GOVERNMENT POLYTECHNIC, PUNE

'120 – NEP' SCHEME

PROGRAMME	DIPLOMA IN EE/ET/CM/IT
PROGRAMME CODE	02/03/06/07
COURSE TITLE	ENGINEERING PHYSICS
COURSE CODE	SC11203
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	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	
SC11203	ENGINEERING PHYSICS	DSC	3	-	2	1	6	3	2	30	70*#	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Term: 2 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,@S - 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 in a way by which fundamental information will help the diploma engineers to apply the basic principles and concepts of physics to solve broad-based engineering problems. The study of basic principles and concepts of motion, light, electricity, and modern physics will help in understanding the technology courses where the emphasis is on the applications of these in different technology applications.

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

Students will be able to achieve & 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: Use basic principles of electrostatics in the engineering field
CO3: Apply basic principles of electricity to solve engineering problems.
CO4: Apply basic principles of magnetism to solve engineering problems
CO5: Use basic principles of light in the technical field
CO6: Apply principles of X-rays and Photoectricity in Engineering.

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-07, Marks-10)			
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.	**1.1. Units and Measurement** Introduction, Definition of unit, Fundamental and derived units, Different System of units, Errors in measurements. Dimensions and its Application Application of Vernier Caliper and Screw Gauge. **1.2 Types of Motion** Displacement, Velocity, Acceleration and retardation Angular displacement, Angular velocity, Angular acceleration and Units. Three equations of angular motion. SHM and its application.	Chalk and board Improved lecture, Tutorial Assignment, and Demonstration	**CO1**
	UNIT-II ELECTROSTATICS (CL Hrs-09, Marks-14)			
2	**TLO 2.1** Describe properties of electric lines of force. **TLO 2.2** Calculate electrostatic force, electric field and electric potential difference of the given static charge. **TLO 2.3** Calculate the equivalent capacity and energy stored in the combination of the capacitors.	**2.1 Electric charge**, Coulomb's law in Electrostatics, a unit of charge, electric field, intensity of electric field, electric lines of forces (Properties), electric flux, flux density, analytical treatment. **2.2 Electric potential:** Explanation, Definition, Potential due to a point charge, potential due to a charged sphere, potential of the earth, absolute electric potential, analytical treatment. **2.3 Electric Capacitor:** Capacitance Introduction of conductor, unit, principle of condenser, parallel plate condenser, capacitances in series and parallel, Super Capacitors and Application, analytical treatment.	Chalk and board, Improved lecture, Tutorial Assignment, Demonstration	**CO2**

Sr. No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with TLO's.	Suggested Learning Pedagogies	Relevant COs
	UNIT-III CURRENT ELECTRICITY (CL Hrs-09, Marks-14)			
3	**TLO 3.1.** State and Explain Ohm's law. **TLO 3.2.** Explain the principle of the potentiometer and its application.	**3.1 Current**, Resistance and its unit, Law of Parallel and Series combination of resistance, 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. **3.2 Potentiometer,** Principle of the potentiometer, Potential gradient, Construction of potentiometer, Applications of potentiometer, E.M.F., Comparison of E.M.F. using potentiometer.	Chalk and board, Improved lecture, Tutorial Assignment, Demonstration	CO3
	UNIT- IV MAGNETISM (CL Hrs-05, Marks-08)			
4	TLO.4.1. Calculate Magnetic induction for the given conductor. TLO 4.2 Explain Electromagnetism with its applications.	**4.1 Magnetic effect of electric current,** Magnetism, Intensity of magnetic field, Magnetic induction, Magnetic Flux, Magnetic lines of force and its Properties, Analytical treatment. **4.2Electromagnetism** and its application.	Simulation, Model Display, Demonstration Chalk and board, Presentations.	CO4
	UNIT –V OPTICS AND LASER (CL Hrs-07, Marks-12)			
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. **TLO 5.3** Differentiate between properties of ordinary light and laser light. State applications of laser in different fields	**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, analytical treatment. **5.2 Fiber optics**: Propagation of light through optical fibre, Structure of optical fibre, Numerical aperture, Acceptance angle, Acceptance cone, Types of optical fibres, Applications of optical fibre, Comparison of optical fibre communication with electrical cable communication.	Simulation, Demonstration, Flipped Classroom, Collaborative Learning, Case Study, chalk and board etc.	CO5

		5.3 Laser: Definition, Properties of LASER, Spontaneous and Stimulated emission, Population inversion, Metastable state, Pumping, Lifetime, He-Ne laser construction and working with energy level diagram, Engineering applications of laser.		
UNIT –VI MODERN PHYSICS (CL Hrs-08, Marks-12)				
6	**TLO 6.1.** Explain the production of X-rays. Describe the properties and applications of X-rays in different fields. **TLO 6.2.** Describe properties of photon Derive Einstein's photoelectric equation. Explain the working of a given photoelectric device.	**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, the concept of the photon, properties of the 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.	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	LLO2.1 Use a Vernier caliper to Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 2.2 Estimate the errors in measurement.	Measurements of dimensions of the given object by Vernier caliper.	2	CO 1
3	LLO3.1 Use a Micrometer Screw gauge to Measure the dimensions of given objects. Measure the dimensions of objects of known dimensions.	Measurements of dimensions of given objects by micrometre screw gauge.	2	CO1

	LLO 3.2 Estimate the measurement errors.			
4	LLO 4.1 Use a simple pendulum to determine acceleration due to gravity.	Determination of Acceleration due to Gravity by Simple Pendulum.	2	CO1
5	LLO5.1 Apply Ohm's law to solve circuit problems	Determination of resistance by Ohm's law.	2	CO2
6	LLO6.1 Determine the specific resistance of a given wire.	Determination of specific resistance of a given wire.	2	CO2
7	LLO7.1 Verify the law of the series connection of resistors /capacitors.	Determination of equivalent resistance in the series connection of resistors /capacitors.	2	CO2
8	LLO 8.1 Verify the law of the parallel connection of resistors /capacitors	Determination of equivalent resistance in parallel connection of resistors /capacitors.	2	CO2
9	LLO 9.1 Use meter bridge to: i) Determine the resistance of the given material of the wire. ii) Calculate the specific resistance of the given material of the wire.	Determination of i) resistance of given material of wire. ii) Calculate the specific resistance of the given material of wire by using a meter bridge.	2	CO3
10	LLO 10.1 Use a potentiometer to : i) Determine the potential gradient of the given cell (Principle of potentiometer). ii) Calibrate the given voltmeter	Calibrate the given voltmeter using a Potentiometer.	2	CO3
11	LLO 11.1 Use a potentiometer to : i) Compare the emf of two cells	Compare the emf of two cells using a Potentiometer.	2	CO3
12	LLO 12.1 Use a potentiometer to: i) Find the internal resistance of a cell.	Find the internal resistance of a cell by using a Potentiometer.	2	CO3
13	LLO 13.1 Use a magnetic compass to draw the magnetic lines of forces of magnets of different shapes and determine neutral points.	Determination of neutral points by magnetic compass.	2	CO4
14	LLO 14.1 Determine the refractive index of the glass slab using the Refraction phenomenon.	Determination of the refractive index of the glass slab.	2	CO5
15	LLO 15.1 Use of He-Ne laser beam.	Study the properties and working of the laser using a He-Ne laser beam.	2	CO5
16	LLO 16.1 Use photoelectric cells to study the effect of : i) Intensity of light on photoelectric current. ii) Applied potential on photoelectric current.	Study effect of i) Intensity of light on photoelectric current. ii) Applied potential on photoelectric current. using Photoelectric cell	2	CO6

VI. SUGGESTED MICRO PROJECT/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 Practical (PA) Assessment. 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:

- Series and parallel resistances: Prepare models for a combination of series and parallel resistances
- Series and parallel capacitors: Prepare models for a combination of series and parallel capacitors
- Magnetic flux: Prepare models to demonstrate magnetic lines of lines of forces
- Vernier Calipers: Prepare prototype vernier caliper of desired least count using card sheet
- Conductivity: Collect different materials such as metal, plastics, glass etc. and prepare models
- Carbon resistors: Determine the resistance and tolerance of carbon resistors using color codes
- Mobile applications: Use mobile applications for measurements 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
- Magnetism: Prepare a chart on magnetic lines of force of bar magnet.
- LASER: Prepare a chart to study Total Internal Reflection/LASER.
- X-rays/Photoelectric cell. Prepare a chart showing the properties of X-rays/Photoelectric cells.
- Ohm's Law: Prepare Chart to Study Ohm's Law.

Assignment

- Convert the units of a given physical quantity from one system of units to another.
- Prepare a chart to summarize units and measurements.
- Give details about the explanation of concepts like electrostatics, and magnetic domain. 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 fibres in, engineering etc.
- Applications of X-ray in engineering etc.
- Applications of LASER in, engineering etc.
- Applications of Photoelectricity in, engineering etc

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

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	2	4	4	10
2	II	Electrostatics	CO2	9	2	6	6	14
3	III	Current Electricity	CO3	9	4	4	6	14
4	IV	Magnetism	CO4	5	2	3	3	8
5	V	Optics and Laser	CO5	7	4	4	4	12
6	VI	Modern Physics	CO6	8	4	4	4	12
			Grand Total	**45**	**18**	**25**	**27**	**70**

IX. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)	Summative Assessment (Assessment of Learning)
1. Tests 2. Rubrics for COs 3. Assignment 4. Midterm Exam 5. Self-Learning 6. Term Work 7. Seminar/Presentation	1. End Term Exam 2. Micro-project 3. Tutorial Performance

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	1		2	1	1	1			
CO2	3	1	1	2	1	1	1			
CO3	3	1	1	2	1	1	1			
CO4	3	1	1	1	1	1	1			
CO5	3	1	1	2	1	1	1			
CO6	3	1	1	2	1	1	1			

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
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
5	Haliday, David; Resnik, Robert and Walker, Jearl	Fundamentals of Physics	John Wiley & Sons, Hoboken, USA, 2014 ISBN: 812650823X
6	Dr. Hussain Jeevakhan	Applied Physics - II	Khanna Book Publishing, (2021), ISBN: 978-93-91505-57-8

XIII. 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

Sr.No	Link/Portal	Description
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.	k. https://www.youtube.com/results?search_query=physics+class+11+chapter+1	Concepts of basic physics
8.	l. 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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