle of DC/AC generators, construction of DC generator, Operation of transformers. **(03 L, 06 M)**

Unit 5.Electric Motors: Single-phase AC & DC motors (Basic design). Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. **(04 L, 8 M)**

Unit 6.Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device) **(04L, 08 M)**

Unit 7.Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board. **(05 L, 10 M)**

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Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.
4. Electrical Technology by V.K.Meheta

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