Sant Gadge Baba Amravati University, Amravati BSc-I sem-I & II CBCS

Faculty: Science and Technology

Programme: B.Sc. (Physics)

POs:

At the time of graduation, Students will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

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PSOs:

Upon completion of the Programme successfully, students would be able to

1. acquire a comprehensive knowledge and sound understanding of fundamentals of Physics
2. develop laboratory skills, enabling them to take measurement in a physic laboratory and analyze the measurements to draw valid conclusions.
3. be prepared to acquire a range of general skills, to solve problems, to evaluate information, to use computers productively, to communicate with society effectively and learn independently.
4. Develop good oral and written scientific communication skill.

Employability Potential of the Programme:

Physics programme develops the skills, particularly the ability to analyze and apply information, gives one a good head start, in any field, one wishes to get in. The skills are useful even in the management disciplines. This programme gives physics enthusiasts a chance to develop their mathematical, problem solving, communication skills and critical thinking, that helps to interpret rich scientific data and that is always a boon to scientific researchers.

After accomplishing M. Sc. in Physics, student can certainly increase his/her employability in this field. Students can easily avail of technical jobs, both in the private and public sector. Some of the common job positions or profiles for a physics enthusiast are Online tutor, College lecturer, Assistant Professor, Observation Scientist, Laboratory Technician, School Science Technician or Research Analyst, Assistant Scientist, Physics Training Manager, Software Engineer, Network Administrator, IT Consultant, Security Expert, Java Developer, Systems Support Administrator, Interface Engineer etc. They can apply for jobs in Aerospace and Defence, Automobile, IT and Software, Railways, Nuclear and Renewable energy, Oil and Gas, Electronics and Telecommunications and the Manufacturing sector.

Students can pursue an MTech/MS degree in a variety of engineering or technology disciplines such as aeronautical, automobile, instrumentation, electronics and communication, or computer sciences. But, make sure to crack the GATE (Graduate Aptitude Test in Engineering) exam first, before going down this road.

For a long career in the field of research, students are advisable to pursue MPhil or PhD in Physics, after completing MSc Physics and join any science/technology research center. Students can also apply in Government or private colleges and universities, polytechnic institutes, degree colleges, engineering

colleges, IITs, IISc etc for teaching job. The minimum requirement is MSc Physics and UGC-CSIR NET exam for lectureship and JRF. Moving on, an MSc Physics followed by a BEd can also land you a job in higher secondary schools and then, there is the option of physics tutor, at the convenience of one's homes. Some of the prominent national organizations, that student can try aim for, include Defence Research and Development Organisation (DRDO), Indian Space Research Organization (ISRO), BARC, SSPL, Space Application Centres, Indira Gandhi Centre for Atomic Research Centre, Variable Energy Cyclotron Centre, National Thermal Power Corporation (NTPC), Cil and Natural Gas Corporation (ONGC), Bharat Heavy Electricals Limited (BHEL) and National Atmospheric Research Laboratory of Department of Space.

The research institutes in India such as Physical Research Laboratory, Ahmedabad, Saha Institute of Nuclear Physics, Kolkata and Nuclear Science Centre, New Delhi, TIFR (Education); IISER also recruit MSc Physics graduates, for technical jobs. At the same time, student can also look out for the national laboratories and institutes like National Geographical Research Institute, Regional Research Laboratories, National Institute of Science Communication and Information Sources, NEERI (CSIR labs) etc. These are some of the leading names to be associated with the field of science. Moving further, student can try for public sector banking to the post of Probationary Officers.

MSc Physics graduates have ample of opportunities, be it, in healthcare, manufacturing and electronics companies in most foreign countries. Those with exceptional academic excellence can go a step further and apply in the best space research organizations such as National Aeronautics and Space Administration (NASA).

After completion of this programme, the students are placed as Scientists, Radiologist, Meteorologist, Analyzers in forensic labs, IAS, SDO, Dy Superintendent of Police in wireless stream, Assistant Professors, Lecturers, Teachers, Radiologist, Telecom officers (JTO).

Syllabus Prescribed for B.Sc. I Year UG Programme
Programme:
Semester 1

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
PHY/S1CS	**Mechanics, Properties of matters, Oscillations & Relativity**	**72**

COs

On successful completion of this course, the students would be able to

1. Discuss the basic concepts of rotational dynamics.
2. Examine the phenomenon of simple harmonic motion and distinction between undamped, damped and force oscillations and the concept of resonance.
3. Explain the superposition of simple harmonic motion and acquire the knowledge of Ultrasonic waves, their production, detection and applications in different field.
4. Determine the constants of elasticity and relate it with appropriate things
5. Interpret the postulates of special theory of relativity.
6. Know the concept of Global positioning system (GPS)

Unit	Content
Unit I	**Rotational Dynamics:** Rigid body, Torque, Rotation about fixed axis, Kinetic Energy of rotation, moment of inertia and its physical significance, Radius of gyration, Perpendicular and parallel axes theorem (Statement Only), Fly-wheel, Moment of inertia of different bodies (Rod, Disc, cylinder and sphere) about different axes, Rolling motion. Principle of Conservation of Angular momentum. Principle and working of Gyroscope. Numericals **12 (periods)**
Unit II	SHM and its solution, time period of simple pendulum, compound pendulum, kater's pendulum & Torsional pendulum; Bifilar pendulum (Qualitative). Damped Oscillations: Differential equation of damped harmonic oscillator and its solution, Energy equation of damped oscillations, Power dissipation and Quality factor. Forced Oscillations: Differential equation of forced oscillation (Qualitative), Resonance (Amplitude). Numericals **12 (periods)**
Unit III	**Superposition of S.H.Ms.:** Superposition of two SHM of same frequency along the same line, superposition of two mutually perpendicular SHM of same frequency, Lissajous figures. Velocity of longitudinal waves (Newton's formula), Laplace correction, velocity of transverse waves in stretched string, Standing waves, Organ Pipe, harmonics and overtones. Velocity of waves by Kundt's tube. Ultrasonic waves: Production (piezoelectric crystal and Magnetostriction) and detection of ultrasonic waves and its applications in medical and industrial field. Numericals **12 (periods)**
Unit IV	**Elasticity:** Different types of elasticity, Twisting couple on a cylindrical rod or wire, Determination of modulus of rigidity by Maxwell needle, Torsional pendulum, Torsional oscillations, Modulus of rigidity of a material of wire by torsional pendulum, Beam, Bending of beam, Bending moment, External and internal bending moments, Cantilever, Expression for depression of a beam (i) loaded at one end and (ii) loaded at the center. Numericals **12 (periods)**
Unit V	**Gravitation and Special Theory of Relativity:** Kepler's laws of planetary motion (Statements only), Newton's law of gravitation, Variation of "g" with altitude and depth, weightlessness, Satellite in circular orbit and applications, Geosynchronous orbit, basic idea of Global Positioning System(GPS). Frame of reference, Inertial and Non-inertial frame of reference, Galilean transformation, Postulates of special theory of relativity, Lorentz transformation, length contraction, Time dilation, Einstein's mass energy relation. Numericals **12 (periods)**

***SEM**

Basics of Measurement Technique

Measurements: Significance of measurements, methods of measurements,
Static and dynamic characteristics: Instruments accuracy, precision, sensitivity, resolution range etc.
Errors in measurements: Types of errors: i) Gross errors ii) Systematic errors iii) Random errors and loading effects.
Statistical evaluation of measurement data: Arithmetic mean & median, Average deviation: Measurement with Screw Gauge, Vernier Caliper, Travelling Microscope, Spectrometer.

(12 periods)

COs:
After completion of this course students will able to

1. apply the principles of measurement and error analysis.
2. Develop the skills to handle various instruments with precision.

**Activities	1. Measurement of dimension of solid block, volume of cylindrical objects, diameter of thin wire. 2. Measurement of length and diameter of capillary tubes. 3. Comparison of diameter of a thin wire using screw gauge and travelling microscope. 4. Measurement and estimation of errors in any one of the above activities.

Course Material/Learning Resources

Text books & Reference Books:

1. A Course in electrical &Electronic Measurements And Instrumentation by A. K. Sawhney, Dhanpatrai& Company (Pvt.) Ltd. Educational & Technical Publishers,
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper. PHI Learning Pvt. Ltd. New Delhi.
3. Measurement, Instrumentation And Experiment Design In Physics And Engineering By Michael Sayer, AbhaiMansingh, Phi Learning Private Ltd. New Delhi.
4. Electronic Instrumentation by H.S. Kalsi
5. Elements of Electronic Instrumentation and Measurement by Joseph J. Carr
6. A text book in Electrical Technology - B L Theraja - S Chand and Co.
7. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
8. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
9. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
10. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning
11. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
12. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
13. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
14. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley

Weblink to Equivalent MOOC on SWAYAM if relevant:

https://nptel.ac.in

Weblink to Equivalent Virtual Lab if relevant:

https://vlab.amrita.edu/

https://www.vlab.co.in/

http://vlabs.iitb.ac.in/vlab/labsps.html

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

https://youtube.com/playlist?list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e

Syllabus Prescribed for B.Sc. I Year UG Programme

Programme: Semester 1

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
PHY/81	Physics Lab-1	6

COs

On successful completion of this practical course, the students would be able to

1. List out, identify and handle various equipment likes different types of pendulum.
2. Learn the procedures of operation of various oscillating objects.
3. Acquire skills in observing and measuring different types of errors.
4. Perform procedures and techniques related to experiments based on mechanics.
5. Conduct an experiments collaboratively and ethically.

Practical sem - I sem - 1

*** List of Practical/Laboratory Experiments/Activities etc.**
It is necessary to perform **TEN** Experiments from the list given below.

1	To determine acceleration due to gravity by Bar pendulum.
2	To determine acceleration due to gravity by Kater's reversible pendulum.
3	To study oscillations in bifilar suspension arrangement
4	To determine Moment of Inertia of a body by a torsion pendulum.
5	To study the theorem of parallel axes of Moment of Inertia
6	To study the theorem of perpendicular of Moment of Inertia
7	To determine the Moment of Inertia of a body using bifilar suspension method (with parallel threads)
8	To determine the moment of inertia of a fly-wheel.
9	To determine the i) equivalent length, ii) radius of gyration, iii) moment of inertia of a compound pendulum by method of coincidences
10	To study the oscillations of a mass in combinations of two springs and hence determination of force constant.
11	To show that the frequency of a Helmholtz resonator varies inversely as the square root of its volume and to estimate the neck correction.
12	To determine Young's modulus of the material of a beam by method of vibration.
13	To determine Young's modulus of the material of a beam by method of bending.
14	To determine Young's modulus of the material of a beam by a cantilever.
15	To determine the Young's Modulus of a Wire by Optical Lever Method.
16	To determine modulus of rigidity of material of a given wire by Maxwell's needle.
17	To determine the modulus of rigidity of material of a given wire by using Torsional pendulum.
18	To determine coefficient of restitution for inelastic collision.
19	To determine the surface tension of mercury by Quinke's method

Text books & Reference Books:

15. *B.Sc. Practical Physics by Harnam Singh & Dr. P. S. Hemne , 2000, S. Chand and Company Limited.*
16. *A Textbook of Practical Physics by Indu Prakash, Ram Krishna & A. K. Jha, 2011, Kitab Mahal Publication.*
17. *B.Sc. Physics Practical by C. L. Arora, 2010, S. Chand and Company Limited.*

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sem-II (CBCS) New

Faculty: Science and Technology

Programme: B.Sc.

Syllabus Prescribed for B.Sc. I Year UG Programme

Programme:

Semester II

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
PHY-S2/physics	Electrostatics, Magneto-statics, Ultrasonic Waves and Acoustics, Network Theorems	72

COs

After going through the course, the student would be able to

7. Discuss the concept of scalars & vectors and their properties.
8. Develop an understanding of Gauss law and its applications to obtain electric filed in different cases.
9. Formulate the relationship between electric displacement vector, electric polarization and dielectric constant.
10. Distinguish between the magnetic effect of electric current, electromagnetic induction and the related laws in appropriate circumstances.
11. Simplify electrical circuits by applying various network theorems.

Unit	Content
Unit I	Vector Analysis: Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors. Numericals **(12 Periods)**
Unit II	Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Relation between electric field and electric potential. Numericals **(12 Periods)**
Unit III	Capacitors: Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. Numericals **(12 Periods)**
Unit IV	Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. Numericals **(12 Periods)**
Unit V	Network Theorems : Series circuit, Series voltage dividers, Parallel circuits, Series Parallel circuits, Resistances in series and parallel, Kirchhoff's Current and Voltage laws, Wheatstone's Bridge, Ideal constant voltage source, Ideal constant current source, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Miliman's theorem, Numericals. **(12 Periods)**

***SEM**

Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

Introduction to electrical components:

Resistor-Types of Resistors, Color coding - Applications of a Resistor as a heating element in heaters and as a fuse element.

Capacitor- Types of Capacitor, Color coding, Applications of Capacitor in power supplies, motors (Fans) etc.

Inductor-Types of Inductors, EMF induced in an Inductor, Applications of Inductor in a fan, radio tuning

circuit and Series resonance circuit. Energy audit: Unit of electricity, power of domestic appliances. (12 periods)	
COs: After completion of this course students would be able to 3. Make use of Multimeter for the measurement of electrical parameters and get the knowledge of electronic components and their applications. 4. Estimate the power consumption of domestic appliances and carry out energy audit.	
**Activities	1. Use of Multimeter for the measurement of ac voltage & dc voltage in different domestic appliances. 2. Use of Multimeter for the measurement of Resistance, Capacitance. 3. Estimate the values of Resistor & capacitor by color code method. 4. Connect two or three resistors or capacitors or inductors and measure the Series, Parallel Combination values using a Multimeter. 5. Identification of electronic components in mobile charger and to estimate their values. 6. Estimate and compare the power consumptions of different domestic appliances. 7. Energy audit of your home and compare it with monthly electric bill (for three months).

Course Material/Learning Resources

Text books & Reference Books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
6. A Course in electrical &Electronic Measurements And Instrumentation by A. K. Sawhney, Dhanpatrai & Sons Educational & Technical Publishers, Delhi.
7. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper. PHI Learning Pvt. Ltd. New Delhi.
8. Physics for degree students (B.Sc.2nd year) by C. L. Arora & P.S. Hemne, S. Chand Publication.
9. Physics for degree students(B.Sc. 1st year)by C. L. Arora & P.S. Hemne, S. Chand Publication.
10. Basic Electronics by B. L. Theraja, S. Shand Publication.
11. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
12. Properties of Matter and Acoustics for B.Sc, Kirutiniga Sivaprasath & R Murugeshan, S. Chand & Co. New Delhi.

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Sant Gadge Baba Amravati University, Amravati

Syllabus Prescribed for B.Sc. I Year UG Programme

Programme: Semester II

Code of the Course/Subject	Title of the Course/Subject (Laboratory/Practical/practicum/hands-on/Activity)	(No. of Periods/Week)
PHY/S2	Physics Lab-2	72

COs

On successful completion of this practical course, the students would be able to

6. Simplify various electrical circuits by using network theorems.
7. Learn the procedures of operation of electrical components like capacitor, resistor and inductor.
8. Acquire skills in measuring dielectric constants of different materials.
9. Perform procedures and techniques related to experiments based on electrical and electronic circuits.
10. Conduct an experiments collaboratively and ethically.

*** List of Practical/Experiments/Activities etc.**

practical sem-II CBCS (New) sem-2

It is necessary to perform **TEN** Experiments from the list given below.

1	Verification of Kirchhoff's Current Law
2	Verification of Kirchhoff's Voltage Law
3	To determine unknown resistance by using Wheatstone's bridge
4	Verification of Thevenin's theorem.
5	Verification of Norton's theorem.
6	Verification of Milliman's theorem.
7	To verify the Superposition theorem
8	To verify Maximum Power Transfer Theorem
9	To determine high resistance by leakage method
10	To study the charging & discharging of a condenser through resistor.
11	To compare capacitances using De Sauty's bridge.
12	To determine capacitance by phaser diagram method
13	To determine inductance by phaser diagram method
14	Study of Primary & Secondary coil of Transformer
15	To determine dielectric constant of a given material
16	Study of frequency response of series LCR circuit
17	Comparison of capacities by repeated charge decay method
18	Measurement of the low resistance by Potentiometer

Text books & Reference Books:

18. *B.Sc. Practical Physics by Harnam Singh & Dr. P. S. Hemne , 2000, S. Chand and Company Limited.*
19. *A Textbook of Practical Physics by Indu Prakash, Ram Krishna & A. K. Jha, 2011, Kitab Mahal Publication.*
20. *B.Sc. Physics Practical by C. L. Arora, 2010, S. Chand and Company Limited.*

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