Sant Gadge Baba Amravati University, Amravati

Three Years- Six Semesters Bachelor's Degree Programme
3 Years B.Sc. / 4 Year B.Sc. (Hons) & 4 Year B.Sc. (Hons with Research) Programme

Subject: **PHYSICS**

(Semester I and II)

Effective from Academic Year 2024-25
(As Per NEP 2020)

Graduation Attributes:

Graduation attributes for a Bachelor of Science (B.Sc.) with Physics as a major course represent the qualities, skills, and abilities that students are expected to develop by the end of the program. These attributes ensure that graduates are well-prepared for their future careers and further studies. Here are some key graduation attributes for B.Sc. Physics graduates:

1. Deep understanding of fundamental physics concepts and principles.
2. Ability to analyze complex problems logically and critically.
3. Expertise in designing and conducting experiments, as well as in using modern laboratory equipment.
4. Proficiency in conducting independent research, including literature review, hypothesis development, experimentation, and data analysis.
5. Strong problem-solving skills, with the ability to approach and resolve complex scientific and technical issues.
6. Effective communication skills, both written and oral, for conveying scientific information to diverse audiences.
7. Understanding of ethical principles in scientific research and professional practice.
8. Ability to work effectively in teams, contributing to collaborative projects and interdisciplinary research.
9. Commitment to continuous learning and staying updated with advancements in physics and related fields.
10. Competence in using computational tools, software, and programming languages relevant to physics.
11. Understanding of global challenges and the role of physics in addressing issues such as climate change, energy sustainability, and environmental conservation.
12. Preparedness for a wide range of career opportunities in academia, industry, government, and other sectors.

These graduation attributes collectively ensure that B.Sc. Physics graduates are not only knowledgeable and skilled in their field but also well-rounded individuals ready to contribute positively to society and their chosen professions.

Programme Outcomes

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

1. understand physics fundamental concepts, including mechanics, electromagnetism, thermodynamics, quantum mechanics, and statistical physics.
2. analyze and solve complex physical problems using mathematical and computational techniques.
3. experience in conducting independent research projects, including literature review, hypothesis formulation, experimentation, data collection, and analysis.
4. communicate complex scientific concepts clearly and effectively to diverse audiences, including peers, professionals, and the general public
5. understand global scientific challenges and the role of physics in addressing environmental and sustainability issues
6. apply physics knowledge to develop sustainable solutions and innovations.

Programme Specific Outcomes

PSO1: Graduates will acquire a comprehensive knowledge and sound understanding of fundamentals of Physics.

PSO2: Graduates will develop practical, analytical and mathematical skills in Physics.

PSO3: Graduates will 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.

PSO4: Graduates will acquire necessary skills to enable them to crack competitive examination for career progression or seeking employment.

Examination, Evaluation and Assessment Scheme

Vertical No.	The Vertical	Mode of Examination, Evaluation & Assessment	Theory				Theory (Total)		Practical				Practical (Total)	
			External		Internal				External		Internal			
			Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks
a	Major	External & Internal	30	9	20	6	50	20	25	10	25	10	50	20
b	Minor		30	9	20	6	50	20	25	10	25	10	50	20
c	Generic/ Open Elective		30	9	20	6	50	20	--	--	--	--	--	--
d	VSC	Internal	--	--					--	--	50	20	50	20
	SEC	Internal	--	--					--	--	50	20	50	20
e	AEC (Eng. & One MIL Composite)	External & Internal	30	9	20	6	50	20	--	--	--	--	--	--
	IKS (Generic)	External & Internal	30	9	20	6	50	20	--	--	--	--	--	--
	VEC	External & Internal	30	9	20	6	50	20	--	--	--	--	--	--
f	Internship/ Apprenticeship	Internal	Assessment of these verticals shall be based on various activities/practices. It shall be evaluated by giving maximum marks of 50 per 2 Credit Course with separate activity weightages/levels. A detailed SOP for this assessment process shall be prescribed separately.											
	FP/CEP													
	CC													

Sant Gadge Baba Amravati University, Amravati
FACULTY: Science and Technology
Subject: PHYSICS
Teaching and Learning Scheme for the Degree of Bachelor of Science
Three Years / Four years- (Six/Eight Semesters) Bachelor's Degree Programme

FIRST YEAR: SEMESTER – I

Mode of Teaching	Vertical No.	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field/Online/ Hybrid	a.	Major	Theory 1	Physics Th1 129200	Gravitation and Rotational Dynamics	2	2	**6**
			Lab/Practical 1	Physics Lab 1 129201	Experiments Related to Physics Th1	2	4	
	b.	Minor	Theory 1	Physics Th1 129200	Gravitation and Rotational Dynamics	2	2	**6**
			Lab/Practical 1	Physics Lab 1 129201	Experiments Related to Physics Th1	2	4	
	c.	Generic/ Open Elective	Theory 1	Physics 129/ OE-1	Space Science (The Wonders of Physics)	2	2	**2**
			Theory 2	Physics 129/ OE- 2	Non-Conventional Energy Sources	2	2	**2**
	d.	VSC	-	-	-	-	-	**4**
		SEC	Lab/Practical	Physics 129/ SEC 1/ Lab	Instrumentation and Measurement Skills	2	4	

Physics 129200/ Th1

Credits: 02 **Workload (Hrs/Week): 02**

Title of the course: Gravitation and Rotational Dynamics

Course Objectives:	1. To explain the concept of gravitational force and its universal nature. 2. To understand the laws of gravitation proposed by Newton and explore their implications. 3. To solve problems related to gravitational attraction between masses. 4. To investigate the effect of gravity on motion and orbits, including satellite motion. 5. To introduce the principles of rotational motion and dynamics. 6. To explore the concept of torque and its relationship with rotational motion. 7. To understand the parallel axis and perpendicular axis theorems. 8. To solve problems involving rotational motion, torque, and angular acceleration.			
Course Outcomes:	On successful completion of this course, the students would be able to 1. Interpret the universal law of gravitation, gravitation field and gravitation potential. 2. Apply Keplerôs laws to describe the motion of planets and others celestial bodies. 3. Understand the motion of satellites in orbit 4. Know the concept Black-hole 5. Relate rotational motion to linear motion through angular and linear quantities 6. Discuss the basic concepts of rotational dynamics and relate it with appropriate things. 7. Apply the parallel axes theorem and perpendicular axes theorem to calculate moments of inertia. 8. Discuss real world application of rotational mechanics, such as the dynamics of rotating machinery and vehicles.			
	Contents	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Gravitation I: Historical perspective, Universal law of Gravitation, Measurement of Gravitational constant, Gravitational potential energy, Gravitational potential, Gravitational Field, Relation between Gravitational Field and Potential. Calculation of Gravitational Potential and Field due to point mass, uniform ring, Uniform thin spherical shell and Uniform solid sphere. Solved examples	8 Hrs	8 Marks	• Use diagrams, simulations, or animations to illustrate gravitational concepts, potential, and field lines. • Provide step-by-step calculations for gravitational potential and field for different configurations to reinforce understanding. • Engage students with interactive simulations or experiments showcasing gravitational effects and field variations.
Unit II	Gravitation II : Acceleration due to gravity, Effect of altitude and depth in the value of ógô, Keplerôs laws (statement only), Projection of Satellite, Critical velocity of a satellite, Periodic time of satellite, Binding energy and escape velocity of a satellite. Weightlessness condition in satellite. Concept of Black-hole. Solved examples	7 Hrs	7 Marks	• Use diagrams, animations, or simulations to illustrate orbital mechanics, satellite motion, and the concept of black holes. • Relate these concepts to real-life scenarios, such as satellite launches, space missions, and astronomical observations. • Engage students in discussions about the implications of gravity variations, satellite motion, and the fascinating nature of black holes in the universe.
Unit III	Rotational Dynamics-I: Rigid body, Torque on a rigid body, Centre of mass, System of two particles, Equation of motion of centre of mass. Rotation about fixed axis, Kinetic energy of rotating body, Moment of Inertia, Physical significance of moment of inertia, Radius of gyration, Analogy between translatory and rotatory motion, Angular Momentum, Law of conservation of angular	8 Hrs	8 Marks	• Use animations, diagrams, or physical models to illustrate concepts like center of mass, moment of inertia, and rotational motion. • Engage students in solving problems related to torque, moment of inertia, and conservation of angular momentum to reinforce concepts. • Conduct experiments or demonstrations to illustrate rotational

	momentum. Solved examples			motion, center of mass, or conservation laws.
Unit IV	Rotational Dynamics-II: Theorem of perpendicular axes, Theorem of parallel axes, Calculation Moment of inertia (Annular ring, Circular disc, Solid cylinder, thin rod, Hollow cylinder, Solid sphere & Spherical shell.) Kinetic energy of a body rolling on a horizontal plane. Solved examples	7 Hrs	7 Marks	• Present step-by-step derivations of moment of inertia equations for various shapes and objects. • Engage students in solving problems involving moments of inertia and kinetic energy of rolling bodies to reinforce understanding. • Use diagrams, animations, or physical demonstrations to illustrate the concepts of moments of inertia and rolling motion.
References	1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, McGraw-Hill. 2. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al., Tata McGraw-Hill. 3. Physics, Resnick, Halliday and Walker, Wiley publication 4. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning 5. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education 6. Mechanics, D.S. Mathur, S. Chand and Company Limited 7. Physics for degree students(B.Sc. 1st year)by C. L. Arora & P.S. Hemne, S. Chand Publication. 8. Concepts of Physics, H. C. Verma Volume-1, Bharati Bhawan publication			
Model Questions	**Short answer questions:** 1. State and derive Newtonôs law of gravitation. 2. Define Gravitational field intensity and gravitational potential. 3. What do you mean by radius of gyration of a body? Write dimensions of radius of gyration. 4. Define Moment of Inertia. Explain the physical significance of it. **Long answer questions:** 1. Derive an expression for variation of acceleration due to gravity with altitude. 2. Derive relation between gravitational field intensity & gravitational potential. 3. State and prove theorem of parallel axes. 4. Obtain an expression for torque acting on rotating body with constant angular velocity.			

Physics 129201/ Lab 1

Credits: 02 **Workload (Hrs/Week): 04**

Course Objectives:

1. Teach accurate measurement techniques for physical quantities such as length, time, mass, and temperature.
2. Emphasize the importance of uncertainty and error analysis in experimental measurements.
3. Develop skills in data analysis using statistical methods and graphical representation.
4. Emphasize the connection between theoretical predictions and experimental results.
5. Encourage students to formulate hypotheses and design experiments to test them.
6. Emphasize the importance of documenting procedures, results, and conclusions.
7. Develop oral communication skills through presentations of experimental findings.

Course Outcomes:

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

1. Acquire skills in making accurate measurements and observations.
2. Learn how to collect experimental data systematically.
3. Understand sources of error in experimental measurements.
4. Design and plan experiments to test specific hypotheses.
5. Learn how to write clear and concise laboratory reports.
6. Create and interpret graphical representations of experimental data.
7. Formulate hypotheses, design experiments, and draw conclusions based on evidence.
8. Develop critical thinking skills by analyzing and interpreting experimental results.

List of Experiments:

Perform at least eight (8) experiments from the given list.

1. To determine acceleration due to gravity by simple pendulum.
2. To determine acceleration due to gravity by Bar pendulum.
3. To determine acceleration due to gravity by Katerôs reversible pendulum.
4. To determine acceleration due to gravity by free fall method.
5. To determine Moment of Inertia of a body by a torsion pendulum.
6. To study the theorem of parallel axes of Moment of Inertia
7. To study the theorem of perpendicular axes of Moment of Inertia
8. To determine the Moment of Inertia of a body using bifilar suspension method (with parallel strings/threads)
9. To determine Moment of inertia of a fly-wheel.
10. To determine the length of equivalent pendulum (ring pendulum).
11. To determine the length of equivalent pendulum (disc pendulum).
12. To determine moment of inertia of a compound pendulum by method of coincidences
13. To study damping of a bar pendulum (logarithmic decrement).

References:

1. B.Sc. Practical Physics, Harnam Singh, Dr. P. S. Hemne, S. Chand and Company
2. Textbook of Practical Physics, H. P. Shrivastava, ABD Publisher
3. B.Sc. Practical Physics, C. L. Arora, S. Chand and Company
4. https://vlab.amrita.edu/
5. https://www.vlab.co.in/
6. http://vlabs.iitb.ac.in/vlab/labsps.html

Physics 129/ OE-1

Credits: 02 **Workload (Hrs/Week): 02**

Title of the Course: Space Science (The Wonders of Physics)

Course Objectives:	1. To Introduce Space science. 2. To explain the formation of solar systems. 3. To relate Keplerôs and Newtonôs laws to solar system. 4. To demonstrate formation of stars. 5. To describe origin of galaxies. 5. To apprise the creation of universe			
Course Outcomes:	After completion of the course the students should be able to: 1. Understand the basic concepts to Space. 2. Discuss the laws of solar system. 3. Demonstrate formation of stellar objects. 4. Analyze evolution and origin of galaxies. 5. Demonstrate creation of Universe.			
Unit System	**Contents**	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Introduction to space science, Nebular theory of formation of our Solar System .Solar wind and nuclear reaction as the source of energy. Sun and Planets: Brief description about shape size, period of rotation about axis and period of revolution, distance of planets from sun. Keplerôs Laws of planetary motion (only Statements)	7 Hrs	7 Marks	• Use images, videos, or models to illustrate the solar system's formation, planetary characteristics, and Kepler's laws. • Encourage comparisons between planets regarding size, distance from the sun, and orbital characteristics to foster a deeper understanding. Engage students with quizzes, discussions, or simulations related to solar system formation and planetary motion laws.
Unit II	Newtonôs Law of gravitation, determination of mass of earth, determination of mass of planets with respect to earth. Brief description of Asteroids, Satellites and Comets	8 Hrs	8 Marks	• Use images, diagrams, or animations to illustrate Newton's law of gravitation, experimental setups, and characteristics of celestial bodies. • Compare the masses and characteristics of Earth with other planets, asteroids, and comets to demonstrate their diversity. • Engage students in exercises or problems related to gravitational calculations and characteristics of celestial bodies to reinforce understanding.
Unit III	Stellar spectra and structure, Classification of stars: Luminosity of star, variable stars; composite stars (white dwarfs, Neutron stars, black hole, star clusters, supernova and binary stars);	7 Hrs	7 Marks	• Use interactive simulations or software to illustrate stellar spectra, star classifications, and variable star behavior. • Compare the characteristics, formation, and life cycles of different types of stars and stellar phenomena. • Utilize images, animations, or videos to showcase the diverse nature of stars, clusters, and supernovae.
Unit IV	Galaxies and their evolution and origin, Early history of the universe.	8 Hrs	8 Marks	• Use visual aids such as images, diagrams, or animations illustrating galaxy types, cosmic evolution, and the early universe's timeline.

				• Compare different galactic structures, their evolution pathways, and theoretical models explaining the universe's origins. • Encourage discussions on cosmic evolution theories, observational evidence, and ongoing research to engage students in critical thinking and exploration.
References	1. Bruce A. Campbell, Samuel Walter McCandless Jr.,Introduction to Space Sciences and Spacecraft Applications, 1996, Gulf publishing Company, Houston, Texas, pp.1-254. 2. Brian Cox, Andrew Cohen, Wonders of the Solar System, 2010, Harper Collins Publishers, pp.1-256. 3. Carlos Jaschek, Mercedes Jaschek, 1990, The Classification of Stars, Cambridge University Press, pp.1- 413. 4. Venzo de Sabbata, The Origin and Evolution of Galaxies, 1982, World Scientific Publishing Co Pte Ltd, pp.1-222. 5. Jerry Sellers, 1994, Understanding Space: An Introduction to Astronautics, 3rd Edition, Learning Solutions; 2106. 6. C.D. Murray, S.F. Dermott, 2001, Solar system Dynamics, Cambridge University Press; 1 edition, pp. 1-596. 3 7. Joseph F. Baugher, 1985, On Civilized Stars, Prentice-Hall, pp.1-265. 8. L. S. Sparke, J. S. Gallagher III, 2010, Galaxies in the Universe: An Introduction, Cambridge University Press, pp. 1-444 **9.** P.C.W. Davies, 1982, The Accidental Universe, Cambridge University Press, Cambridge, pp. 1-152			

Physics 129/ OE-2

Credits: 02 **Workload (Hrs/Week): 02**

Title of the Course: Non-Conventional Energy Sources

Course Objectives:	1. To provide an information of the most important renewable energy resources and the technologies for harnessing these resources within the framework. **2.** To Explore the concepts involved in solar energy, wind energy and ocean energy conversion system by studying its components, types			
Course Outcomes:	After completion of the course the students should be able to: **1.** Demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells. **2.** Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation. **3.** Explore the concepts involved in wind energy conversion system by studying its components, types and performance. **4.** Illustrate ocean energy and explain the operational methods of their utilization. **5.** Acquire the knowledge on Geothermal energy.			
Unit System	**Contents**	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Need for Non-conventional energy sources, Types of Non-Conventional energy sources Fuel cells: Definition-Design and Principle of operation Advantages and Disadvantages of fuel cells-Applications of Fuel cells.	8 Hrs	8 Marks	• Present real-world examples showcasing the implementation and success of fuel cell technology. • Engage students with interactive models or simulations illustrating fuel cell operations. • Encourage debates on the feasibility and challenges of adopting fuel cells as a viable energy solution.
Unit II	Solar Energy: Solar radiation and its measurements-Solar energy collectors: Flat Plate and Concentrating Collectors- solar pond -Applications of Solar energy.	7 Hrs	7 Marks	• Conduct experiments or demonstrations showcasing solar radiation measurement techniques and the operation of solar collectors. • Organize visits to solar installations or facilities utilizing solar energy to provide practical insights. • Assign projects where students design and analyze solar energy systems for specific applications.
Unit III	Wind Energy: Nature of wind-Basic components of Wind Energy Conversion System (WECS)-Wind energy collectors: Horizontal and vertical axis rotors-Advantages and Disadvantages of WECS - Applications of wind energy.	7 Hrs	7 Marks	• Utilize simulations or models to demonstrate the functioning of wind turbines and their efficiency. • Organize visits to wind farms or facilities utilizing wind energy to observe real-world applications. • Foster discussions on the societal impact, environmental considerations, and technological advancements in wind energy.
Unit IV	Ocean Energy: Ocean thermal electric conversion (OTEC) methods: Open cycle and Closed cycle Principles of tidal power generation-Advantages and limitations of tidal power generation. Geothermal Energy: Types of Geothermal resources-Applications of Geothermal Energy.	8 Hrs	8 Marks	• Utilize diagrams, animations, or videos to illustrate the principles of OTEC, tidal power generation, and geothermal energy. • Present case studies highlighting successful projects or installations of OTEC, tidal power, or geothermal energy for practical insights.

				• Engage students in discussions about the feasibility, challenges, and potential future advancements in ocean and geothermal energy.
References:	1. Non-conventional energy resources 3rd Edition , by B.H.Khan McGraw Hill publishers 2. Geothermal Energy ,by Kriti Yaav, Anirbid Sirkar, Apurwa Yadav, CRC Press 3. Fundamentals & Applications of Renewable Energy ,by 4. Mehmet Konoglu Yunus Cengel, John Cimbala, McGraw Hill publishers 5. Non-conventional Energy Resources by S. Hasan Saeed & D.K.Sharma , KATSON BOOKS 6. Understanding Biomass Energy by Baby Professor 7. Biomass: As Renewable Source of Energy by Bibhuprasad Ganthia, Selva Suman Ray, Asutosh Parida, Maitri Mallick 8. Non-conventional energy resources by G.D.Rai, Khanna Publishers 9. Non-conventional energy resources by Shobh Nath Singh, Pearson Publications 10. Wind energy : Theory and Practices by Siraj Ahmed, PHI edition 11. Future power, Future energy, Wind Power: Richa Sharma, Pearson-Longman 12. Fuel cell Geothermal Energy &Tidal power by Sameer Zodgekar ICFAI Uni. Press			

Physics 129/ SEC-1/Lab

Credits: 02 **Workload (Hrs/Week): 04**

Title of the Course: Instrumentation and Measurement Skills

Course Objectives:

The objective of teaching this subject is to enable students for measurement of various mechanical and temperature instruments and equipment like Screw gauge, Vernier callipers, Travelling microscope, spherometer, Spectrometer, Electronic balance, Density meter, Thermometer, etc.

This subject will give in depth insight for taking accurate readings (measurements) of dimensions of daily usable devices such as rods, rings, strings, wires, chains, blocks, vessels etc. Conversions of units into desired and applied practicable units. The subject will enrich students about measuring fundamental aspects of given mechanical, optical, thermal devices.

Course Outcomes:

1. Identify different types of mechanical, thermal devices/instruments.
2. Conversion of unit into desired, practicable and suitable (proper) units.
3. Errors in measurements, different methods of minimizing the errors.
4. Choosing the proper instrument between screw gauge, vernier callipers, spherometers, stop watch, spectrometers etc.

Overview of Basic measuring devices:

Vernier callipers, Screw gauge: Determination of width, area, volume, linear dimensions

spherometers: for finding radius of spherical objects.

Thermometers: for measurements of temperatures and their conversions into other units.

Density Measuring device: for determining volumetric density of given liquid.

Spectrometer: for finding refractive indices, determining wavelengths of light source.

Electric balance: measurement of mass, fractional, gross mass etc.

Travelling microscope: for measurement of thickness of thin objects, level measurements etc.

List of activities to be performed in the laboratory

1	Determination of least count of vernier callipers, screw gauge, spherometer, thermometers, travelling microscope, density meter, spectrometer, mechanical(Physical) balance, electronic balance,
2	Measurement of length of an eraser, duster, small objects using Vernier callipers
3	Measurement of an inner diameter of a glass tube using Vernier callipers
4	Measurement of width of a scale by using Screw gauge
5	Measurement of radius of curvature of a tennis ball/cricket ball by using Spherometer

6	Measurement of inner radius of curvature of a shallow objects like a steel vessel
7	Measurement of hot water by using thermometer into Celsius, Fahrenheit, Kelvin
8	Measurement of density of given liquid by density meter
9	Measure the gravitational mass of an object by using Mechanical (physical) balance
10	Measurement of gravitational mass of an object by using Electronic balance
11	To verify law of cooling by using stopwatch and thermometer plot a graph from the observed data
12	Measurement of area, volume of a Physics lab using meter scale
13	Measurement of diameter of an ear ring using screw gauge
14	Measurement of density of water by using measuring jar and physical /electronics balance.
15	Measurement of room temperature using thermometer, express it into Kelvin, Fahrenheit
16	Determination of refractive index of an prism by using spectrometer
17	Measurement of inner and outer diameter of a capillary tube using travelling microscope

Note: Students should at least perform 10 Lab/ Practical/ Demonstrations/Activities.

Suggested activities for students

1. Measure the length of playground, determine area using measuring tape available in physical education department of the college.
2. Measure the radius of curvature of a curve road using measuring tape.
3. Plot a sectorial part of an open plot using measuring tape.
4. Determine diameter of a football/volleyball using spherometer
5. Using stethoscope find the time and frequency of human heart beats

Reference:

1. B.Sc. Practical Physics by C. L.Arora ,S. Chand and Company Ltd.
2. Practical physics by S.L. Gupta,V. Kumar ,Pragati prakashan, Meerut
3. University practicalPhysics ,D.C.Tayal, Himalaya Publishing house

Internal and External Assessment Scheme:

- **External Assessment for Theory (Major/Minor/OE):**

Multiple Choice Questions MCQ) based on all units	06 Marks
Short answer questions	08 Marks
Long answer questions	16 Marks
Total	30 Marks

- **External Assessment for Practical (Major/Minor):**

Experiment Performance	20 Marks
Viva-Voce	5 Marks
Total	25 Marks

- **Internal Assessment for Theory/Practical/Laboratory:**

All the internal assessments should be conducted on the basis of *Continuous Assessment Tests (CAT)*.

Continuous Assessment Tests (CAT):

For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under

i. Three CAT each of 8/10 Marks (Theory) as applicable and 10 Marks (Practical).
   - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
   - Second on completion of 50% Syllabus of the course or on completion of 50 teaching days,
   - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days.

ii. Each concurrent assessment (CAT-I, II & III) will be mapped to relevant Course Learning Outcome.

iii. Total Performance in CAT (i.e.40 %) shall be based on the **best two out of three** in CAT examinations

iv. Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, record book, seminar, case study, field work, mini project work, quiz or any innovative method, which may be deemed to be appropriate for assessing the relevant course outcome.

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FIRST YEAR: SEMESTER – II

Mode of Teaching	Vertical No.	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field/Online/ Hybrid	a.	Major	Theory 2	Physics Th 2 129202	Oscillations and Properties of Matter	2	2	**6**
			Lab/Practical 2	Physics Lab 2 129203	Experiments Related to Physics Th 2	2	4	
	b.	Minor	Theory 2	Physics Th 2 129202	Oscillations and Properties of Matter	2	2	**6**
			Lab/Practical 2	Physics Lab 2 129203	Experiments Related to Physics Th 2	2	4	
	c.	Generic/ Open Elective	Theory 3	Physics 129/ OE-3	Medical Physics	2	2	**4**
			Theory 4	Physics 129/ OE- 4	Physics Behind Every Day Life	2	2	
	d.	VSC	Lab/Practical 1	Physics 129/ VSC-1/Lab	Electric Technician - I	2	4	**8**
		SEC	Lab/Practical 2	Physics 129/ SEC- 2/ Lab	Instrumentation and Measurement Skills	2	4	

Physics 129202/ Th 2

Credits: 02 **Workload (Hrs/Week): 02**

Title of the course: Oscillations and Properties of Matter

Course Objectives:	1. To define simple harmonic motion and identify its characteristics. 2. To relate simple harmonic motion to real-world examples. 3. To describe the oscillatory motion of a mass-spring system and a simple pendulum. 4. To define elasticity and understand the behavior of elastic materials. 5. To explore real-world examples of elasticity in engineering and materials science. 6. To explore the molecular basis of surface tension. 7. To explore applications of surface tension in everyday life and various industries.			
Course Outcomes:	On successful completion of this course, the students would be able to 1. Understand the mathematical representation of simple harmonic motion using equations and graphs. 2. Relate position, velocity and acceleration in simple harmonic motion. 3. Relate the phase of motion to velocity and acceleration. 4. Apply the principles of simple harmonic motion to real-world applications. 5. Interpret stress-strain curves for different materials. 6. Differentiate between elastic and plastic deformation. 7. Understand how elasticity varies in different materials (metals, polymers, ceramics) 8. Differentiate between cohesive and adhesive forces. 9. Identify and explain the role of surface tension in everyday phenomena, such as soap bubbles, wetting of surfaces, etc.			
	Contents	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Simple Harmonics Motion-I: Oscillatory and simple harmonic motion, differential equation of SHM and its solution, velocity and acceleration of simple harmonic oscillator, Graphical representation of displacement, Velocity and acceleration. Period and frequency of SHM, energy of a simple harmonic oscillator. Examples of simple harmonic oscillators: Spring-mass system, Simple pendulum, Compound pendulum, Torsion pendulum. Solved examples	8 Hrs	8 Marks	• Conduct experiments with springs, pendulums, or simulation software to illustrate SHM characteristics. • Engage students in solving problems involving SHM equations, energy calculations, and period/frequency determination. • Use animations, diagrams, and real-world examples to visually depict SHM concepts and oscillatory motion.
Unit II	Simple Harmonics Motion-II: Resultant of two SHMs in the same direction, Lissajousô figures, graphical method for Lissajousô figures. Damped harmonic oscillator: damping force, Differential equation of motion of a damped harmonic oscillator and its solution. Forced harmonic oscillator: Differential equation for forced harmonic oscillator and its solution. Solved examples.	7 Hrs	7 Marks	• Provide mathematical demonstrations and derivations for finding resultant SHMs, Lissajous figures, and solutions to differential equations. • Use interactive simulations or graphical representations to demonstrate Lissajous figures, damped and forced harmonic oscillations. • Relate examples of damped and forced oscillations to practical scenarios, such as mechanical systems with damping or resonance effects.
Unit III	**Elasticity:** Different types of elasticity, Twisting couple on a cylindrical rod or wire, Determination of modulus of rigidity by Maxwell needle, Beam: Bending of beam, Bending moment, External and internal bending moments, Cantilever, Expression for depression of a	8 Hrs	8 Marks	• Use diagrams, animations, or videos to illustrate the concepts of beam bending, twisting forces, and different types of elasticity. • Conduct experiments or demonstrations to showcase beam bending or torsional rigidity using simple setups or models.

	beam (i) Loaded at one end and (ii) Loaded at the center. Solved examples			• Engage students in solving problems related to beam bending, modulus of rigidity, and depression in beams to reinforce understanding. • Relate these concepts to real-world examples such as bridge structures, materials testing, or engineering design.
Unit IV	Surface Tension : Introduction, Molecular theory of surface tension, Surface film, Surface energy, Excess pressure inside drop and soup bubble, Contact angle, Rise of liquid in a capillary tube, Viscosity: Poiseuilleôs equation, Stokesô law, Terminal velocity, Critical velocity and Reynolds number. Solved examples	7 Hrs	7 Marks	• Use animations, diagrams, or experiments to illustrate surface tension, capillary rise, and viscosity concepts. • Engage students in solving problems using equations like Poiseuille's and Stokes' laws to understand fluid flow and viscosity. • Relate these concepts to real-life scenarios, such as the behavior of liquids in biological systems, engineering, or everyday phenomena.
References:	Study Materials in the form of - Reference Books, Text Books, Research Articles, Digital Resources like Weblinks, E- Contents, Educational Software, Databases, etc. References 1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, McGraw-Hill. 2. Physics, Resnick, Halliday and Walker, Wiley publication 3. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning 4. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education 5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole. 6. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley 7. Physics for degree students (B.Sc. 1st year) by C. L. Arora & P.S. Hemne, S. Chand Publication. 8. Concepts of Physics, H. C. Verma Volume-1, Bharati Bhawan publication			
Model Questions	**Short answer questions:** 1. Define. I) periodic motion ii) oscillation 2. Show that the total energy of the particle performing linear S.H.M. is constant. 3. Define surface energy. State its SI unit & dimensions. 4. Define external and internal bending moment. **Long answer questions:** 1. Obtain an expression for period of simple pendulum. On which factors it depends? 2. State & derive relation between surface tension & surface energy. 3. Derive an expression for external bending moment. 4. Derive an expression for modulus of rigidity by using Maxwell needle.			

Physics 129203/ Lab-2

Credits: 02 **Workload (Hrs/Week): 04**

Course Objectives:

1. Teach accurate measurement techniques for physical quantities such as length, time, mass, and temperature.
2. Emphasize the importance of uncertainty and error analysis in experimental measurements.
3. Develop skills in data analysis using statistical methods and graphical representation.
4. Emphasize the connection between theoretical predictions and experimental results.
5. Encourage students to formulate hypotheses and design experiments to test them.
6. Emphasize the importance of documenting procedures, results, and conclusions.
7. Develop oral communication skills through presentations of experimental findings.

Course Outcomes:

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

1. Acquire skills in making accurate measurements and observations.
2. Learn how to collect experimental data systematically.
3. Understand sources of error in experimental measurements.
4. Design and plan experiments to test specific hypotheses.
5. Learn how to write clear and concise laboratory reports.
6. Create and interpret graphical representations of experimental data.
7. Formulate hypotheses, design experiments, and draw conclusions based on evidence.
8. Develop critical thinking skills by analyzing and interpreting experimental results.

List of Experiments:

Perform at least Eight (08) experiments from the given list.

1. To study the oscillations of a mass in combinations of two springs.
2. To show that frequency of a Helmholtz resonator varies inversely as the square root of its volume and to estimate the neck correction.
3. To determine Youngôs modulus of the material of a beam by method of vibration.
4. To determine Youngôs modulus of the material of a beam by method of bending.
5. To determine Youngôs modulus of the material of a beam by a cantilever.
6. To determine Young's Modulus of a Wire by Optical Lever Method.
7. To determine modulus of rigidity of material of a given wire by Maxwellôs needle.
8. To determine modulus of rigidity of material of a given wire by using Torsional pendulum.
9. To determine coefficient of restitution for inelastic collision.
10. To determine the surface tension of mercury by Quinkeôs method

11. To study oscillations in Bifilar suspension arrangement.
12. To determine the surface tension of a liquid by Jaegerôs method.
13. To determine the surface tension of a liquid by capillary rise method.
14. To determine the coefficient of viscosity of water by Poiseuilleôs flow method.
15. To determine the coefficient of viscosity of glycerin by Stokeôs method.
16. To determine the coefficient of viscosity of glycerin by rotating cylinder method.

References

1. B.Sc. Practical Physics, Harnam Singh, Dr. P. S. Hemne, S. Chand and Company
2. Textbook of Practical Physics, H. P. Shrivastava, ABD Publisher
3. B.Sc. Practical Physics, C. L. Arora, S. Chand and Company
4. https://vlab.amrita.edu/
5. https://www.vlab.co.in/

Physics 129/ OE-3

Credits: 02 **Workload (Hrs/Week): 02**

Title of the Course: Medical Physics

Course Objectives:	1. To promote the application of Physics 2. Understand the anatomy of the nervous system and its signal measurements. 3. Analyze and understand the applications of the imaging techniques transmission(x- ray and ultrasound) **4.** Updating the knowledge in recent trends in medical field.			
Course Outcomes:	**After completing the course, the student will** able to 1. Know the application of Physics in medical Sciences. 2. Understood the applications of the imaging techniques transmission(x- ray and ultrasound) **3.** Understood the anatomy of the nervous system.			
	Contents	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Mechanics Of Human Body, properties and functions of Bone, Heat and Temperature, Temperature scales, Clinical thermometer, thermography, Heat therapy, Cryogenics in medicine, Heat losses from body, Pressure in the Body , Pressure in skull, Eye and Urinary Bladder.	8 Hrs	8 Marks	Multimedia and Visual Aids, Case-Based Learning and Collaborative Learning
Unit II	Physics Of Respiratory And Cardiovascular System Body as a machine, Airways, Blood and Lungs interactions, Measurement of Lung volume Breathing mechanism, blood Pressure, direct and indirect method of measuring	7 Hrs	7 Marks	Interdisciplinary Approach, Practical Demonstrations and Case-Based Learning
Unit III	Electricity In The Body Nervous system and Neuron ï Electrical potentials of Nerves, Electric signals from Muscles, Normal ECG waveform, Amplifier and Recording device ï Block diagram and working to record ECG, Patient monitoring.	8 Hrs	8 Marks	Connect biological concepts of the nervous and cardiovascular systems with electrical principles to create a comprehensive understanding. Visualization and Simulations.
Unit IV	Diagnostic X- Rays, properties of X- rays, Basic Diagnostic X-ray Machine, X-ray image, Live X-ray image, Radioactivity sources for nuclear, Principles of Radiation Therapy.	7 Hrs	7 Marks	Visual Aids and Simulations, Interactive Learning and Ethical Discussions
References:	1. John R. Cameron and James G. Skofronick, John Wiley &Sons ï Medical Physics, Wiley ï Interscience Publications ,1978. 2. R.S.Khandpur ï Handbook of Biomedical Instrumentation, Tata McGraw Hill Publication Co., Delhi, 1987.			

Physics 129/ OE-4

Credits: 02 **Workload (Hrs/Week): 02**

Title of the Course: Physics behind Every Day Life

Course Objectives:	To introduces physics through a set of modules that closely connected to our everyday life and future			
Course Outcomes:	**After completing the course, the student will** able to 1. Explain physics related phenomenon using basic physics principles and terminology 2. Perform basic calculation/estimations to solve simple physics related problems 3. Make correct judgment/decisions on physics related issues in their daily life based on basic physics principles			
Unit System	**Contents**	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Transportation: Linear motion, Speed, velocity, acceleration, Force, Newtonôs laws, circular motion, friction, collision, energy and momentum	8 Hrs	8 Marks	Interactive Demonstrations, Graphical Representation and Problem-Solving Approach
Unit II	Sports: Force, energy, projectile motion, rotation, moment of inertia, angular momentum	7 Hrs	7 Marks	Hands-On Activities, Interactive Demonstrations, Real-Life Connections and Problem-Based Learning
Unit III	Weather and climate: Energy, heat and temperature, the first law thermodynamics, heat transfer, black body radiation	7 Hrs	7 Marks	Use visual aids, hands-on experiments, and verbal explanations to accommodate different learning styles and Field Trips or Observations
Unit IV	Home Electricity: Electrostatics, electric potential, current, and resistance, ohmôs law, electric power, refrigeration, electric safety.	8 Hrs	8 Marks	Real-Life Applications, Problem-Based Learning and use of Visual and Interactive Materials
References:	1. Physics Beyond the Comfort Zone, Peter Watson publication			

Physics 129/ VSC-1/Lab

Credits: 02 **Workload (Hrs/Week): 04**

Title of the Course: Electric Technician - I

Course Objectives:

1. Develop a strong understanding of safety protocols and procedures in electrical work, emphasizing adherence to industry standards and regulations.
2. Identify, select, and effectively utilize various electrical components, tools, and equipment used in electrical installations and repairs.
3. Understand the fundamental principles of electricity, including voltage, current, resistance, and power.

Course Outcomes:

1. Understand and apply the principles of electricity, including voltage, current, resistance, and power in practical scenarios.
2. Follow industry-standard safety protocols effectively while working with electrical systems, ensuring personal safety and compliance with regulations.

Course Contents:

Module	Theoretical Background	Lab/ Practical/ Demonstrations/Activities
1	**Basic Tools & Safety** ÅFamiliarization with trade, safety precautions, and elementary first aid. ÅIdentification and care of hand tools with their specifications. ÅResponse to emergencies (power failure, system failure, fire) and safety signs. ÅIntroduction to Standards (BIS/ISI) and advantages.	1. Hands-on identification and understanding of commonly used hand tools. 2. Setting up toolkit with various hand tools. 3. Demonstrations: Proper handling, use, and maintenance of tools. 4. Demonstrations: Practical steps and protocols to follow in each emergency situation like power failure, system failure, and fire. 5. Presentation on BIS/ISI standards, safety signs, and their meanings. 6. Demonstrations on treating minor cuts, burns, and electric shock.
2	**Fundamentals of Electricity** ÅDefinitions, units, and effects of electric current. ÅVoltage, current, resistance, and power concepts. ÅOhm's law and circuit combinations (series, parallel, series-parallel). ÅDifferences between AC and DC, conductors, insulators, and conducting materials. ÅTechniques of soldering and types of solders.	7. Setting up basic circuits with varying current strengths and measuring current using ammeters. 8. Building circuits with different resistors and power sources and voltage, current, and calculation of power using multi-meters and Ohm's law. 9. Constructing series and parallel circuits with resistors and measuring of voltage, current, and resistance in series and parallel setups. 10. Demonstration of differences of AC and DC with reference to behavior and characteristics of some basic electrical devices in AC and DC circuits. 11. Demonstration of proper soldering methods, solder types, and safety precautions. 12. Practical soldering exercises on circuit boards or connectors. 13. Prepare a chart of wattage of different electrical items/appliances like CFL bulb, LED bulb, Tube light, Ceiling Fan, Table Fan, Gyger, Mixer-grinder, Refrigerator, Water pump, Iron, Xerox Machine, Inverter, TV, Hanging/ pendant Light, Microwave oven etc.

3	**Electrical Wires & Cables** ÅIdentification and uses of various wires used in house wiring, motor winding, and appliances. Joints, testing procedures, insulation, and voltage grades. ÅUnderground cables: types, joints, testing procedures, insulation, and voltage grades. ÅUnderstanding voltage drop and losses across cables. ÅInstruments to measure current, voltage, power in DC and AC circuits.	14. Identification and classification of wires (1/27, 3/22, 3/20 Copper, 1.3, 2.5 and 4 mm2 Aluminum, V.I.R., P.V.C., C.T.S., Lead covered, Enameled, Super Enameled Wire, Earthing Wire (G.I and Copper), Guide Wire. 15. Demonstration: Testing procedures for insulation resistance and continuity checks. 16. To measure the gauge of a given wire with the help of a wire gauge. 17. Measurement of voltage drop using voltmeters and calculation of losses. 18. Simulation of voltage drop across cables of varying lengths and materials. 19. Hands on experience of use of muti-meters, clamp meters, and power meters to measure current, voltage, and power in DC and AC circuits. 20. Skinning the cable and joint practice on single and multi-strand wire.
4	**Electric Accessories & Meters** ÅInstallation and specifications of electric meters and common accessories. ÅFunctions and uses of ammeters, voltmeters, energy meters, and wattmeters. ÅIntroduction to Megger and its applications.	21. Demonstration of mounting and installation of various types of electric meters. 22. Uses of energy meters and watt-meters in electrical circuits. 23. Use of the Megger for insulation resistance testing in circuits. 24. Simulation of complex electrical circuits with faults. 25. Troubleshooting faults using meters and Megger for diagnosis.

Note:
Students should at least perform 10 Lab/ Practical/ Demonstrations/Activities.

References:

1. Textbook of Electrical Technology, Volume 1, B.L. Thereja
2. National Electrical Code 2011, Bureau of Indian Standards
3. Electrical Wiring An Introduction, Satheesh Kumar, Ana Books, Pvt. Ltd.
4. Electrical Wiring Estimating And Costing, 6th Edition, S. L. Uppal , G. C. Garg
5. Electrical Home Appliance with Electric Wiring
6. Electrical Technician (ET) Handbook for Intermediate Vocational Course, Second Year All In 1 - Vocational Made Success Series, 2023

Physics 129/ SEC-2/Lab

Credits: 02 **Workload (Hrs/Week): 04**

Title of the Course: Instrumentation and Testing Skills

Course Objectives:

The objective of teaching this subject is to enable students for testing of various electronic and electrical Components and Instruments such as Diodes, Transistors, Transformer, Switches, Fuses, Cables, CRO, Multimeters, Voltmeter, and Ammeters etc. Further this subject will give an insight upon the Soldering and De-soldering methods. This in turn will enhance their capabilities of Identifying, Assembling, and Fault diagnosis in a systematic way. The subject will enrich students about reliability and quality control standards of equipment.

Course Outcomes:

- Identify of different types of Electronic & Electrical Components & Devices.
- Test different types of Electronic & Electrical Components & Instruments
- Practise of Soldering & Desoldering process with correct methods.
- Capabilities of identifying, assembling, fault diagnosis of electrical and electronic Components & Devices.
- Identify faults in domestic electronic gadgets.

Topics to be covered:

Introduction: Voltage and Current sources, Resistance in Series & Parallel, Kirchoffôs current and voltage laws, loop and nodal analysis of simple circuits.

Overview of Basic Measuring Instruments:

Multimeter: Specifications of a Multimeter and their significance.

Cathode Ray Oscilloscope: Block diagram of CRO. Construction of CRT, Electron gun, Study of Front panel controls.

Basics of Soldering:

Soldering tools and materials (solder, flux), Types of soldering irons (Wattage, temperature, Tips), The SMD (surface mounted Devices) and its soldering and de-soldering.

Safety & Testing of Various Devices: Safety precautions and rules in handling electrical appliances, Earthing, Electric shock Fuses, MCB and Relays. Testing of different Electrical & Electronic Components & Devices.

List of Activities to be performed in the Laboratory

1. To Study of Multimeter. Measurement of AC & DC Voltages, Current and Resistance by using Multimeter (Analog & Digital).
2. Testing of Continuity of Cables & Wires in Electrical Circuits by using Multimeter and also check whether a circuit is in open or short circuited.
3. Testing of Resistance of Resistor by using Multimeter. Arrange several resistors of known and unknown resistance in different ranges, measure their values and tabulate your results in an observation table.
4. Testing of Capacitor by using Multimeter, test whether the electrolyte capacitor is in working order or not.
5. Testing of P-N Junction Diode by using Multimeter, check whether a P-N junction diode is working and identify its p- and n ends. Check the diode connected in Forward or in Reverse Biased condition
6. Testing of Bipolar Junction Transistor by using Multimeter and identifying Emitter, Base & Collector terminals of npn and pnp Transistors. Check the Basing Conditions of Transistors.
7. Testing of Electrical Switches & Fuses by using Multimeter, Check the Different switches and Fuses is in good condition or short circuited.
8. Set up a simple RC circuit (Resistor-Capacitor circuit) with a known resistor and unknown Capacitor. Use the multimeter to measure the Time constant of the circuit during charging and discharging.
9. To study soldering and desoldering techniques. Practice soldering and de-soldering of components like Resistor, Capacitor, diodes. etc. on PCB.
10. To Measure amplitude, time period and frequency of time varying signals by using a cathode ray oscilloscope.
11. To study the controls of CRO. Test the AC and DC Voltage levels of electrical circuit by using CRO and observe the Waveforms of AC Voltages.
12. To study Lissajous figures to know about the Phase difference between the two signals and the ratio of their frequencies by using CRO.
13. Connect the CRO to various points in a circuit and observe the waveforms. Identifying problems and optimizing performance of circuit.
14. To measure the DC Voltage across the given Resistance and determine the current through it by using CRO.
15. Testing of parameters of Semiconductor Diode and Bipolar Junction Transistor by using CRO.

Note: Suggested Home Activities for students

1. Visit an electrical appliance repair shop and prepare a chart of frequently used components and their applications.
2. Take a domestic electrical appliance, Identify and enlist the components used in that.
3. Prepare & testing a Printed Circuit Board (PCB)

4 Use the continuity check or resistance measurement to test different materials in your house. Which ones are conductors and which ones are insulators?

Reference

1. A. K. Sawhney, A Course in Elec. & Electronics Measurements & Instrumentation, Dhanpatrai &Co. 1978
2. A.D. Helfrick & W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques PHI, 2016
3. D C Kulshreshtha, Basic Electrical Engineering, Mc Graw Hill Publications, 2019
4. David G Alciatore and Michel B Histand, Introduction to Mechatronics and Measurement Systems, 3rd, Tata McGraw Hill Education Private Limited, New Delhi., 2005
5. Vincent Del Toro, Electrical Engineering Fundamentals Prentice Hall India 2009
6. Louis E. Frenzel, Jr, Practical Electronic Design for Experimenters, 1st Edition, McGraw-Hill Education, 2020.
7. Glen A. Mazur, Digital Multimeter Principles, American Technical Publishers; 4th

Internal and External Assessment Scheme:

- **External Assessment for Theory (Major/Minor/OE):**

Multiple Choice Questions MCQ) based on all units	06 Marks
Short answer questions	08 Marks
Long answer questions	16 Marks
Total	30 Marks

- **External Assessment for Practical (Major/Minor):**

Experiment Performance	20 Marks
Viva-Voce	5 Marks
Total	25 Marks

- **Internal Assessment for Theory/Practical/Laboratory:**

  All the internal assessments should be conducted on the basis of *Continuous Assessment Tests (CAT)*.

  Continuous Assessment Tests (CAT):

  For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under

i. Three CAT each of 8/10 Marks (Theory) as applicable and 10 Marks (Practical).
   - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
   - Second on completion of 50% Syllabus of the course or on completion of 50 teaching days,
   - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days.

ii. Each concurrent assessment (CAT-I, II & III) will be mapped to relevant Course Learning Outcome.

iii. Total Performance in CAT (i.e.40 %) shall be based on the **best two out of three** in CAT examinations

iv. Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, record book, seminar, case study, field work, mini project work, quiz or any innovative method, which may be deemed to be appropriate for assessing the relevant course outcome.