Government Polytechnic, Pune

'180 OB' – Scheme

Programme	Diploma in **CE**/EE/ET/**ME/MT**/CO/IT/DDGM
Programme Code	**01**/02/03/**04**/**05**/06/07/08/**15**/16/17/**18**/**19**/**21**/22/23/**24**/26
Name of the Course	**Applied Physics**
Course Code	**SC1103**
Prerequisite course code and name	**NA**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Practical		Total Marks
L	T	P	C		#ESE	PA	*ESE	PA	150
03	00	02	05	Marks	80	20	25	25	
				Exam Duration	2 Hrs	1 Hrs	2 Hrs	--	--

Legends: L- Lecture, P- Practical, T- Tutorial, C- Credits, ESE-End Semester Examination, PA- Progressive Assessment (Test I, II/ Term Work), *- Practical Exam, $- Oral Exam, #- Online Examination. Each Lecture/Practical period is of one clock hour.

2. RATIONALE

This course is designed with some fundamental information to help the diploma engineers to 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.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply principles of physics to solve broad-based engineering problems.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Estimate errors in the measurement of physical quantities.
2. Apply laws of motion in various applications.
3. Apply the concepts of elasticity, viscosity and surface tension to solve engineering problems.
4. Use basic principles heat, light and optics in related engineering problems.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	**Unit No.**	**Practical Exercises** (Outcomes in Psychomotor Domain)	**Relevant COs**	**Approx. Hrs. required**
1	1	Identify given instrument and i) Mention name and range of given instrument. ii) Calculate least count of given instrument. iii) List the uses of given instrument.	1	02
2	1	Use Vernier caliper to : i) Identify and calculate instrumental error. ii) Measure dimensions of different objects. i) Estimate error in the measurement (if any).	1	04*
3	1	Use micrometer screw gauge to: i) Identify and calculate instrumental error. ii) Measures dimensions and determine volume of given object. iii) Estimate error in the measurement.	1	04*
4	1	Use simple pendulum to determine acceleration due to gravity.	1,2	02*
5	2	Determine surface tension by capillary rise method.	1,3	02
6	2	Measure coefficient of viscosity of given liquid using Stoke's method (Stokes law).	1,3	02*
7	2	Calculate spring constant using Hooke's law.	3	02
8	3	Use resonance tube to determine velocity of sound. (Concept of resonance).	1,3	04*
9	4	Verify of Boyle's law and establish relation between pressure and volume for given gas.	4	04*
10	5	Determine refractive index of glass slab using principle	4	02

		of total internal reflection.		
11	5	Study the properties and working of laser using He-Ne laser beam.	4	02*
12	6	Use photoelectric cell to study effect of : i) Intensity of light on photoelectric current. ii) Applied potential on photoelectric current.	4	04*
13	All	Complete a Micro- project based on guidelines provided in Sr.No.11	1 to 4	04*
		Total		**32**

Note: A suggestive list of Practical is given in the above table. Minimum 10 practical need to be performed out of which practical marked as * are compulsory. Any one practical out of Sr. No. 1,5,7 & 10 need to be performed.

Sr.No.	Performance Indicators	Weightage in %
a.	Arrangement of available equipment / test rig or model	10
b.	Setting and operation	10
c.	Safety measures	10
d.	Observations and Recording	20
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	20
g.	Submission of report in time	10
	Total	**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Equipment Name with Broad Specifications	Experiment Sr. No
1	Voltmeter (0-10 V), ammeter (0-5 A),	1
2	Vernier Calliper : Range: 0-15 cm, Resolution 0.01 cm.	1,2,8
3	Micrometer screw gauge: Range 0-25 mm, Resolution 0.01 mm.	1,3,6
4	Simple pendulum, Stop Watch.	4
5	Travelling microscope: Range: 0.05-22 cm, Resolution 0.001 cm, Capillary tube.	5
6	Stoke's apparatus, Wooden scale, small metal sphere.	6
7	Hooke's law apparatus	7
8	Resonance tube, tuning fork set, rubber pad.	8
9	Boyles law apparatus.	9

10	Glass Slab 75x50x12mm.	10
11	He-Ne laser kit.	11
12	Photoelectric cell.	12

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	**Topics and Sub-topics**
Unit I General Physics (8 Hrs,14 Marks)	
1a. List fundamental and derived quantities with their unit. 1b. Explain various systems of unit and its need for the measurement. 1c. Estimate errors in measurement. 1d. Derive relation between linear velocity and angular velocity. 1e. Calculate angular velocity of the given body 1f. Distinguish between centripetal and centrifugal force. 1g. Derive equation of SHM.	**1.1 Units and Measurements:** Introduction, Definition of unit, Fundamental and derived units, Different System of units, Errors in measurements **1.2 Circular Motion**: Definition, Uniform circular motion(UCM), radius vector, angular displacement, angular velocity, angular acceleration and units, relation between linear and angular velocity, relation between linear acceleration and angular acceleration, explanation of centripetal and centrifugal force, examples, applications of centripetal and centrifugal force, analytical treatment. **1.3 SHM**: Concept of time period, frequency, amplitude, wavelength, relation between wave velocity frequency and wavelength. Definition of SHM, examples of SHM, SHM as a projection of UCM, equation of SHM starting from mean position.
Unit II Properties of Matter (12 Hrs,18 Marks)	
2a. Compare cohesive and adhesive force. 2b. Explain phenomenon of ST with the help of molecular theory. 2c. Calculate surface tension of given liquid. 2d. State Newton's law of viscosity. 2e. Calculate coefficient of viscosity of given liquid. 2f. Distinguish between streamline flow and turbulent flow 2g. Describe concept of elasticity and	**2.1 Surface Tension :** Definition and unit, molecular theory of surface tension, Cohesive and adhesive forces, angle of contact and its significance, shape of liquid surface in capillary tube, capillary action and examples, surface tension by capillary rise method (no derivation), analytical treatment, effect of impurity and temperature on surface tension. **2.2 Viscosity:** Definition, velocity gradient and its unit, Newton's law of viscosity, terminal velocity, Stokes law, Stokes formula,

plasticity. 2h. State Hooke's law of elasticity. 2i. Establish relation between given types of modulii of elasticity. 2j. Predict the behavior of the given wire.	coefficient of viscosity by stokes method (no derivation), type of flow of liquid - stream line flow, turbulent flow, Reynolds's number (significance), applications and analytical treatment. **2.3 Elasticity:** Elastic, plastic and rigid bodies, stress, strain and its types, Hook's law, types of elastic modulii with its relation, analytical treatment, behavior of wire under continuously increasing load (stress-strain diagram).
Unit III Sound (6 Hrs,10 Marks)	
3a. Distinguish between Transverse and Longitudinal wave. 3b. Describe phenomenon of resonance with example and applications. 3c. Describe properties and applications of ultrasonic wave in engineering.	**3.1 Sound:** Wave motion, Transverse and longitudinal waves, free and forced vibrations, Resonance – explanation, example and applications, absorption, reflection and transmission of sound. **3.2 Ultrasonic:** Definition, properties of ultrasonic waves, applications of ultrasonic in engineering.
Unit IV Heat (6 Hrs,12 Marks)	
4a. State Boyle's law, Charles's law and Gay lussac's law. 4b. Verify Boyle's law. 4c. Derive general gas equation 4d. Convert given temperature in different scale. 4e. Explain different modes of heat transfer with example.	**4.1 Gas Laws:** Explanation of Gas laws, Boyle's law, Charles's law, Gay Lussac's law, General Gas Equation, analytical treatment, units of temperature ^{0}C, ^{0}K with their conversion, absolute scale of temperature. **4.2 Heat:** modes of heat transfer, conduction, convection and radiation.
Unit V Optics and Laser (8 Hrs,14 Marks)	
5a. State laws of reflection and refraction. 5b. Describe phenomenon of total internal reflection. 5c. Calculate acceptance angle and numerical aperture for given optical fiber. 5d. Distinguish between optical fiber communication system and ordinary system. 5e. Differentiate between properties of ordinary light and laser light. 5f. Explain spontaneous and stimulated emission.	**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 refraction of light. **5.2 Fiber optics**: Propagation of light through optical fiber, structure of 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. **5.3 LASER:** Definition, properties of LASER,

5g. Describe working of He-Ne laser with energy level diagram. 5h. State applications of laser in different field.	spontaneous and stimulated emission, population inversion, metastable state, pumping, life time, He-Ne laser-construction and working with energy level diagram, engineering applications of laser.
Unit VI Modern Physics (8 Hrs,12 Marks)	
6a. Describe properties of photon 6b. Derive Einstein's photoelectric equation. 6c. Explain working of given photoelectric device. 6d. Explain production of X-rays. 6e. Describe properties and applications of X-ray in different field.	**6.1 Photo electricity**: photoelectric effect, Plank's quantum theory, concept of photon, properties of photon, threshold frequency, threshold wavelength, stopping potential, photoelectric work function, Einstein's photoelectric equation, photocell (circuit diagram and working), applications of photoelectric cell, analytical treatment. **6.2 X- ray:** principle, production of X-rays using Coolidge tube, origin of X-rays, types of X-rays, properties of X-rays, engineering applications.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	General Physics	**8**	4	4	6	14
II	Properties of matter	**12**	8	6	4	18
III	Sound	**6**	4	4	2	10
IV	Heat	**6**	4	4	4	12
V	Optics and Laser	**8**	6	6	2	14
VI	Modern Physics	**8**	6	4	2	12
Total		**48**	**32**	**28**	**20**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal based on practical performed in Physics laboratory. Journal consists of drawing, observations, required equipment's, date of performance with teacher signature.

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

b. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).

c. With respect to item No.9, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

d. Use proper equivalent analogy to explain different concepts.

e. Use Flash/Animations to explain various components, operation and

f. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECT

Only one Micro Project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. She/He ought to submit it by the end of semester to develop industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs. The Micro-Project could be industry application based, internet based, workshop based, laboratory based or field based. The assessment of micro-project is to be done under Practical (PA) Assessment. The Micro Project preferably assign to the group of (4-6) students or an individual taking into the considerations the capabilities and circumstances at the time .
A suggested list is given here. Similar micro-project could be added by the concerned faculty.

a. **Systems and Units** : Prepare Chart on comparison of systems of units for different physical quantities.

b. **Gas Laws :** Prepare report on Boyles law, Charles law and Guy Lussacs law .

c. **Optics :**Prepare chart to study Total Internal Reflection/LASER.

d. **X-Ray** :Prepare chart showing properties of X-rays/Photoelectric cell.

e. Collect different **Viscous Liquids** and List their applications.

12. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publisher, Edition Year of publication and ISBN Number
1	Physics Textbook Part I- Class XI	J.V.Narlikar, A.W.Joshi, et al.	National Council of Education Research and Training, New Delhi,2010, ISBN:8174505083
2	Physics Textbook Part II- Class XI	J.V.Narlikar, A.W.Joshi, et al.	National Council of Education Research and Training, New Delhi,2015, ISBN:8174505660
3	Physics Textbook Part I- Class XII	J.V.Narlikar, A.W.Joshi, et al.	National Council of Education Research and Training, New Delhi,2013, ISBN:8174506314
4	Physics Textbook Part II- Class XII	J.V.Narlikar, A.W.Joshi, et al.	National Council of Education Research and Training, New Delhi,2013, ISBN:8174506713
5	Fundamentals of Physics	David Halliday, Robert Resnick and Jearl Walker	7^{th} Edition John Wily (2004) ISBN :9781118230718,111823071X
6	Engineering Physics	R.K. Gaur and S. L. Gupta	Dhanpat Rai Publications ISBN : 9788189928223 (1981)
7	Applied Physics	Prakash Manikpure	S. Chand Publishing ISBN: 9788121919548
8	Applied Physics	Arthur Beiser	Schaum's Outline Series McGraw-HILL,ISBN :9780071426114
9	Engineering Physics	Avadhanulu, Kshirsagar	S Chand ISBN: 9788121908177

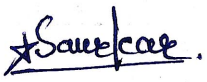
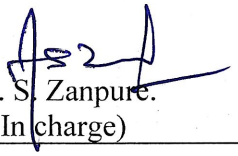
13. SOFTWARE/LEARNING WEBSITES

1) https://en.wikipedia.org/wiki/**Engineering_physics**
2) www.nanowerk.com
3) www.brainscape.com
4) https://www.open2study.com/courses/basic-physics
5) http://nptel.ac.in/course.php?disciplineId=115
6) http://nptel.ac.in/course.php?disciplineId=104
7) http://hperphysics.phy-astr.gsu.edu/hbase/hph.html
8) www.physicsclassroom.com
9) www.physics.org

14. PO - COMPETENCY- CO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	2	-	2	2
CO2	3	2	-	-	-	-	2
CO3	3	2	-	2	-	-	2
CO4	3	-	-	1	-	2	2

CO	PSO1	PSO2
1	-	2
2	-	2
3	-	2
4	-	-

Sign:  Name: Smt. D. V. Saurkar Dr. R. B. Birajadar (Course Expert)	Sign:  Name : Mrs.N.S.Kadam (Head of Department)
Sign:  Name: Dr. N. G. Kulkarni. (Program Head) (Mechanical Engg Dept.)	Sign:  Name: Shri. A. S. Zanpure. (CDC In charge)