AC: 02.06.2025 ITEM NO: 21.2

Deccan Education Society's

# Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

# UNIVERSITY OF MUMBAI

Syllabus for
Program: Bachelor of Science
Course: S.Y.B.Sc
Subject: Physics

Choice Based Credit System (CBCS)
with effect from
Academic Year 2025-2026

# PROGRAM OUTCOMES

| PO | Description |
|---|---|
| A student completing Bachelor's Degree in **Arts/Commerce/Science** Program will be able to | |
| PO1 | **Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate Programme. Execute strong theoretical and practical understanding generated from the specific graduate Programme in the area of work. |
| PO2 | **Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions. |
| PO3 | **Social competence:** Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally. |
| PO4 | **Research-related skills and Scientific temper:** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research. |
| PO5 | **Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem. |
| PO6 | **Personal and professional competence:** Performing dependently and collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics. |
| PO7 | **Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centered national development and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility. |
| PO8 | **Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. |

**Deccan Education Society's**

**Kirti M. Doongursee College (Autonomous)**

**Proposed Curriculum For S.Y.B.Sc. as per NEP 2020**

**Year of implementation- 2025-26**

**Name of the Department: PHYSICS**

| Semester | Course Code | Course Title | Vertical | Credit |
|---|---|---|---|---|
| III | 25PHYMJ311 | Thermodynamics and Digital Electronics | Major | 2 |
| | 25PHYMJ312 | Mathematical Methods | Major | 2 |
| | 25PHYMN321 | Electronics | Minor | 2 |
| | 25PHYOE331 | Physics in Everyday Life-3 | OE | 2 |
| | 25PHYVS341 | Power Supplies | VSC | 2 |
| | 25PHYMJP31 | Physics Major Practical | Major Practical | 4 |
| | 25PHYMNP31 | Physics Minor Practical | Minor Practical | 2 |
| IV | 25PHYMJ411 | Electrodynamics | Major | 2 |
| | 25PHYMJ412 | Quantum mechanics | Major | 2 |
| | 25PHYMN421 | Optics | Minor | 2 |

| | | | | |
|---|---|---|---|---|
| | 25PHYOE431 | Physics in Everyday Life-4 | OE | 2 |
| | 25PHYSE451 | Operational Amplifier Applications | SEC | 2 |
| | 25PHYMJP41 | Physics Major Practical | Major Practical | 4 |
| | 25PHYMNP42 | Physics Minor Practical | Minor Practical | 2 |

| Course Code | MAJOR SEM – III - Course Title ( P I ) | Credits | Lectures/ Week |
|---|---|---|---|
| 25PHYMJ311 | Thermodynamics and Digital Electronics | 2 | 2 |

**Course Outcomes:**

After successful completion of this course, students would be able to

CO1: Remember the basic concepts of thermodynamics and digital electronics.
CO2: Understand the events happening around and correlate them with these concepts.
CO3: Apply the conceptual knowledge in daily life situations.
CO4: Analyze the situations critically for the benefit to society.

| Unit | Topics | No of Lectures |
|---|---|---|
| I | Reversible and irreversible process, Heat Engines, Carnot's cycle, Effective way to increase Efficiency, Carnot's Engines and refrigerator, Coefficient of performance, Second Law of Thermodynamics - Statements, Carnot Theorem, Steam Engine, Otto Engine, Diesel Engine.<br>BSH: 4.20, 4.23, 4.24, 4.25, 4.26, 4.27, 4.28,4.29, 4.30, 4.31& 4.33.<br><br>Low temp physics: Different methods of liquefaction of gases, Method of freezing, Cooling by Evaporation under reduced Pressure, Cooling by Adiabatic Expansion, , Joule Thomson Cooling, Principle of Regenerative Cooling, Liquefaction of Oxygen.<br>BSH: 6.3, 6.4.1, 6.4.2, 6.4.6, 7.1, 7.2, 7.3, 7.4, 7.7&7.9 | **15After successful completion of this course, students would be able to** |
| II | **Flip Flops** : RS Flip-Flops (only NOR gate latch, NAND gate latch) , Gated Flip-Flops, Edge-Triggered RS Flip-Flop, Edge- Triggered D Flip-Flop, Edge-Triggered J-K Flip-Flop, JK Master- Slave Flip-Flops. | **15** |

| | | |
|---|---|---|
| | **Types of registers:** SISO , SIPO, PISO , PIPO [in this chapter the teacher should make all IC specific diagrams into general diagrams ie. Ignore pin numbers and IC numbers] Asynchronous counter -3 bit (ignore IC specific diagrams), Synchronous counter only mod 8, Decade Counters Mod 5 and Mod 10<br><br>**LMS Articles:**<br>FFs: 8.1 to 8.5, 8.7<br>Registers: 9.1 to 9.5<br>Counters: 10.1, 10.3( upto fig 10.12)<br>10.5( upto fig 10.22). | |

**Textbooks:**

- BSH: Brijlal, Subramanyam and Hemne, Heat Thermodynamics and Statistical Physics, S Chand,Revised, Multi-coloured,2007 Ed.
- LMS: Digital Principles and Applications - Leach, Malvino, Saha_ 6th ed

**Additional References:**

- M W Zemansky and R H Dittman, Heat and Thermodynamics, McGraw Hill.
- D K Chakrabarti, Theory and Experiments on Thermal Physics, (2006 Ed) Central books.
- Evelyn Guha,Basic Thermodynamics (Narosa Publications)

| Course Code | MAJOR SEM – III - Course Title ( P II ) | Credits | Lectures/ Week |
|---|---|---|---|
| 25PHYMJ312 | Mathematical Methods | 2 | 2 |

**Course Outcomes:**

After successful completion of this course, students would be able to

CO1: Remember and learn Mathematical Techniques required to Physical phenomena and get exposure to important ideas of differential equations.
CO2: Understand non homogeneous differential equation and partial differential equation using simple methods.
CO3: Apply the principles of physics to solve new and unfamiliar problems.
CO4: Analyze different types of differential equation in program.

| Unit | Topics | No of Lectures |
|---|---|---|
| I | Differential Equations: Introduction, Ordinary differential equations: first order homogeneous and non-homogeneous differential equations with variable coefficients, Variable separable method, exact differentials equation<br><br>General first order Linear Differential equation and Second-order homogeneous differential equations with constant coefficients. Problems depicting physical situations like LC and RL circuits. | 15 |
| II | Second-order non homogeneous equations with constant coefficients, partial differential equations, some important partial differential equations in physics, method of separation of variables.<br><br>Applications of Partial differential Equation: Modeling of vibrating stretched string and two dimensional heat flow equation, Laplace's equation in two dimensions, Solution of wave equation and Helmoltz's equation. | 15 |

**Textbooks:**

- Higher Mathematical Physics, 1st Edition, 2014, by H.K. Dass and Dr. Rama Verma, S.Chand Publishing ,New Delhi -110 055(Article no.12.1 to 12.7 , page no :273-305)

**Additional References:**

- Mathematical Physics, B.D. Gupta-Vikas Publishing House, 4th Edition (2006)

- Mathematical Physics, Sathya Prakash, Sultan Chand, 6th edition (2014)
- Mathematical Physics Rajput, Pragathi Prakasan Pub., (2017)
- Mathematical Physics, H.K. Dass, S. Chand & Co., Eighth edition (2018)
- Mechanics and mathematical methods by R Murugeshn, S Chand. Elements of mechanics by Gupta.
- Mathematical physics- Piyoosh kumar tyagi , RBSA Publishers
- Mathematical Methods for Physicists: A concise introduction, - Tai L. Chow - Cambridge University Press.


| **Course Code** | **MINOR SEM – III - Course Title** | **Credits** | **Lectures/ Week** |
|---|---|---|---|
| **25PHYMN321** | **ELECTRONICS** | **2** | **2** |

**Course Outcomes:**

After successful completion of this course, students would be able to

CO1: Remember the basics of transistor biasing, operational amplifiers, their applications

CO2: Understand the basic concepts of oscillators and be able to perform calculations using them

CO3: Apply quantitative problem solving skill in all the topics covered

CO4: Analyze techniques of electronics for betterness of society

| **Unit** | **Topics** | **No of Lectures** |
|---|---|---|
| **I** | 1.Faithful amplification, Transistor Biasing, Inherent Variations of Transistor Parameters, Essentials of a Transistor Biasing Circuit, Methods of Transistor Biasing, Base Resistor Method, Emitter Bias Circuit, Circuit analysis of Emitter Bias, Voltage Divider Bias Method.<br>2.General amplifier characteristics**:** Concept of amplification, amplifier notations, current gain, Voltage gain, power gain, | **15** |

| | | |
|---|---|---|
| | input resistance, output resistance, frequency response, Decibel gain and Band width. General theory of feedback, reasons for negative feedback, loop gain. | |
| **II** | 1. Oscillators**:** Introduction, effect of positive feedback. Requirements for oscillations, phase shift oscillator, Wien Bridge Oscillator, Colpitt's oscillator.<br>2. **Operational Amplifiers:** Introduction, Schematic symbol of OPAMP, Output voltage from OPAMP, , Bandwidth of an OPAMP, Slew rate, Frequency Response of an OPAMP, Virtual ground concept , gain , offset voltage and current , OPAMP with Negative feedback, Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, Summing Amplifier, Applications of Summing amplifier, OPAMP Integrator and Differentiator, Critical frequency of Integrator, Comparator. | **15** |

**References:**


- Principles of Electronics – V. K. Mehta and Rohit Mehta. (S. Chand – Multicolour
- revised edition)
- Digital Principles and Applications - Leach, Malvino, Saha_ 6th ed
- Electronic devices and circuits – An introduction Allan Mottershead (PHI Pvt. Ltd.– EEE – 1986)


**Additional References:**


- Functional Electronics - K. V. Ramanan, TMH Publication.
- Electronic Principles – Malvino and Bates, 7 th edition, TMH publication.

| Course Code | OPEN ELECTIVE –SEM III - | Credits | Lectures/ Week |
|---|---|---|---|
| **25PHYOE331** | **Physics in Everyday Life-3** | **2** | **2** |

**Course Outcomes:**

After successful completion of this course, students would be able to

CO1: (Remember) Physical laws, Fundamental dimensions, various parameters of waves and geometrical optics

CO2: (Understand) Laws of motion, light reflection and refraction and common features of waves.

CO3: (Apply) laws of motion, wave propagation and concepts optics in daily life

CO4: (Analyze) the problem on the basis of laws of mechanics, sound and optics.

| Unit | Topics | No of Lectures |
|---|---|---|
| **I** | **Classical Mechanics:** Galileo's laws, Keplers laws , Dimensions and unit of physical quantities (Fundamental units and derived units), Action of physical force on an object, Introduction to Newton's laws, Conservation of momentum (Newton cradle) and their application in daily life, Friction and its application to simple problems, | **15** |
| **II** | **Sound and Optics**: Types of waves, common properties of waves, characteristics of transverse waves and longitudinal waves, Echo and Acoustics, qualities of sound, Doppler effect.<br><br>Nature of light, Geometrical optics and physical optics, laws of reflection and refraction, reflection from plane and curved surfaces, aberrations, total internal reflection and its applications, dispersion, microscopes and telescopes. | **15** |

**References:**


1. University of Physics, by Hugh D. Young, Roger A. Freedman, Fifteenth Edition, Pearson
2. Dr. N. Subrahmanyam, Brijlal, and Dr. M. N. Avadhanulu, A Textbook of Optics, 25th Revised Edition 2012(Reprint 2016), S. Chand and Company Pvt. Ltd.
3. H. J. Pain, The physics of vibrations and waves, 6 th edition.


**Additional References:**


4. Fundamental of Physics, by Haliday, Robert Resnick, Jearl Walker, 12 edition, Wiley.
5. The Feynman Lectures on Physics, by Richard Feynman, Leighton, Sands, Pearson Education.

| Course Code | VOCATIONAL SKILL COURSE SEM III | Credits | Lectures/ Week |
|---|---|---|---|
| 25PHYVC341 | POWER SUPPLIES | 2 | 4 |

**Course Objectives:**

On successful completion of this course students will be able to:

CO1: Remember & practice the skills while performing experiments,the concept of errors and their estimation..

CO2: Understand the use of apparatus and their use without fear & hesitation.

CO3: Apply and Correlate the physics theory concepts to practical application.

CO4: Analyse various power supply circuits with their advantages and disadvantages.

| EXPERIMENT NO. | POWER SUPPLIES | No of Lectures |
|---|---|---|
| 1 | Study of Transformer | 60 |
| 2 | Half Wave Rectifier | |
| 3 | Full Wave Rectifier ( Two Diodes ) | |
| 4 | Bridge Rectifier | |
| 5 | Ripple factor and percentage regulation measurement | |
| 6 | Power supply using IC | |
| 7 | Regulated Power supplies | |
| 8 | Unregulated Power Supplies | |

All 8 experiments should be completed and reported in the journal, in the first semester. **Certified Journal is a must,** to be eligible to appear for practical examination.

## References:


1. B.Sc PRACTICAL Physics – Harnam Singh S.Chand& Co. Ld. 2001
2. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)


## Additional References:


3. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S.Chand and Co Ltd.
4. Practical Physics CL Squires (3rd Edition) Cambridge University

| Course Code | PRACTICAL SEM III | Credits | Lectures/ Week |
|---|---|---|---|
| 25PHYMJP31 | Practical (Major) | 4 | 8 |
| | | | |

**Learning Outcomes:**

**On successful completion of this course students will be able to:**

CO1: Remember practical skills while performing experiments.

CO2: Understand the use of apparatus and their use without fear & hesitation.

CO3: Apply physics theory concepts to practical application.

CO4: Analyse the concept of errors and their estimation**.**

**Instructions:**

1. All the measurements and readings should be written with proper units in SI system only.
2. After completing all the required number of experiments in the semester and recording them in journal, student will have to get their journal certified and produce the certified journal at the time of practical examination.
3. While evaluating practical, weightage should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
4. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

- Each experiment will be of four lecture hours' duration.
- A Minimum 12 from each group and in all minimum 25 experiments must be reported in journal.
- Students are required to report all these experiments in the journal. Evaluation in viva voce will be based on regular experiments.

A learner will be allowed to appear for the external practical examination only if he submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester III as per the minimum requirements.

| EXPERIMENT NO. | | No of Lectures |
|---|---|---|
| **GROUP A** | | |
| 1 | Thermocouple | 120 |
| 2 | Young's modulus by Koenig's method/ Y by bending. | |
| 3 | Young's Modulus (Y) of Flat spiral spring. | |
| 4 | Modulus of rigidity for the material of Flat spiral spring. | |
| 5 | Determination of acceleration due to gravity using BAR pendulum | |
| 6 | Y By Bending | |
| 7 | Log Decrement using Simple Pendulum | |
| 8 | LCR parallel resonance | |
| 9 | Verification of Stefan's law (Electrical method) | |
| 10 | Constant pressure air thermometer | |
| 11 | Newton's law of cooling | |
| 12 | PC simulations: graph, curve fitting, etc | |
| **GROUP B** | | |
| 13 | Square wave oscillator using gates | |
| 14 | Study of MS-JK flip flop | |
| 15 | MOD 2 , MOD 5 & MOD 10 counter using IC 7490 | |
| 16 | CE amplifier : Variation of gain with load | |
| 17 | Searl's experiment: Determination for Young's Modulus | |
| 18 | Introduction to Number systems and their conversion. | |
| 19 | To study basic logic gates and verify its truth table. | |

| | | |
|---|---|---|
| **20** | To study EX-OR gate and verify its truth table. | |
| **21** | Construct basic logic gates using Universal gates. | |
| **22** | Verify De-Morgan's Theorem. | |
| **23** | Working of Half adder circuit. | |
| **24** | CE amplifier: Determination of bandwidth | |

**Note:** Minimum **16** experiments (Eight From each group) should be completed and reported in the journal, in the first semester. **Certified Journal is a must,** to be eligible to appear for the semester end practical examination.

**Semester End Practical Examination:**

**Scheme of Examination:**

There will be a sem end assessment for practical. A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department /Institute to the effect that the candidate has completed the practical course of that semester of S.Y.B.Sc. Physics as per the minimum requirement. The duration of the practical examination will be of two hours per experiment. There will be two experiments (one from each group) through which the candidate will be examined in practical. The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for its skill and understanding of physics.

**References:**


1. Advanced course in Practical Physics D. Chattopadhya, PC Rakshit& B Saha. (6th Edition) Book and Allied Pvt.Ltd.
2. B.Sc PRACTICAL Physics – Harnam Singh S.Chand& Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)


**Additional References:**


4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S.Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop&Flint.

| Course Code | PRACTICAL SEM – III - Course Title | Credits | Lectures/ Week |
|---|---|---|---|
| 25PHYMNP31 | PHYSICS MINOR PRACTICAL | 2 | 4 |

**Course Objectives:**

On successful completion of this course students will be able to:

CO1: Remember the basic concepts of OPAMP and Bipolar Junction Transistor.

CO2:Understand the relent concepts and designing of experiments.

CO3: Apply the physics theory concepts to practical application.

CO4: Analyse the concept of experiments by recording the observations and plotting of graph, and errors and their estimation.

| EXPERIMENT NO. | MINOR | No of Lectures |
|---|---|---|
| 1 | OPAMP: Inverting Amplifier with different gain | 60 |
| 2 | OPAMP: Non-inverting amplifier | |
| 3 | Study of CE Amplifier: Determination of Bandwidth | |
| 4 | Study of CE Amplifier: Verification of gain with load | |
| 5 | OPAMP: Difference amplifier | |
| 6 | OPAMP: Unity gain follower | |
| 7 | C1/C2 by Wien Bridge Oscillator | |
| 8 | OPAMP: As integrator | |
| 9 | OPAMP: As differentiator | |
| 10 | To study output characteristics of common emitter amplifier. | |

Minimum 8 experiments should be completed and reported in the journal, in the third semester. **Certified Journal is a must,** to be eligible to appear for practical examination.

**References:**


1. Advanced course in Practical Physics D. Chattopadhya, PC Rakshit& B Saha. (6th Edition) Book and Allied Pvt.Ltd.
2. B.Sc PRACTICAL Physics – Harnam Singh S.Chand& Co. Ld. 2001

**Additional References:**A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)

3. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S.Chand and Co Ltd.

| Course Code | SEM – IV MAJOR PAPER I | Credits | Lectures/ Week |
|---|---|---|---|
| **25PHYMJ411** | **Electrodynamics** | **2** | **2** |
| | | | |

**Course Outcomes:**

After successful completion of this course, students would be able to

CO1: Remember terms and concepts related to the course.

CO2: Understand the topics and identify their applications.

CO3: Apply the knowledge acquired to solve the related problems.

CO4: Analyse the problems properly to come out with concrete solutions to existing situations.

| Unit | Topics | No of Lectures |
|---|---|---|
| **I** | **Electrodynamics and Vector calculus:**<br>Line, surface, volume integrals, Fundamental theorems of Gradient, Curvilinear co-ordinates, Divergence and Curl.<br>**DG**: 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.5, 1.4, 2.2.2, 2.2.4 | **15** |
| **II** | **Electromagnetism (Electrostatics & Magnetostatics)**<br>Coulomb's law, Comments on potential, Poisson's equation and Laplace's equation.<br>Solution and properties of 1D Laplace equation. Properties of 2D and 3D Laplace equation (without proof). First & Second Uniqueness theorem<br>**DG**: 2.1.2, 2.1.3, 2.3.2, 2.3.3, 3.3.2, 3.3.3, 3.3.4, 3.1.5, 3.1.6<br>Magnetization, The Divergence and Curl of B, Ampere's law in magnetized materials, Comparison of Magnetostatics and Electrostatics ,<br>Bound currents and their physical interpretation, Magnetic susceptibility and permeability.<br>**DG**: 5.2.1, 5.2.2, 5.3.1, 5.3.2, 5.3.3, 5.3.4, 6.1.4, 6.2.1, 6.2.2, 6.4.1 | **15** |

**Textbooks:**

- DG : Introduction to Electrodynamics : David J. Griffiths (3rd Ed) Prentice Hall of India.

**Additional References:**


- Introduction to Electrodynamics: A. Z. Capria and P. V. Panat. Narosa Publishing House.
- Engineering Electrodynamics : William Hayt Jr. & John H. Buck (TMH).
- Electricity and Magnetism :Navina Wadhwani (PHI – 2010).

| Course Code | MAJOR SEM – IV - Course Title P II | Credits | Lectures/ Week |
|---|---|---|---|
| 25PHYMJ412 | QUANTUM MECHANICS | 2 | 2 |
| | | | |

**Course Outcomes:**

After successful completion of this course, students would be able to

CO1: Remember difference between classical and Quantum Mechanics

CO2: Understand Concept of Quantum mechanics

CO3: Apply the knowledge acquired to solve the related problems.

CO4: Analyze the problems properly to come out with concrete solutions to existing situations

| Unit | Topics | No of Lectures |
|---|---|---|
| I | Concepts of operator in quantum mechanics examples – position, momentum and energy operators.Eigenvalue equations, expectation values of operators.Schrodinger equation.Postulates of Quantum Mechanics.<br>Analogy between Wave equation and Schrodinger equation.<br>Time dependent and time independent (Steady State) Schrodinger equation, Stationary State Superposition principle.<br>Probability current density, Equation of continuity and its physical significance.Concept of wave function, Born interpretation of wave function.Concepts of operator in quantum mechanics examples – position, momentum and energy operators.Eigenvalue equations, expectation values of operators.<br>Schrodinger equation.Postulates of Quantum Mechanics.<br>Analogy between Wave equation and Schrodinger equation.<br>Time dependent and time independent (Steady State) Schrodinger equation, Stationary State<br>Superposition principle.Probability current density, Equation of continuity and its physical significance.<br>Concept of wave function, Born interpretation of wave function.<br>Concepts of operator in quantum mechanics examples –<br>position, momentum and energy operators.<br>Eigenvalue equations, expectation values of operators.<br>Schrodinger equation.Postulates of Quantum Mechanics. | 15 |

| | | |
|---|---|---|
| | Analogy between Wave equation and Schrodinger equation.<br>Time dependent and time independent (Steady State) Schrodinger equation, Stationary StateSuperposition principle.<br>Probability current density, Equation of continuity and its physical significance. | |
| **II** | Applications of Schrodinger steady state equation-I<br>Free particle.Particle in infinitely deep potential well (one - dimension).Particle in finitely deep potential well (one - dimension).Step potential.Particle in three dimension rigid box, degeneracy of energy state. | **15** |
| | | |
| | | |

**References:**


1. Concepts of Modern Physics – A. Beiser (6th Ed.) Tata McGraw Hill.

2 Quantum Mechanics – S P Singh, M K Bagade, Kamal Singh, - S. Chand : 2004 Ed.

3. Quantum Mechanics of Atoms, Molecules, Solids, Nuclei and particles. - By R. Eisberg and R. Resnik Published by Wiley.


**Additional References:**


1.Introduction to Quantum Mechanics. - By D. Griffiths Published by Prentice Hall.

2.Quantum Mechanics. - By Ghatak and Lokanathan Published by Mc. Millan.

3.Quantum Mechanics. - By L. I. Schiff.

| Course Code | MINOR SEM – IV - Course Title | Credits | Lectures/ Week |
|---|---|---|---|
| 25PHYMN421 | Optics | 2 | 2 |

**Course Outcomes:**

After successful completion of this course, students would be able to

CO1: Remember the diffraction, polarization processes and applications of them in physical situations.

CO2: Understand the applications of interference in design and working of interferometers.

CO3: Apply concept of interference and diffraction in different optical instruments.

CO4: Analyze the diffraction and interference in day to day life

| Unit | Topics | No of Lectures |
|---|---|---|
| I | Diffraction and Polarization<br>1. **Fresnel diffraction:** Introduction, Huygens-Fresnel's theory, Fresnel's assumptions, Distinction between interference and diffraction, Fresnel and Fraunhoffer types of diffraction, Diffraction pattern due to straight edge: positions of maximum and minimum intensity<br>SBA: 17.1, 17.2, 17.3, 17.6, 17.7, 17.10, 17.10.1<br>2. **Fraunhoffer diffraction:** Introduction, Fraunhoffer diffraction at a single slit, intensity distribution in diffraction pattern due to a single slit, Fraunhoffer diffraction at double slit, Distinction between single slit and double slit diffraction patterns<br>SBA: 18.1, 18.2, 18.2.1, 18.4, 18.4.2<br>3. **Polarization:** Introduction, Malus' Law, Production of Polarized light: The wire grid polarizer and a Polaroid, Polarization by Reflection, Polarization by Double Refraction, Interference of Polarized light: Quarter wave plates and half wave plates (Qualitative) Ordinary and Extraordinary Rays, Positive and Negative crystals<br>AG: 22.1, 22.2, 22.3, 22.3.1, 22.3.2, 22.3.3, 22.6<br>SBA: 20.11.2, 20.11.3 | 15 |

| | | |
|---|---|---|
| **II** | **Interferometers and Resolving Power**<br><br>1. **Michelson's Interferometer**: Principle, construction, working, circular fringes, localized fringes, White light fringes, Visibility of fringes.<br>Applications of Michelson Interferometer: a) Measurement of wavelength b) Determination of the difference in the wavelength of two waves c)Thickness of a thin transparent sheet d) Determinaton of the refractive index of gases .<br>SBA: 15.7, 15.7.1 to 15.7.7, 15.8, 15.8.1 to 15.8.4<br><br>2. **Resolving Power**:Introduction, Rayleigh's criterion, Resolving power of optical instruments, Criterion for resolution according to Lord Rayleigh, Resolving power of a telescope, Resolving power of a prism, Resolving power of a plane transmission grating.<br>SBA: 19.1, 19.2, 19.5, 19.6, 19.7, 19.11, 19.12 | **15** |

**References:**


1. (SBA) Dr. N. Subrhmanyam, Brijlal, and Dr. M. N. Avadhanulu A Textbook of Optics, 25th Revised Edition (2012) S. Chand
2. (AG) Ajoy Ghatak, Optics 6E Mc Graw Hill Education


**Additional References:**


1. Principles of optics by B.K Mathur and P.P. Pandya (3 edition McGraw Hill International)
2. Fundamental of optics by Jenkins and White (4th edition McGraw Hill International)
3. Optics by C.L.Arora S. Chand and company Ltd. 2001

| Course Code | OPEN ELECTIVE SEM – IV- Course Title | Credits | Lectures/ Week |
|---|---|---|---|
| **25PHYOE431** | **Physics in Everyday Life-4** | **2** | **2** |

**Course Outcomes:**

After successful completion of this course, students would be able to

CO1: Remember Examine the atomic model, origin of electric and magnetic fields.

CO2: Understanding the concept of atom, photoelectric effect and optical fiber, comparison of electric and magnetic fields and their sources.

CO3: Apply Laws of physics, electricity and magnetism to application in modern physics.

CO4: Analyze the problems on the basis of basic concept.

| Unit | Topics | No of Lectures |
|---|---|---|
| **I** | **Modern Physics and its applications:** Constituents of atoms, Atomic structure, What is modern physics, Black body radiation, Introduction to photoelectric effect and its application, LASER and its application, Optical fiber and its applications, Introduction to relativity and quantum mechanics. | **15** |
| **II** | **Electricity and Magnetism:** Sources of electricity and magnetism and laws governing electric and magnetic field forces, Flux of electric and magnetic fields, Gauss law law in electrostatics, Ampere's law in magnetostatics, Ohm's law, conductors, insulators and semiconductors, electromotive force (emf), Bar magnet, earth's magnetism, Applications of electricity and magnetism. | **15** |

**References:**


1. Elements of modern physics by R Murugeshan, Kiruthiga Sivaprasth, S Chand publication.
2. Modern Physics by Kenneth S. Krane, Fourth Edition, Willey Publication.


**Additional References:**


1. Problems in modern physics by P.Mandal, 2nd edition, Techno word Publication.
2. Electricity and Magnetism by Brijlal.
3. Electromagnetism by John C. Slater.

| Course Code | SKILL ENHANCEMENT COURSE<br>SEM – IV | Credits | Lectures/ Week |
|---|---|---|---|
| **25PHYSE451** | **Operational Amplifier Applications** | **2** | **4** |

**Course Outcomes:**

After successful completion of this course, students would be able to

CO1: remember the concept of logic gates in digital electronics.

CO2: understand the working of logic gates.

CO3: apply the concept of logic gates in digital systems and their design process.

CO4: analyze and create basic digital circuits for practical real world application.

| Topics | No of Lectures |
|---|---|
| 1. OPAMP: Summing Amplifier | **60** |
| 2. OPAMP: Difference Amplifier | |
| 3. OPAMP: Differentiator | |
| 4. OPAMP: Integrator | |
| 5. OPAMP: Unity gain follower | |
| 6. OPAMP: Inverting Amplifier with different gain | |
| 7. OPAMP: Non-inverting amplifier | |
| 8. OPAMP: comparator | |
| 9. OPAMP: schmitt trigger | |
| 10. OPAMP: Wien bridge oscillator | |
| 11. OPAMP: instrumentation amplifier | |
| 12. OPAMP as a buffer | |

**References:**


- R.P Jain,"Modern digital electronics", Tata McGraw Hill.
- Gotham,"Digital Electronics-An introduction to theory and practice",Pearson Education.


**Additional references:**


- Douglas-Hall,"Digital Circuits and systems", Tata McGraw Hill.

- Digital Principles and Applications - Leach, Malvino, Saha_ 6th ed

| Course Code | MAJOR PRACTICAL SEM – IV- Course Title | Credits | Lectures/ Week |
|---|---|---|---|
| 25PHYMJP41 | SEM – IV MAJOR PRACTICAL | 4 | 8 |

**Course outcomes:**

**On successful completion of this course students will be able to:**

CO1: Remember practical skills while performing experiments.
CO2: Understand the use of apparatus and their use without fear & hesitation.
CO3: Apply physics theory concepts to practical application.

CO4: Analyse the concept of errors and their estimation**.**

**Instructions:**

1. All the measurements and readings should be written with proper units in SI system only.
2. After completing all the required number of experiments in the semester and recording them in journal, student will have to get their journal certified and produce the certified journal at the time of practical examination.
3. While evaluating practical, weightage should be given to circuit/ray diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
4. Skill of doing the experiment and understanding physics concepts should be more important than the accuracy of final result.

- For practical examinations, the learner will be examined in three experiments (one from each group).
- Each experiment will be of four lecture hours' duration.
- A Minimum 12 from each group and in all minimum 25 experiments must be reported in journal.
- Students are required to report all these experiments in the journal. Evaluation in viva voce will be based on regular experiments and skill experiments.
- A learner will be allowed to appear for the semester and practical examination only if he submits a certified journal of Physics or a certificate that the learner has completed the practical course of Physics Semester IV as per the minimum requirements.

| **EXPERIMENT NO.** | | **No of Lectures** |
|---|---|---|
| | **GROUP A** | |
| **1** | Optical lever: determination of μ | **120** |
| **2** | Cylindrical obstacle: determination of λ/ Fresnel's bi-prism: determination of λ | |
| **3** | Determination of Couchy's constants | |
| **4** | R.P. of telescope/ R.P. of grating | |
| **5** | Brewster's law: determination of μ | |
| **6** | Determination of wavelength of laser using grating | |
| **7** | Cylindrical abstract: Determination of wavelength. | |
| **8** | Determination of R.I. of liquid by laser | |
| **9** | Fresnel diffraction-straight edge, cylindrical obstacle using LASER | |
| **10** | Fraunhoffer diffraction- Single slit, Double slit, Diffraction grating, reflection grating (steel ruler, CD, etc.), transmission grating (wire gauge, fabric, etc.) | |

| | | |
|---|---|---|
| 11 | Total internal reflection using LASER | |
| 12 | Spectrometer: Mean refractive index for Yellow doublet of mercury source. | |
| 13 | Error analysis of a given experiment. | |
| **GROUP B** | | |
| 14 | Study of 8 Bit D latch. | |
| 15 | Study of 8 Bit Unidirectional Buffer/ Bidirectional Buffer. | |
| 16 | Verification of Inverse square law using LUX meter | |
| 17 | Diode as a temperature sensor | |
| 18 | To determine self inductance of a coil by Maxwell bridge. | |
| 19 | Passive band pass filter | |
| 20 | Passive low pass filter | |
| 21 | Passive high pass filter | |
| 22 | Slew rate of OPAMP | |
| 23 | Wave form generation using OPAMP- Square wave, triangular wave | |
| 24 | First order active notch filter | |
| 25 | Transistorized bistable multivibrator | |

**Note:** Minimum **24** experiments (Twelve From each group) should be completed and reported in the journal, in the first semester. **Certified Journal is a must,** to be eligible to appear for the semester end practical examination.

**Semester End Practical Examination:**

**Scheme of Examination:**

There will be a sem end assessment for practical. A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the

Department /Institute to the effect that the candidate has completed the practical course of that semester of S.Y.B.Sc. Physics as per the minimum requirement. The duration of the practical will be of two hours examination per experiment. There will be two experiments (one from each group) through which the candidate will be examined in practical. The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for its skill and understanding of physics.

**References:**


1. Advanced course in Practical Physics D. Chattopadhya, PC Rakshit& B Saha. (6th Edition) Book and Allied Pvt.Ltd.
2. B.Sc PRACTICAL Physics – Harnam Singh S.Chand& Co. Ld. 2001
3. A test book of advanced practical PHYSICS _ SAMIR Kumar Ghosh, New Central Book Agency (3rd edition)


**Additional References:**


4. B.Sc. Practical Physics – CL Arora (1st Edition) -2001 S.Chand and Co Ltd.
5. Practical Physics CL Squires (3rd Edition) Cambridge University
6. University Practical Physics – DC Tayal. Himalaya Publication
7. Advanced Practical Physics – Worsnop&Flint.

| Course Code | MINOR PRACTICAL SEM – IV- Course Title | Credits | Lectures/ Week |
|---|---|---|---|
| 25PHYMNP41 | SEM – IV MINOR PRACTICAL | 2 | 4 |

**Course Outcomes:**

On successful completion of this course students will be able to:

CO1: Remember practical skills while performing experiments.

CO2: Understand the use of apparatus and their use without fear & hesitation.

CO3: Apply physics theory concepts to practical application.

CO4: Analyse the concept of errors and their estimation.

| EXPERIMENT NO. | MINOR | No of Lectures |
|---|---|---|
| 1 | Determination of Couchy's constants | 60 |
| 2 | R.P. of telescope/ R.P. of grating | |
| 3 | Brewster's law: determination of μ | |
| 4 | Polarimeter: Determination of specific rotation of sugar solution | |
| 5 | Determination of wavelength of laser using grating | |
| 6 | Determination of R.I. of liquid by laser | |
| 7 | Study Michelson Interferometer | |
| 8 | Single slit fraunhofer diffraction | |
| 9 | Optical lever determination of refractive index | |
| 10 | Recognition of positive/negative crystal | |

8 experiments should be completed and reported in the journal, in the fourth semester.

**Certified Journal is a must,** to be eligible to appear for practical examination.

**References:**


1. Advanced course in Practical Physics D. Chattopadhya, PC Rakshit& B Saha. (6th Edition) Book and Allied Pvt.Ltd.
2. B.Sc PRACTICAL Physics – Harnam Singh S.Chand& Co. Ld. 2001


**Additional References:**


1. University Practical Physics – DC Tayal. Himalaya Publication
2. Advanced Practical Physics – Worsnop&Flint.

## Evaluation Scheme for Second Year (UG) under NEP (2 credits)

I. Internal Evaluation for Theory Courses – 20 Marks

1. Continuous Internal Assessment(CIA) Assignment - Tutorial/ Case Study/Project / Presentations/ Group Discussion / Ind. Visit. – 10 marks

2. Continuous Internal Assessment(CIA) ONLINE Unit Test – 10 marks

II. External Examination for Theory Courses – 30 Marks

Duration: 1 Hours

Theory question paper pattern: All questions are compulsory.

| Question | Based on | Marks |
|---|---|---|
| Q.1 | Unit I | 15 |
| Q.2 | Unit II | 15 |

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & theallocation of Marks depends on the weightage of the topic.

III. Practical Examination

- Each core subject carries 100 (50+50) Marks.
- Duration: 2 Hours for each practical course.
- Minimum 80% practical from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam

NOTE: To pass the examination, attendance is compulsory in both Internal & External (Theory + Practical) Examinations.