GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN CE/ME/MT
PROGRAMME CODE	01/04/05
COURSE TITLE	APPLIED PHYSICS
COURSE CODE	SC11204
PREREQUISITE COURSE CODE & TITLE	NA

I. LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Course Type	Learning Scheme					Credits	Assessment Scheme											
			Actual Contact Hrs./Week			SLH	NLH		Paper Duration Hrs.	Theory			Based on LL & TSL				Based on SL		Total Marks
													Practical						
			CL	TL	LL					FA-TH	SA-TH	Total	FA-PR		SA-PR		SLA		
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
SC11204	APPLIED PHYSICS	DSC	3	0	2	1	6	3	2	30	70*#	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 02 Hrs

Abbreviations: **CL**-Classroom Learning, **TL**-Tutorial Learning, **LL**-Laboratory Learning, **SLH**-Self Learning Hours, **NLH**-Notional Learning Hours, **FA** - Formative Assessment, **SA** -Summative assessment, **IKS** – Indian Knowledge System, **SLA**- Self Learning Assessment

Legends: @- Internal Assessment, # - External Assessment, *# - Online Examination, @$ - Internal Online Examination

Note:

FA-TH represents an average of two class tests of 30 marks each conducted during the semester.

1. If a candidate is not securing minimum passing marks in **FA-PR** (Formative Assessment - Practical) of any course, then the candidate shall be declared as **'Detained'** in that semester.
2. If a candidate does not secure minimum passing marks in SLA (Self Learning Assessment) of any course, then the candidate shall be declared as **'fail'** and will have to repeat and resubmit SLA work.
3. **Notional learning hours** for the semester are **(CL + LL + TL + SL) hrs. * 15 Weeks**
4. **1 credit** is equivalent to **30 Notional hours.**
5. * Self-learning hours shall not be reflected in the Timetable.
6. *Self-learning includes micro-projects/assignments/other activities.

II. RATIONALE:

This course is designed with some fundamental information to help diploma engineers apply the basic concepts and principles of physics to solve broad-based engineering problems. The study of basic principles and the concepts of motion, elasticity, viscosity, surface tension, sound, heat, optics, photo electricity and X-rays will help in understanding the technology courses where emphasis is laid on the applications.

III. COURSE-LEVEL LEARNING OUTCOMES (CO'S)

Students will be able to achieve and demonstrate the following CO's on completion of course-based learning

CO1: Estimate errors in measurement and Apply laws of motion in various applications.
CO2: Select relevant material in industries by analyzing its physical properties.
CO3: Apply the concept of simple harmonic motion, resonance and ultrasonic waves for various engineering applications.
CO4: Use basic principles of heat in related engineering problems.
CO5: Use basic principles of optics in related engineering problems.
CO6: Apply the concept of modern Physics (X-rays, LASER, Photocell) for various engineering applications.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-I GENERAL PHYSICS (CL Hrs-7, Marks-12)			
1	**TLO 1.1** List fundamental and derived quantities with their unit. Explain the procedure of measuring the dimensions of a given object by using Vernier Calipers and Screw Gauge. **TLO 1.2** Calculate the angular velocity of the given body. Derive equations of Angular motion. **TLO 1.3** To Study range, angle of projection and maximum height of projectile.	**1.1 Units and Measurements:** Introduction, Definition of unit, Fundamental and derived units, Different System of units, Dimensions of physical quantities, measurement errors. **1.2 Angular Motion**: Definition, radius vector, angular displacement, angular velocity, angular acceleration and units, relation between linear and angular velocity, relation between linear acceleration and angular acceleration. Analytical Treatment. **1.3 Projectile motion:** Projectile motion, trajectory, range of projectile, angle of projection, time of flight.	Chalk and board Improved lecture, Tutorial Assignment Demonstration	CO1
	UNIT-II PROPERTIES OF MATTER (CL Hrs -10, Marks-14)			
2	**TLO 2.1** Apply the concept of elasticity and plasticity to select the material for engineering applications. **TLO 2.2** Apply the concept of Surface Tension to find the coefficient of Viscosity. **TLO 2.3** Establish a relation between given types of moduli of elasticity.	**2.1 Surface Tension:** Definition and unit, molecular theory of surface tension, Cohesive and adhesive forces, angle of contact and its significance, the shape of the liquid surface in a capillary tube, capillary action and examples, surface tension by capillary rise method (no derivation), effect of impurity and temperature on surface tension. analytical treatment. **2.2 Viscosity:** Definition, velocity gradient and its unit, Newton's law of viscosity, terminal velocity, Stokes law, Stokes formula, coefficient of viscosity by Stokes method (no derivation), types of flow of liquid - streamline flow, turbulent flow, Reynold's number (significance), applications and analytical treatment. **2.3 Elasticity:** Deforming Force and Restoring Force, Elasticity, Plasticity,	Chalk and board Improved lecture, Tutorial Assignment Demonstration Educational Games	CO2

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		Rigidity. Stress and Strain and their types, elastic limit and Hooke's law, types of moduli of elasticity, analytical treatment.		
		UNIT-III WAVES & OSCILLATIONS (CL Hrs-07, Marks-10)		
3	**TLO 3.1** To study the properties of sound waves. **TLO 3.2** Find the parameters required to analyze the given wave motion and simple harmonic motion. **TLO 3.3** Explain the concept of resonance and its applications. **TLO 3.4** Describe the properties of given ultrasonic waves.	**3.1 Sound:** Sound waves, amplitude, frequency, time-period, wavelength and velocity of the wave, the relation between velocity, frequency and time-period of a wave. Analytical Treatment. **3.2 SHM:** Simple Harmonic Motion, Uniform Circular Motion as Simple Harmonic Motion, Equation of Simple Harmonic Motion, Phase of Simple Harmonic Motion. **3.3 Resonance:** Resonance concept in prehistoric times, the concept of different frequencies (Mantras) used to ignite different chakras in the body (IKS). Applications of resonance. **3.4 Ultrasonic waves:** Properties of ultrasonic waves. Applications of ultrasonic waves.	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO3
		UNIT- IV HEAT (CL Hrs-6, Marks-10)		
4	**TLO 4.1** To study different Gas laws. **TLO 4.2** Distinguish Between Good Conductors and Bad Conductors of Heat. **TLO 4.3** Introduction of Thermodynamics	**4.1 Gas Laws:** Explanation of Gas laws, Boyle's law, Charles law, Gay Lussac's law, General Gas Equation, analytical treatment, units of temperature ^0C, ^0K, ^0F with their conversion, absolute scale of temperature. **4.2 Heat:** modes of heat transfer, conduction, convection and radiation. **4.3** Introduction of Thermodynamics	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO4
		UNIT –V OPTICS (CL Hrs-6, Marks-10)		
5	**TLO 5.1** State laws of reflection and refraction. Describe the phenomenon of total internal reflection. **TLO 5.2** Distinguish between optical fibre communication systems and ordinary systems.	**5.1 Light:** Introduction to reflection and refraction of light, laws of reflection and refraction, Snell's law, refractive index, physical significance of refractive index, critical angle, total internal reflection of light.	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO5

Sr. No	Theory Learning Outcomes (TLO'S) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
		5.2 Fiber optics: Propagation of light through optical fiber, the structure of the optical fiber, numerical aperture, acceptance angle, acceptance cone, types of optical fibers, applications of optical fiber, comparison of optical fiber communication with electrical cable communication, analytical treatment.		
	UNIT - VI MODERN PHYSICS (CL Hrs-9, Marks-14)			
	TLO 6.1 Explain the properties of photons based on Planck's hypothesis. **TLO 6.2** Explain the construction and working of a given photoelectric device. **TLO 6.3** Explain the method to produce X-rays with its properties and engineering applications. **TLO 6.4** Differentiate between LASER and ordinary light. **TLO 6.5** Describe the properties of nanomaterials.	**6.1 Photoelectricity:** Planck's hypothesis, properties of photons.Photoelectric effect: threshold frequency, threshold wavelength, stopping potential, Work function, characteristics of the photoelectric effect, Einstein's photoelectric equation Photoelectric cell and LDR: Principle Working and applications. **6.2 X-rays:** Production of X-rays by modern Coolidge tube, properties and engineering applications. **6.3 LASER:** Laser: properties, absorption, spontaneous and stimulated emission, Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser. Engineering applications of Laser. **6.4** Introduction to Nanotechnology.	Chalk and board Improved lecture, Tutorial Assignment Demonstration.	CO6

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/TUTORIAL EXPERIENCES.

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
1	LLO1.1 Use of given instrument and i) Mention name and range of the given instrument. ii) Calculate the least count of the given instrument. iii) List the uses of the given instrument.	Identify the given instrument and i) Mention the name and range of the given instrument. ii) Calculate the least count of the given instrument. iii) List the uses of the given instrument.	**2**	**CO1**
2	LLO 2.1 Use a Vernier caliper to	Measurements of dimensions of the given	**2**	**CO 1**

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
	Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 2.2 Estimate the errors in measurement	object by Vernier caliper.		
3	LLO 3.1 Use a Micrometer Screw gauge to Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 3.2 Estimate the measurement errors.	Measurements of dimensions of given objects by micrometer screw gauge.	2	CO1
4	LLO 4.1 Study of Projectile motion.	Predict the range of the projectile from the initial launch speed and angle.	2	CO1
5	LLO 5.1 Use Capillary Rise Method to study Surface Tension.	Determine surface tension by capillary rise method.	2	CO2
6	LLO 6.1 Use Stokes's method to determine the coefficient of viscosity.	Measure the coefficient of viscosity of a given liquid using Stokes's method (Stokes law).	2	CO2
7	LLO 7.1 Use Hooke's Law to calculate Spring constant.	Calculate the spring constant using Hooke's law.	2	CO2
8	LLO 8.1 Use a resonance tube to determine the velocity of sound. (Concept of resonance).	Determine the velocity of sound by using a Resonance Tube. (Concept of resonance).	2	CO3
9	LLO 9.1 Use a simple pendulum to determine the acceleration due to gravity.	Determination of Acceleration due to Gravity by Simple Pendulum.	2	CO3
10	LLO 10.1 Use Boyle's Law to study the relation between pressure and volume for a given gas.	Verify Boyle's law and establish a relation between pressure and volume for a given gas.	2	CO4
11	LLO 11.1 Use the Refraction Phenomenon to determine the refractive index of the glass slab.	Determination of the refractive index of the glass slab.	2	CO5
12	LLO 12.1 Use of He-Ne laser beam, to study properties of LASER.	Study the properties and working of the laser using a He-Ne laser beam.	2	CO6
13	LLO 13.1 Use photoelectric cells to study the effect of : Intensity of light on photoelectric current.	Study the effect of the Intensity of light on photoelectric current.	2	CO6

Sr. No	Practical/Tutorial/Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant COs
14	LLO 14.1 Use photoelectric cells to study the effect of : Applied potential on photoelectric current.	Study effect of Applied potential on photoelectric current. using Photoelectric cell	2	CO6
15	LLO 15.1 Study of Divergence of LASER.	Determine the divergence of laser beam	2	CO6

Note: A suggestive list of practical LLOs is given in the table, more such practical LLOs can be added to attain the COs and competency. A judicial mix of a minimum of 12 or more for physics practical LLOs needs to be performed so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. ii. Hence, the 'Process' and 'Product' related skills associated with each LLOs of the laboratory work are to be assessed according to a suggested sample of Performance Indicators (Weightage in %) as follows:

1) Preparation of experimental set up 20%
2) Setting and operation 20%
3) Safety measures 10%
4) Observations and Recording 10%
5) Interpretation of result and Conclusion 20%
6) Answer to sample questions 10%
7) Submission of the report in time 10%.

VI. SUGGESTED MICROPROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING/SKILLS DEVELOPMENT(SELF-LEARNING)

Only one Micro Project is planned to be undertaken by a student assigned to him/her at the beginning of the semester. She/He ought to submit it by the end of the semester to develop industry-oriented COs. Each micro-project should encompass two or more COs. The Micro-Project could be industry application-based, internet-based, workshop-based, laboratory-based or field-based. The assessment of the micro-project is to be done under Self Learning Assessment (SLA). The Micro Project is preferably assigned to a group of (4-6) students or an individual taking into consideration the capabilities and circumstances at the time.

A suggested list is given here. A similar micro-project/ Assignment could be added by the concerned faculty.

Micro project:

- Vernier calipers: Prepare prototype vernier caliper of desired least count using card sheet
- Properties of matter: Prepare a chart of different viscous liquids.
- Sound: Prepare a chart of the velocity of sound in different materials.
- Heat: Collect good and bad conducting materials of heat
- Mobile applications: Use mobile applications for conversions of different physical quantities.
- Optical Fiber and TIR: Prepare model to demonstrate total internal reflection
- Physical quantities: Prepare a Chart on comparison of systems of units for different physical quantities.

- LASER: Prepare a chart to study Total Internal Reflection.
- X-rays/Photoelectric cell: Prepare a chart showing the properties and applications of X-rays and Photoelectric cells.

Assignment:

- Convert the units of a given physical quantity from one system of units to another.
- Prepare a chart to summarize units and measurements.
- Distinguish between transverse waves and longitudinal waves based on frequencies explain infrasonic waves, audible sound waves and ultrasonic waves.
- Collect different elastic materials and mention their Young's modulus.
- Demonstrate the variation of the angle of refraction with respect to the refractive index.
- Use a digital vernier caliper and micrometer screw gauge for measurements (lab-based).
- Applications of optical fibers in, engineering.
- Applications of X-Ray in engineering.
- Applications of LASER in engineering.
- Applications of Photoelectricity in engineering.

VII. LABORATORY EQUIPMENT/INSTRUMENTS/TOOLS/SOFTWARE REQUIRED

Sr. No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Vernier Calliper : Range: 0-15 cm, Resolution 0.01 cm.	2
2	Micrometer screw gauge: Range 0-25 mm, Resolution 0.01 mm.	3
3	Simple pendulum, Stop Watch.	4
4	Glass Slab 75x50x12mm.	10
5	Travelling microscope: Range: 0.05-22 cm, Resolution 0.001 cm, Capillary tube	5
6	Battery eliminator (0-12 V, 2 A)	11,12,13
7	Voltmeter(0-10 V), ammeter (0-5 A)	1
8	Boyle's law apparatus.	10
9	Stoke's apparatus, Wooden scale, Small metal sphere.	6
10	Hooke's law apparatus	7
11	Resonance tube, Tuning fork set, Rubber pad.	8
12	Photoelectric cell.	12,13
13	He-Ne laser kit	11

VIII. SUGGESTED FOR WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

(Specification Table)

Sr. No	Unit	Unit Title	Aligned COs	Learning Hours	R - Level	U - Level	A - Level	Total Marks
1	I	General Physics	CO1	**7**	3	4	5	12
2	II	Properties of Matter	CO2	**10**	4	4	6	14
3	III	Waves And Oscillations	CO3	**7**	3	3	4	10
4	IV	Heat	CO4	**6**	3	4	3	10
5	V	Optics	CO5	**6**	3	4	3	10
6	VI	Modern Physics	CO6	**9**	4	5	5	14
Grand Total				**45**	**20**	**24**	**26**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
Two Unit Tests of 30 marks and the average of two unit tests. For Laboratory Learning 25 MARKS	End Semester assessment of 25 marks for laboratory learning. End Semester assessment of 70 marks (Online)

X. SUGGESTED COs- POs MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline - Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	-	1	1	1	2			
CO2	3	2	1	2	1	1	2			
CO3	3	1	1	1	1	1	2			
CO4	3	1	1	1	1	1	2			
CO5	3	1	1	1	1	1	2			
CO6	3	1	1	2	2	1	2			

Legends:-High:03, **Medium**:02, **Low**:01, **NoMapping**:-

*PSOs are to be formulated at the institute level

XI. SUGGESTED LEARNING MATERIALS/BOOKS

Sr.No.	Author	Title	Publisher with ISBN Number
1	Narlikar J. V. ;Joshi , A. W.; Mathur, Anuradha ; et al	Physics Textbook Part I - Class XI	National Council of Education Research and Training, New Delhi, 2010, ISBN: 8174505083
2	Narlikar, J.V.;Joshi , A. W.; Mathur, Anuradha ; et al	Physics Textbook Part II - Class XI	National Council of Education Research and Training, New Delhi, 2015, ISBN: 8174505660
3	Narlikar J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part I - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN: 8174506314
4	Narlikar, J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part II - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN: 8174506713

XII. LEARNING WEBSITES & PORTALS

Sr.No	Link/Portal	Description
1	www.sciencejoywagon.com/physicszone	Electricity, Magnetism and Semiconductors, basic fiber optics
2	https://phet.colorado.edu	Electricity, Magnetism and Semiconductors, Thermometry and basic fiber optics
3	www.physicsclassroom.com	Concepts of basic physics
4	http://nptel.ac.in/course.php?disciplineId=104	Concepts of basic physics
5	http://hperphysics.phy-astr.gsu.edu/hbase/hph.html	Concepts of basic physics
6	https://www.youtube.com/results?search_query=amruta+university+physics+expts	Concepts of basic physics
7	https://www.youtube.com/results?search_query=physics+class+11+chapter+1	Concepts of basic physics
8	https://www.youtube.com/watch?v=zRGh9_a1J7s	Concepts of basic physics
9	https://iksindia.org	IKS physics
10	https://www.ancient-origins.net/history-famous-people/indian-sageacharya-kanad-001399	IKS Philosophy of atom by Acharya Kanad.

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