AC 20.08.22 ITEM NO: 1.21

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: F.Y.B.SC.
Subject: Physics

Choice Based Credit System (CBCS)
with effect from
Academic Year 2022-2023

| Course Code | Course Title (Semester I) | Credits | Lectures/Week |
|---|---|---|---|
| **KUSPH22101** | **Paper 1 -** Classical Physics | **2** | **3** |

**About the Course:** The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics.

**Course Objectives:**

1. Understand Newton's laws and applications in daily life.
2. Understand the concepts of friction
3. Understand Work and Energy Equivalence
4. Understand the concepts of Elasticity, Viscosity and Fluid dynamics
5. Understand behavior of real gases in relation to their thermo dynamical response.

**Learning Outcomes:**

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

1. Apply Newton's laws for the calculations of the motion of simple systems.
2. Use Work and Energy equivalence and its applications through suitable numerical.
3. Use Elasticity, Viscosity and Fluid dynamics in daily life.
4. Understand Real gases and validity of the laws of thermodynamics.
5. Demonstrate quantitative problem solving skills in all the topics covered

| Unit | Topics | No of Lectures |
|---|---|---|
| **I** | 1. **Newton's Laws of Motion**: Newton's first, second and third laws of motion, interpretation and applications, pseudo forces, inertial and non-inertial frames of reference. Worked out examples (with friction present). HCV: 5.1 to 5.5<br><br>2. **Friction:** Advantages & disadvantages of friction in daily life, Friction as the component of Contact force, Kinetic Friction, Static friction, laws of friction, Understanding friction at Atomic level. HCV: 6.1 to 6.5<br><br>3. **Work and Energy:** Kinetic Energy, Work and Work-energy theorem, Potential Energy, Conservative and Non Conservative Forces, Different forms of Energy: Mass Energy Equivalence Worked out Examples. HCV: 8.1, 8.2, 8.5, 8.6, 8.11 | **15** |
| **II** | **1. Elasticity:** An introduction to Elasticity, Stress, Strain, | **15** |

| | | |
|---|---|---|
| | Hooke's Law and Moduli of Elasticity and relation between them<br>HCV**:** 14.2, 14.3, 14.4, 14.5<br><br>2. **Viscosity:** An introduction to Viscosity, Flow through a Narrow Tube: Poiseuille's Equation, Stokes' Law, Terminal velocity, Measuring Coefficient of Viscosity by Stokes' method, Critical velocity and Reynolds number. Worked out Examples<br>HCV: 14.15, 14.16, 14.17, 14.18, 14.19, 14.20<br><br>3. **Fluid Mechanics:** Streamline and Turbulent flow, Equation of Continuity, Bernoulli's equation, Applications of Bernoulli's equation. Worked out Examples<br>HCV: 13.8, 13.10, 13.11, 13.12 | |
| **III** | **1. Behavior of real gases:** An introduction, Van der Waals equation of state BSH: 2.8<br><br>**2. Laws of Thermodynamics:** Thermodynamic Systems, Zeroth law of thermodynamics, Concept of heat, Thermodynamic Equilibrium, Work: A Path dependent function, Internal energy, First law of Thermodynamics, Internal Energy as a state function, Specific heat of gases, Applications of First Law of thermodynamics, The indicator diagram, Work done during Isothermal and Adiabatic processes<br>BSH: 4.1 to 4.13<br><br>**3. Heat engine:** Definition of Efficiency of heat engine, Carnot's Ideal heat engine, and Numerical examples<br>BSH: 4.21, 4.22, 4.23 | **15** |
| | ***Note: A good number of numerical examples are expected to be covered during the prescribed lectures.*** | |

**Textbooks:**

1. **HCV:** H. C. Verma, Concepts of Physics – Part I, (Second Reprint of 2020) Bharati Bhavan Publishers and Distributers
2. **BSH:** BrijLal, Subrahmanyam and Hemne, Heat Thermodynamics and Statistical Physics, S. Chand , Revised, Multi-coloured, (Reprint 2019)

**Additional References:**

1. **Halliday, Resnick and Walker, Fundamental of Physics (extended) – (6th Ed.), John Wiley & Sons.**
2. **D.S Mathur, P.S Hemne, Mechanics, 2012, S. Chand**
3. **M. W Zemansky and R. H Dittman, Heat and Thermodynamics, McGraw Hill.**
4. **Thornton and Marion, Classical Dynamics (5th Ed.)**
5. **D. S Mathur, Element of Properties of Matter, S. Chand & Co.**
6. **R. Murugeshan and K. Shivprasath, Properties of Matter and Acoustics, S. Chand.**
7. **D. K Chakrabarti, Theory and Experiments on Thermal Physics,(2006 Ed.), Central**

**books.**
8. **Hans and Puri, Mechanics, (2nd Ed.) Tata McGraw Hill**

| Course Code | Course Title (Semester I) | Credits | Lectures /Week |
|---|---|---|---|
| KUSPH22102 | Paper 2 - Modern Physics | 2 | 3 |

**About the Course:**

**Course Objectives:**

- To grasp and understand the basic concepts of Modern Physics

**Learning Outcomes:**

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

1. Understand nuclear properties, nuclear behavior and various types of nuclear reactions
2. Understand the concept of radioactivity, its applications and different types of equilibria in radioactive elements
3. Understand various types of nuclear detectors and their applications
4. Demonstrate and understand the quantum mechanical concepts.
5. Demonstrate quantitative problem solving skills in all the topics covered.

| Unit | Topics | No of Lectures |
|---|---|---|
| I | **1. Basic properties of nuclei**: Composition, Charge, Size, density, Spin and Magnetic dipole moment, Rutherford's experiment and estimation of nuclear size , mass defect and binding energy, BE/A vs A plot and its interpretation, stability of nuclei (N vs Z plot)<br>Problems<br>AB: 11.1, 11.2, 11.3, 11.4<br>SBP: 4.1.2<br><br>**2. Radioactivity:** Review of properties of α, β and γ-rays. Law of Radioactive decay, half-life and mean life (derivation required), units of radioactivity, statistical nature of radioactivity, successive radioactive disintegration- A to B to C (stable) type, natural radioactive series, radioactive equilibriums, artificial radioactivity, determination of the age of the Earth, Carbon dating, radioisotopes and its applications, radiation hazards.<br>Problems<br>SBP: 2.3, 2.4, 2.6, 2.7, 2.8, 2.9, 2.11, 2.12, 2.13<br>DCT: 2.13 Page No.86 and 87 | 15 |

| | | |
|---|---|---|
| | AB: 12.1 Page No. 422,423 | |
| **II** | **1. Radiation Detectors**: Interaction between particles and matter, plot of variation of ionization current with applied voltage, Gas filled radiation detectors- Ionization chamber (qualitative), Proportional Counter and GM Counter<br>Problems<br>SBP: 1.I.1, 1.I.2, 1.I.3 (i, ii)<br>SNG: Figure: 7.3 (exclude mode of operation), 7.4<br><br>**2. Nuclear Reactions**: Introduction, types of nuclear reactions, conservation laws (mass, energy and charge), concept of compound and direct reaction, Q value equation and solution of the Q equation, threshold energy<br>Problems<br>SBP: 3.1, 3.2, 3.3, 3.4, 3.5 | **15** |
| **III** | Review (Photoelectric effect, Black body, Black Body spectrum, Wien's displacement law)<br>**1. Origin of Quantum theory**: Matter waves: De Broglie waves, Concept of wave packet, phase velocity, group velocity and relation between them, wave particle duality, Davisson-Germer experiment, Heisenberg's Uncertainty Principle<br>AB: 3.1, 3.2, 3.3, 3.4, 3.5, 3.7, 3.8, 3.9<br><br>2. **X-Rays:** Production and properties, X-Ray spectra, X-Ray Diffraction, Bragg's Law, Compton Effect, Pair production, Photons and Gravity, Gravitational Red Shift, Black holes<br>AB: 2.5, 2.6, 2.7, 2.8, 2.9 | **15** |
| | ***Note: A good number of numerical examples are expected to be covered during the prescribed lectures*** | |

**Textbooks:**

1. AB: Arthur Beiser, Concepts of Modern Physics, 6th Edition
2. SBP: S.B. Patel, Nuclear Physics: An Introduction, New Age International Publishers, 2nd Edition
3. SNG: S.N, Ghoshal, Nuclear Physics
4. DCT: D.C. Tayal, Nuclear Physics, Himalaya Publishing House, 5th Edition

**Additional References:**


1. **S.L Kakani and Shubhra Kakani, Nuclear and Particle Physics, Viva Books, 2nd Edition**
2. **Kenneth S. Krane, Modern Physics, 4th Edition, Wiley.**
3. **Ronald Gautreau, Schaum's Outline of Modern Physics, Second Edition, McGraw Hill Besides reference books, Standard websites are expected to be referred.**

| Course Code | Course Title (Semester I) | Credits | Lectures/Week |
|---|---|---|---|
| KUSPHP22101 | Practical 1 | 2 | 2 |

**Learning Outcome:**

1. On successful completion of this course students will be able to:
2. Understand & practice the skills while performing experiments.
3. Understand the use of apparatus and their use without fear & hesitation.
4. Correlate the physics theory concepts to practical application.
5. Understand the concept of errors and their estimation.

**Regular Experiment:**

| Sr No | Name of the Experiment |
|---|---|
| | **GROUP A** |
| 1 | Torsional Oscillation: To determine modulus of rigidity η of a material of wire by Torsional oscillations |
| 2 | Bifilar Pendulum: Determination of moment of inertia of rectangular and cylindrical bar about an axis passing through its centre of gravity |
| 3 | Moment of inertial of Flywheel |
| 4 | Constant volume air thermometer |
| 5 | Frequency of AC Mains: To determine frequency of AC mains (Sonometer wire) |
| 6 | LDR Characteristics: To study the dependence of LDR resistance on intensity of light |
| | **GROUP B** |
| 7 | Study of Logic gates & To verify De Morgan's Theorems |
| 8 | To study EX-OR Gate and verify its truth table |
| 9 | To study half adder and full adder and verify their truth table Ex-OR Gate |
| 10 | To study load regulation of a Bridge Rectifier |

| | |
|---|---|
| 11 | To study Zener Diode as Regulator |
| 12 | Study of LASER Beam Divergence |
| **GROUP C:Skill Experiment** | |
| 1 | Use of Vernier Callipers, Micrometer Screw Gauge and Travelling Microscope |
| 2 | Graph plotting (Plot BE/A verses A graph for 30 atoms, Plot Packing Fraction graph for 30 atoms) |
| 3 | Spectrometer: Schuster's Method |
| 4 | To determine the Resistance & Capacitance using Color code/Number & verify using Multimeter (Analog/Digital) |
| 5 | Use of digital multimeter |
| 6 | Absolute and relative error calculation |

**Note:** Minimum **8** experiments (Four From each group) and **4** Skill experiments 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.

| Course Code | Course Title (Semester II) | Credits | Lectures/Week |
|---|---|---|---|
| KUSPH22201 | Paper 1 - Optics I | 2 | 3 |

**Course Objectives:**

1. To acquire knowledge of fundamental optics

**Course Outcomes:**

After successful completion of the course, the student will be able to:

1. Understand the concept of lens, lens defects and their minimization.
2. Significance of combination of lenses implied to eyepiece of optical instrument.
3. Understand interference of light with few well known daily life examples.
4. Understand Lasers and Optical fibers, their applications in day to day life.

| Unit | Topics | No of Lectures |
|---|---|---|
| I | **Geometrical Optics**<br><br>**(15 lectures)**<br>**1. Lenses and Lens Maker's Equation:** Introduction to lenses, Terminology and sign conventions, Introduction to Thin lenses and Lens equation for single convex lens, Lens maker's equation: Positions of the Principal Foci and Newton's Lens equation.<br><br>SBA: 4.1, 4.2, 4.3, 4.7, 4.8, 4.9, 4.10, 4.10.1, 4.11<br><br>**2. Magnification by a lens and power of lens**: Lateral, Longitudinal and Angular magnification, Deviation by a thin lens and its power, Necessity to combine the lenses & equivalent focal length & power of two thin lenses, Concept of cardinal points and their significance<br><br>SBA: 4.12, 4.12.1, 4.12.2, 4.12.3, 4.15, 4.16, 4.17, 4.17.1, 4.17.2, 4.17.3, 4.17.4, 5.2<br><br>**3. Introduction to Aberration in lenses**: Spherical aberration & reduction, chromatic aberration & reduction (Qualitative)<br>SBA: 9.2, 9.5, 9.5.1, 9.10<br>Suitable numerical with appropriate difficulty level. | 15 |
| II | **Introduction to Optical Instruments and Interference in Thin Films** | |

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|---|---|---|
| | 1. Optical Instruments and Eyepieces: Human Eye as an optical instrument, Camera and Lenses of Camera, Simple Microscope & Compound Microscope, Concept of eyepiece & its significance: Huygens Eyepiece and Ramsden Eyepiece (Principle, Construction, Expression for Equivalent Focal Length, Merits and Demerits), Comparison of Huygens Eyepiece and Ramsden Eyepiece, Gauss Eyepiece, Refracting Astronomical Telescope (Construction and Working), Reflecting Telescope (Qualitative)<br>SBA: 10.2, 10.3, 10.3.1, 10.5, 10.8, 10.10, 10.11, 10.12, 10.13, 10.14, 10.15, 10.15.1, 10.16<br><br>2. **Interference in Thin Films:** Interference due to reflected and transmitted light in plane thin films, Conditions for Maxima and Minima, Interference pattern in wedge-shaped film & Newton's rings<br>SBA: 15.1, 15.2, 15.2.1, 15.2.2, 15.5, 15.6<br>Suitable numerical with appropriate difficulty level. | **15** |
| **III** | **Lasers and Fiber Optics**<br><br>**(15 lectures)**<br>**1. An Introduction to LASERS**: Absorption and Emission, Spontaneous and Stimulated Emission, Components of laser, Ruby laser, He-Ne Laser, Laser Beam Characteristics, Applications of Laser<br>SBA: 22.1, 22.4.1, 22.4.2, 22.8, 22.8.1, 22.8.2, 22.8.3, 22.14.1, 22.14.3, 22.16, 22.19<br><br>**2. An Introduction to Optical Fiber**: Total Internal Reflection, Propagation of light through an Optical fiber, Numerical Aperture, Classification of Optical fibers, Single Mode Step Index Fiber, Multimode Step Index Fiber, Graded Index Fiber, Optical Fiber applications (Optical fiber based communication system & Optical Fiber based Temperature sensor)<br>SBA: 24.2, 24.3, 24.4, 24.6, 24.10, 24.11.1, 24.11.2, 24.11.3, 24.21, 24.23.1 | **15** |

**Textbooks:**

**SBA:** 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.

**Additional References:**

1. **Jenkins and White, Fundamentals of Optics by (4th Ed.), McGraw Hill International**
2. **Ajoy Ghatak, Optics, 6th Edition, Mc Graw Hill Education (India) Private Limited**

| Course Code | Course Title (Semester II) | Credits | Lectures/Week |
|---|---|---|---|
| KUSPH22202 | Paper 2 - Electricity and Electronics | 2 | 3 |

**Course Outcomes:**

After successful completion of the course, the student will be able to:

1. Understand the basic concepts of Alternating current theory, AC bridges and Circuit Theorems
2. Understand the basics of Analog and Digital Electronics and apply them in real life situations
3. Demonstrate quantitative problem solving skills in all the topics covered

| Unit | Topics | No of Lectures |
|---|---|---|
| I | **Electricity**<br><br>**15 lectures**<br>**1. Alternating current theory**: (Review: Concept of L, R, and C)<br>AC circuit containing pure R, pure L and pure C, representation of sinusoids by complex numbers, Series L-R, C-R and LCR circuits, Resonance in LCR circuit (both series and parallel), Power in ac circuit. Q- Factor.<br>**TT:** 11.29, 11.30, 11.32, 12.5, 12.6, 13.1, 13.7, 13.9, 13.10, 13.11, 13.12, 13.13, 13.14,<br>13.17, 13.19, 14.2<br><br>**2. AC bridges**: General AC Bridge, Maxwell's Inductance Bridge, Maxwell's L/C Bridge, De Sauty Bridge, Wien Bridge. (Bridge diagram, balancing condition derivation, applications)<br>**TT**: 16.1, 16.2, 16.3, 16.9, 16.11<br><br>3. **Circuit Theorems:** (Review: Ohm's law, Kirchhoff's laws) Ideal Current and Voltage Sources, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem. Problems related to circuit analysis using the above theorems.<br>TT: 2.15, 2.16, 2.18, 2.25, 2.30 | 15 |
| | **Analog Electronics**<br>**1. DC Power Supply:** Block diagram of a dc power supply – concept of a transformer,(Review: Half wave rectifier, Full wave rectifier) Bridge | |

| | | |
|---|---|---|
| **II** | rectifier, PIV, Efficiency and Ripple factor of full wave rectifier, Capacitor Filter, Need for voltage regulation - Zener diode as voltage stabilizer, Clipper and Clampers (Basic diode based circuits only).<br>BN: 1.15, 2.6, 2.7, 2.8, 2.9, 2.10, 15.2, 15.3<br>AD: 4.2, 22.1<br><br>**2. Transistor dc Biasing:** (Review: transistor structure and characteristics), Definition of gains α, β (dc and ac) and relation between them, load line analysis, operating point, cut-off and saturation points, Inherent Variations of transistor Parameters, Stabilization, Necessity of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor or fixed bias, Emitter Bias and Voltage Divider Bias Methods(Qualitative Analysis only, No mathematical derivation) , Stability factor for Potential Divider Bias.<br>Transistor as a switch: circuit and working, Transistor as an Amplifier: CE, CB and CC modes, Practical circuit of an amplifier and its operation and phase reversal.<br>BN: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.1, 4.2, 4.17, 4.18(Transistor Switch) | **15** |
| **III** | **Digital Electronics**<br>**1. Number Systems –** Binary number system: Binary to decimal and Decimal to binary conversion, Hexadecimal number system: Hexadecimal to decimal Conversion, Decimal to hexadecimal conversion, Hexadecimal to binary conversion, Binary to hexadecimal conversion.<br>LMS: 5.1 to 5.5<br><br>**2. Derived Gates** (Review: Basic Logic gates),NAND and NOR as Universal Building blocks, Ex-OR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications – Parity generator and checker, Half adder and Full adder.<br>LMS: 2.1, 2.2<br>Tokheim: 3.6, 3.8, 10.2, 10.3<br><br>**3. Boolean Algebra:** Boolean theorems, De-Morgan theorems, Sum of Product (SOP) and Product of sum (POS) methods, Simplification of logical expressions.<br>LMS: 3.1, 3.2, 3.7, 3.8 | **15** |

**Textbooks:**


1. TT: B.L. Theraja and A.K. Theraja, A Textbook of Electrical Technology Vol. I, S. Chand Publication
2. BN: R. L. Boylestad and L. Nashelsky, Electronic devices and Circuit Theory - 10th Edition, Pearson
3. LMS: Leach, Malvino, Saha, Digital Principles and Applications – 6th Edition.Tata McGraw Hill
4. Tokheim: Digital Electronics, Principles and Applications, 6th Edition, McGraw Hill Edition.
5. AD: Albert Malvino, David Bates, Electronic Principles, 8th Edition, Tata McGraw Hill.


| **Course Code** | **Course** | **Credits** | **Lectures /Week** |
|---|---|---|---|

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|---|---|---|---|
| | **Title** | | |
| **KUSPHP2201** | **Practical 2** | **2** | **2** |

**Learning Outcome:**

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

1. Understand & practice the skills while performing experiments.
2. Understand the use of apparatus and their use without fear & hesitation.
3. Correlate the physics theory concepts to practical application.
4. Understand the concept of errors and their estimation.

**Regular Experiment:**

| Sr. No | Name of the Experiments |
|---|---|
| | **GROUP A** |
| 1 | Young's Modulus of a wire material by method of vibrations |

| | |
|---|---|
| 2 | Spectrometer: To determine of angle of Prism |
| 3 | Spectrometer: To determine refractive index of prism material |
| 4 | Combination of Lenses: To determine equivalent focal length of a lens system by magnification method |
| 5 | Newton's Rings: To determine radius of curvature of a given convex lens using Newton's rings. |
| 6 | Determination of diameter of thin wire using Wedge Shaped Film |
| **GROUP B** | |
| 7 | To study NAND/NOR gates as Universal Building Blocks |
| 8 | LR Circuit: To determine the value of given inductance and phase angle |
| 9 | CR Circuit: To determine value of given capacitor and Phase angle |
| 10 | Transistor configurations : CB/CE/CC (study of input-output characteristics) |
| 11 | LCR series Resonance: To determine resonance frequency of LCR series circuit |
| 12 | To study Thermistor characteristics: Resistance vs. Temperature |
| **GROUP C: DEMONSTRATION EXPERIMENT** | |
| 1 | Radius of ball bearings (single pan balance) |
| 2 | Use of Oscilloscope: Wave forms at output of half wave , bridge rectifiers with and without Capacitor filter, Ripple |
| 3 | Use of PC for graph plotting |
| 4 | I-V Characteristics of LED |
| 5 | Testing of components (Resistors , Diode , Transistor , capacitor) |
| 6 | Study of I-V characteristics of solar cell |

**Note:** Minimum **8** experiments (Four From each group) and **4** Demo experiments 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.

# Evaluation Scheme for First Year (UG) under AUTONOMY

## I. Internal Evaluation for Theory Courses – 40 Marks

(i) Continuous Internal Assessment 1 (Assignment- Tutorial/ Ind. Visit/– 20 Marks

(ii) Continuous Internal Assessment 2 – 20 Marks (Class Test with Fill in the Blanks, True or False & Answer the following)

## II. External Examination for Theory Courses – 60 Marks

Duration: 2 Hours

Theory question paper pattern:

All questions are compulsory.

| **Question** | **Based on** | **Options** | **Marks** |
|---|---|---|---|
| Q.1 | MCQ and fill in the blanks | 6 fill in the blanks and 6 MCQs on (Unit-I, II & III), 1 mark each | 12 |
| Q.2 | Unit I | *Any 3 out of 5 sub questions, 4 marks each* | 12 |
| Q.3 | Unit II | *Any 3 out of 5 sub questions, 4 marks each* | 12 |
| Q.4 | Unit III | *Any 3 out of 5 sub questions, 4 marks each* | 12 |
| Q.5 | Unit I,II,III | *Solve 3 out of five questions, 4 marks each (problems).* | 12 |

- 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. & the allocation of Marks depends on the weightage of the topic.

**III. Practical Examination**

- Each core subject carries 50 Marks (30 marks External + 20 marks Internal)

| Sr. No. | Undergraduate Practical Internal Evaluation: | Marks |
|---|---|---|
| 1 | Short Experiment/Field Trip/Excursion/Industrial Visit Report | 15 |
| 2 | Journal | 5 |

| Sr. No. | Undergraduate Practical External Evaluation: | Marks |
|---|---|---|
| 1 | Experiment/s | 25 |
| 2 | Viva | 5 |

- 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