Syllabus for SEC in Physics (B.Sc. 3rd semester)

Course code: SEC
Title of the course: Physics Laboratory Instrument Handling and Maintenance
Nature of course: Skill Enhancement Course (**SEC340**)
Course credit: 03
Distribution of marks:40(Theory)+20(Practical) + 40(In Semester)

Course Objectives: The aim of this course is to

1. Teach students about handling procedures of various instruments in an undergraduate Physics laboratory.
2. Give students an idea of proper maintenance of instruments in a Physics laboratory.

Units	Contents	L	T	P	M	Hours
	1-Credit Theory					
1	General Physics of travelling microscope, bar pendulum & Kater's pendulum. Capillary flow method for viscosity measurement and Maxwell's needle method for determination of Young's modulus. Searle's & Angstrom's method for thermal conductivity measurement of copper, determination of temperature coefficient of resistance by platinum resistance thermometer (PRT).	5	2	-	7	7
2	Waves, Optics & Modern Physics: Study of sine, square and sawtooth waves in a CRO, obtaining Lissajous figures with the help of function generators & CRO. Formation of standing waves with the help of Melde's apparatus. Fundamentals of different types lenses, mirrors, prisms & gratings. Uses of Newton's ring apparatus for obtaining interference fringes. Safety issues in handling sodium vapour lamp and lasers (He-Ne, Solid State 532 nm Green Laser). Planck's constant apparatus, photoelectric effect study apparatus, e/m determination apparatus.	5	3	-	10	8
3	Electricity & Magnetism: Basics of resistors, capacitors, inductors, rheostat, galvanometer, voltmeter, ammeter, potentiometer, RC, LR and LC circuits, LCR circuit, Carey Foster's bridge, De Sauty	5	1	-	6	6

	bridge, Anderson's bridge, Thevenin and Norton's theorem verification apparatus. Magnetic susceptibility measurement of solids, Apparatus for measurement of susceptibility of paramagnetic solution.					
4	Solid State Electronic Components and Devices: Identification of different types of diodes, transistors, LEDs, etc. Common IC packages such IC 741, timer IC 555, etc. Different modular practical kits such as design of a switch using transistor, verification of OR, AND & NOT gates using NAND gates, design of a combinational logic system, etc. SR, JK & Master-Slave JK flip-flops. Apparatus for studying V-I characteristics of PN junction diode, zener diode & solar cells, BJT in CE mode, Colpitt's oscillator, Phase-shift oscillator, Digital to Analog converters.	5	2	-	7	7
	2-Credits Practical (Demonstration & Laboratory)					
Lab	1. To know how to use the horizontal and vertical vernier scales of a travelling microscope for the measurement diameter of a capillary tube. 2. To know how to connect a platinum resistance thermometer for the measurement of temperature coefficient of resistance. Take a set of readings. 3. To set up a CRO for studying Lissajous figures. 4. To set up Melde's apparatus for obtaining standing waves on a stretched string. 5. To set up Newton's ring apparatus for determining wavelength of sodium vapour lamp. 6. To obtain diffraction spots with the help of a diffraction grating and He-Ne laser/Solid State green laser. 7. To determine Planck's constant with the help of Planck's constant apparatus. 8. To construct series and parallel LCR circuits from individual components. 9. To set up Gouy's experiment for the measurement of susceptibility of	-	-	28	30	56

	paramagnetic solution. 10. To learn how to use NAND gates for designing various logic combinations. 11. To connect a zener diode in a circuit for voltage regulation (with minimum components).					
	Total	20	8	28	60	84

(L=Lecture, T=Tutorial, P=Practical, M=Marks)

Mode of In-semester assessment:

(i) Viva-voce/Assignments/Attendance (Marks 20)

(ii) Two In-semester Examinations (Marks 20)

Learning outcomes: After successful completion of the course, students will acquire the much required knowledge for handling some common and few special instruments belonging to different branches of Physics. Also, they will be aware of the safety rules & proper maintenance procedures in Physics laboratories.

Suggested reading:

1. Mechanics-D.S. Mathur, P.S. Hemne (S. Chand & Co.)
2. Thermal Physics, S.C. Garg, R.M. Bansal, C.K. Ghosh (Tata McGraw Hill)
3. Concepts in Thermal Physics, S.J. Blundell, K.M. Blundell (Oxford Univ. Press)
4. Advanced Practical Physics for students, B.L. Flint, H.T. Worsnop (Methuen & Co. Ltd.-London)
5. A text book of Practical Physics, I. Prakash, R. Krishna (Kitab Mahal)
6. A laboratory manual of Physics for undergraduate classes, D.P. Khandelwal (Vani Publication)
7. Vibration & Waves, A.P. French (CBS)
8. Vibration & Waves, G.C. King (Wiley)
9. Optics, E. Hecht (Pearson Education)
10. Optics, A. Ghatak (Tata McGraw Hill)
11. Elements of Modern Physics, R. Murugeshan, K. Sivaprasath (S. Chand & Co.)
12. Concepts of Modern Physics, A. Beiser (Tata McGraw Hill)
13. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan (Tata McGraw Hill)
14. Electricity & Magnetism, E.M. Purcell (McGraw Hill Education)
15. Digital Principles and Applications, A.P. Malvino, D.P. Leach (Tata McGraw Hill)
16. Digital Computer Electronics, A.P. Malvino, J.A. Brown (Tata McGraw Hill)
17. Digital Electronics, G.K. Kharate (Oxford University Press)
18. Digital Circuits & Systems, Venugopal (Tata McGraw Hill)
19. Integrated Electronics, J. Millman, C.C. Halkias (Tata McGraw Hill)
20. Electronic Devices & Circuits, S. Salivahanan, N.S. Kumar (Tata McGraw Hill)