Government Polytechnic, Pune

‘180 OB’ – Scheme

Course Title: Engineering Physics

(Course Code: SC 1104)

Diploma programme in which this course is offered	Semester in which offered
Diplôma in EE/ET/CO/IT	01

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, light, electricity, and modern physics will help in understanding the technology courses where emphasis is on the applications of these principles in engineering and technology.

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 measurement of physical quantities.
2. Apply laws of motion in various applications.
3. Apply Coulomb’s law to calculate electrostatics force, electric field and electric potential.
4. Use basic principles of light, X-rays and Laser 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	-	2	5	80	20	25	25	150

4. SUGGESTED PRACTICALS/ EXERCISES

The practical's 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**: (Any Ten).**

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. required
1	Observe given instrument i) mention name and range of given instrument ii) calculate least count of given instrument iii) list the use of given instrument	1	2
2	Use Vernier calliper to measure dimensions of different objects.	1	2
3	Use micrometer screw gauge to measure dimensions of given objects.	1	2
4	Determine acceleration due to gravity by simple pendulum (Concept of SHM).	1	2
5	Determine refractive index of glass slab using total internal reflection.	2	2
6	Observe and list different characteristics of laser beam using He-Ne laser.	2	2
7	Determine permittivity of free space (Concept of electrostatics).	3	2
8	Construct circuit to verify Ohm's law and determine specific resistance of given material of wire.	4	2
9	Determine resistance of given material of wire using meter bridge and calculate its specific resistance.	4	2
10	Calibration of voltmeter using potentiometer (Principle of potentiometer).	4	2
11	Compare e.m.f's of two cells using potentiometer by single cell method.	4	2
12	Use potentiometer to find internal resistance of a cell.	4	2
13	Use magnetic compass to draw magnetic lines of force of magnet of different shapes.	5	2
14	Verify characteristics of photoelectric cell.	6	2
	Total		**28**

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**

5. 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	Vernier Calliper : Range: 0-15 cm, Resolution 0.01 cm.	1,2
2	Micrometer screw gauge: Range 0-25 mm, Resolution 0.01 mm.	3
3	Simple pendulum, Stop Watch.	4
4	Glass Slab 75x50x12mm.	5
5	He-Ne laser kit	6
6	Battery eliminator (0-12 V, 2 A)	7,8,9
7	Voltmeter(0-10 V), ammeter (0-5 A)	8
8	Meter Bridge (100 cm), Galvanometer (30-0-30) and jockey.	9
9	Potentiometer (400 cm).	10, 11, 12
10	Potentiometer, Daniell cell, Leclanche cell.	11,12
11	Bar Magnet, Magnetic Needle.	13
12	Photoelectric cell.	14

6. 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. Finding relation between linear velocity and angular velocity. 3. Distinguish between centripetal and centrifugal force. 4. Explain SHM as a projection of UCM on any one diameter of circle. 5. Derive equation of Simple harmonic motion.	**1.1 Units and Measurement** Introduction, Definition of unit, Fundamental and derived units, Different System of units, Errors in measurements. **1.2 Circular Motion**: Definition, Uniform circular motion(UCM) 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 on the diameter, Equation of SHM starting from mean position, analytical treatment.
Unit 2 Optics and Laser	1. State Snell's law of refraction. 2. Explain phenomenon of total internal reflection 3. Classify optical fiber with its different types. 4. Distinguish between electrical cable and optical fiber communication	**2.1 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, analytical treatment. **2.2 Fiber optics**: Propagation of light through optical fiber, Structure of optical fiber, Numerical aperture, Acceptance angle, Acceptance cone, Types of optical fibers, Applications of

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	5. Working of LASER with its properties and applications .	optical fiber, Comparison of optical fiber communication with electrical cable communication. **2.3 LASER:** Definition, Properties of 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 3 Electrostatics	1. Calculate electrostatic force and intensity of electric field. 2. Calculate electric potential. 3. Calculate net capacitance when capacitors are connected in series and parallel.	**3.1 Electric charge**, Coulomb's law in Electrostatics, unit of charge, electric field, intensity of electric field, electric lines of forces (Properties), electric flux, flux density, analytical treatment. **3.2 Electric potential:** Explanation, Definition**,** Potential due to a point charge, potential due to a charged sphere, potential of earth, absolute electric potential, analytical treatment. **3.3 Electric Capacitor :**Capacitance Introduction**,** of conductor, unit, principle of condenser, parallel plate condenser, capacitances in series and parallel, analytical treatment.
Unit 4 Current Electricity	1. Comparison of Wheatstone network with meter bridge. 2. Comparison of EMF using potentiometer. 3. Calculation of electric bill for given application.	**4.1 Current**, Resistance and its unit, Dependence of resistance- length, area of cross-section, temperature, Ohms law, specific resistance and its unit, Whetstone's network construction and principle, Meter bridge, Balancing condition of meter bridge, Measurement of unknown resistance using meter bridge, analytical treatment. **4.2 Potentiometer,** Principle of potentiometer**,** Potential gradient, Construction of potentiometer, Applications of potentiometer, E.M.F., Comparison of E.M.F. using potentiometer. **4.3 Electric work-** Electric power, Electric energy, Units and Calculations of electric bill.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit 5 Electromagnetism	1. State Ampere's right hand and Fleming's left hand rule. 2. Explain Biot-Savert's Law (Laplace's Law), 3. Calculate Magnetic induction of given application.	**5.1 Magnetic effect of electric current**, Ampere's rule, Coulombs inverse square law in magnetism, Intensity of magnetic field, Magnetic induction, Biot- Savert's Law (Laplace's Law), Fleming's left hand rule, Force experienced by current carrying straight conductor placed in magnetic field, analytical treatment.
Unit 6 Modern Physics	1. Explain production of X-Ray with neat label diagram. 2. Verify characteristics of photoelectric cell 3. List applications of photo electric cell.	**6.1 X- ray:** principle, production of X- rays using Coolidge tube, origin of X-rays, types of X-rays, properties of X-rays, engineering applications of X-rays, analytical treatment. **6.2 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.

7. **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**	2	4	6	12
02	**Optics and Laser**	**6**	2	4	6	12
03	**Electrostatics**	**10**	4	4	8	16
04	**Current Electricity**	**10**	4	4	8	16
05	**Electromagnetism**	**8**	2	4	8	14
06	**Modern Physics**	**6**	2	4	4	10
Total		**48**	**16**	**24**	**40**	**80**

8. 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.

9. 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

10. 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

11. 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

12. 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

13. **PO - COMPETENCY- CO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	-	1	-	-	1
CO2	3	2	-	-	-	-	1
CO3	3	3	-	1	1	-	1
CO4	3	3	-	-	1	-	1
	3	2.5	-	0.5	0.5	-	1

	PSO 1				**PSO 2**				**PSO 3**				**PSO 4**			
CO1																
CO2																
CO3																
CO4																

14. **PREPARED BY :**

Signature of Course Expert Name of Course Expert 1. Y D Bhide 2. N S Biradar 3. Dr. R B Birajadar 4. D V Saurkar	Signature of Head of Department Name of Head of Department Y D Bhide
Signature of Programme Head Name of Programme Head	Signature of CDC In-Charge Name of CDC In-Charge