Government Polytechnic, Pune

'180 OB' – Scheme

Course Title: Applied Physics

(Course Code: SC 1103)

Diploma programme in which this course is offered	Semester in which offered
Diploma in CE/ME/MT	II

1. RATIONALE

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

2. 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 the basic principles of heat, light, and optics in related engineering problems.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	00	2	5	80	20	25	25	150

Legends: L-lecture, T-Tutorial/teacher guided theory practice, P-practical, ESE-End semester examination, PA- Progressive Assessment.

4. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency**:**

S. No.	**Practical Exercises** (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
1	Identify given instrument and calculate instrumental error, range, and least count of instrument.	1	2
2	Use Vernier calliper to measure dimensions of different objects and calculate volume of given objects.	1	2
3	Use micrometer screw gauge to measure dimensions of given objects and to determine the volume.	1	2
4	Determine acceleration due to gravity by simple pendulum (Concept of SHM).	1	2
5	Determine surface tension by capillary rise method.	2	2
6	Measure coefficient of viscosity of given liquid using Stoke's method (Stokes law).	2	2
7	Calculate spring constant using Hooke's law.	2	2
8	Determine velocity of sound using resonance tube. (Concept of resonance).	3	2
9	Verification of Boyle's law.	4	2
10	Determine refractive index of glass slab using principle of total internal reflection.	5	2
11	Observe characteristics of laser using He-Ne laser beam.	5	2
12	Verify characteristics of photoelectric cell.	6	2
	Total		24

5. SCHEME OF PRACTICAL EVALUATION

S.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**.**

S. No.	Equipment Name with Broad Specifications	Ex. No.
1	Voltmeter (0-10 V), ammeter (0-5 A), Travelling microscope: Range: 0.05-22, Vernier Calliper : Range: 0-15 cm, Resolution 0.01 cm. Micrometer screw gauge: Range 0-25 mm, Resolution 0.01 mm.	1,23,5
2	Vernier Calliper : Range: 0-15 cm, Resolution 0.01 cm.	2
3	Micrometer screw gauge: Range 0-25 mm, Resolution 0.01 mm.	3
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

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency**.**

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit 1 General Physics	1. Describe Various Errors in measurements. 2. Distinguish between centripetal and centrifugal force. 3. 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 2 Properties of Matter	1. Explain phenomenon of ST with the help of Laplace's molecular theory. 2. State Newton's law of viscosity. 3. Describe types of stress and strain.	**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, coefficient of viscosity by

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		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 3 Sound	1. Distinguish between Transverse wave and Longitudinal wave. 2. Explain resonance with its applications. 3. Sate 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 4 Heat	1. State Boyle's law, Charles's law and Gay lussac's law. 2. Convert given temperature in different scale. 3. Explain different modes of heat transfer.	**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 5 Optics And LASER	1. Explain phenomenon of total internal reflection. 2. Sate different types and applications optical fiber. 3. Describe LASER with its properties and applications **.**	**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

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		LASER, 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 6 Modern Physics	1. Explain photoelectric effect with its circuit diagram. 2. State properties and applications of X-rays in engineering.	**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
01	General Physics	**8**	4	4	6	14
02	Properties of matter	**12**	8	6	4	18
03	Sound	**6**	4	4	2	10
04	Heat	**6**	4	4	4	12
05	Optics and Laser	**8**	6	6	2	14
06	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.8, 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-PROJECTS
(Only for Class Declaration Courses)

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. . Nil

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
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)
6	Engineering Physics	R.K. Gaur and S. L. Gupta	Dhanpat Rai Publications ISBN 9788189928223
7	Applied Physics	Prakash Manikpure	S. Chand Publishing ISBN 9788121919548
8	Applied Physics	Arthur Beiser	Schaum's Outline Series McGraw-HILL
9	Engineering Physics	Avadhanulu, Kshirsagar	S Chand ISBN 9788121908177

13. SOFTWARE/LEARNING WEBSITES

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

14. PO - COMPETENCY- CO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	1	-	1	1
CO2	3	-	-	1	-	-	1
CO3	3	1	2	1	1	-	1
CO4	3	1	1	1	1	-	1
Average	3	0.5	0.75	1	0.5	0.25	1

15.CO-PSO MATRICES OF COURSE

Branch	ME		CE			MT			
CO	PSO1	PSO2	PSO1	PSO2	PSO3	PSO1	PSO2	PSO3	PSO4
1	-	-	1	-	-	1	-	-	-
2	-	1	-	-	-	-	-	-	-
3	-	2	-	2	1	1	1	1	-
4	-	1	-	-	-		1	1	-
Average	-	1	0.25	0.5	0.25	0.5	0.5	0.5	-

***Correlation levels 1, 2 or 3 as defined below:**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) ***"-": No correlation***

16. PREPARED BY :

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Signature of Programme Head Name of Programme Head	Signature of CDC In-Charge Name of CDC In-Charge