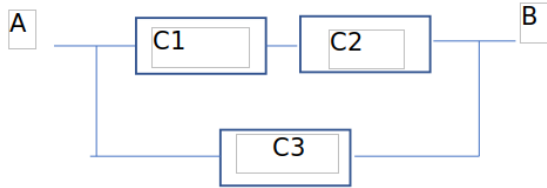


St. Philomena's College (Autonomous), Mysore
Question Bank
Programme: M. Sc. Physics
I Semester
Course Title: Experimental Techniques in Physics
Course Type: Soft Core
Q.P Code:

Sl. No.	Questions	Marks
1.	What is meant by sensitivity of a sensor? Illustrate with an example.	5
2.	The emf of a thermocouple with the cold junction at 0°C and hot junction at T°C is $V(T) = 40T + 0.002T^2$ micro-volts. What is the emf V at 500C?	5
3.	What is a strain gauge? Explain how a strain gauge works.	5
4.	The resistance of a magneto-resistance sensor to measure magnetic field in Tesla varies as $R(B) = 10000 - 5000B + 10000 B^2$ Ohms. What is its resistance in a magnetic field of 0.1 Tesla?	5
5.	Describe with a diagram how a piezoelectric sensor is used to measure a load. Which of these sensors are active and which are passive? (i) Thermocouple (ii) Capacitive liquid level sensor (iii) Strain gauge (iv) Hall Sensor	5
6.	(v) Piezoelectric sensor for measuring load Three conductances $C1 = 20 \text{ m}^3/\text{hr}$, $C2 = 20 \text{ m}^3/\text{hr}$ and $C3 = 10 \text{ m}^3/\text{hr}$ are connected between A and B as shown in the Figure below. What is the effective conductance between A and B?	5
		
7.	Why does the mean free path of a molecule vary with pressure? When the pressure is reduced by a factor of 10, how much is the mean free path changed and in what direction?	5
8.	Distinguish between viscous flow, transition flow and molecular flow regimes in vacuum practice .	5
9.	What is outgassing? How does the rate of gassing change with pressure? How	5

do you reduce outgassing in a chamber.

A diffusion pump of 1000 l/s is connected to a chamber of 1 m³ volume. The chamber is initially at a pressure of 10⁻⁴ mbar. How long will it take the pressure to fall to 10⁻⁶ mba, if the conductance of the connection between the pump and the chamber is 5000 l/s? Assume there is no outgassing in the

11. chamber. 5
12. How do you detect gross leaks? 5
Why should you immerse a liquid helium dewar in a liquid nitrogen bath?
13. Explain clearly. 5
14. What resistance thermometer will you use below 10 K and why? 5
What is the critical temperature of a gas? What is its significance for
15. liquefaction of the gas? 5
Why is the final stage of liquefaction in a liquefier a Joule-Thomson expansion
16. through an orifice, and not adiabatic expansion in a cylinder with a piston? 5
What is the material used as a vacuum sealing ring at low temperature and
17. why? 5
Does helium become a solid when cooled to very low temperatures under
18. atmospheric pressure? Justify your answer. 5
How do you control the number of argon ions produced in triode sputtering?
19. What consequence does it have on pressure of Argon gas used? 5
20. Why is the substrate heated in thin film deposition by evaporation? 5
21. What is the purpose of the magnetic field in magnetron sputtering? 5
22. What is meant by threshold energy of the ion for sputtering? 5
23. When is RF sputtering used and why? 5
24. How does a quartz crystal monitor measure thickness of the deposited film? 5
25. How does Nickel filter work to filter out Copper K X radiation? 5
How does the scattering of X rays depend on the atomic number of the
26. element? Can one locate the position of hydrogen atom in the presence of a 5
heavy atom such as Barium?
27. How are thermal neutrons produced? Why can thermal neutrons be used for 5
Bragg diffraction from a crystal?
28. The spacing of the lattice planes in a crystal is 2 Angstroms. Cu K radiation 5
with a wavelength of 1.55 Å falls on the crystal. What is the Bragg angle in
degrees for reflection from the lattice planes?
29. What is meant by coherent and incoherent cross sections for neutrons? The 5
nucleus of an atom has a spin 0. Will it scatter neutrons incoherently?
30. What is meant by texture of a powder sample? How is it reflected in the X 5
ray powder pattern?
31. What is resolving power of a microscope? How does it depend on the 5

	wavelength of radiation?	
32.	How are electrons focused? Describe the operation of a magnetic lens.	5
33.	An electron of mass 9×10^{-31} kg and charge 1.6×10^{-19} Coulomb is accelerated through a potential of 100 V? What is its De Broglie wavelength?	5
34.	What are the advantages of a scanning electron microscope over a transmission electron microscope?	5
35.	With a diagram explain the difference between the imaging and diffraction modes of an electron microscope.	5
36.	How are secondary electrons detected in a scanning electron microscope?	5
37.	How do you use a Wheatstone bridge to measure the change in resistance of sensor?	10
38.	What is a sensor and what is an actuator? Give two examples of each to illustrate your answer.	10
39.	What is a piezoelectric sensor? What is its equivalent circuit?	10
40.	Explain with a diagram the operation of a thermocouple gauge. In what range of pressure can it be used?	10
41.	Draw a figure of a turbo-molecular pump and explain its action. Can you operate a turbo pump to evacuate directly a chamber from atmospheric pressure?	10
42.	Draw a diagram of a cryopump and describe its operation. How do you reduce the pressure of hydrogen in such a pump?	10
43.	Describe with a diagram a bath type glass cryostat for work with liquid helium.	10
44.	Explain with a diagram the operation of a Gifford Macmohan closed cycle refrigerator.	10
45.	What are primary and secondary thermometers? Explain how a primary thermometer works.	10
46.	Explain with a diagram the evaporation technique for making thin films. Can one make thin films of oxides by evaporation. Justify your answer.	10
47.	Draw a diagram and explain how magnetron sputtering works.	10
48.	Explain the meaning of threshold energy, yield and derive an expression for the efficiency of sputtering. Draw a graph showing how the efficiency varies with energy of the ion.	10
49.	Explain how X ray powder diffraction spectrum is obtained. How are the lines in a crystal belonging to the cubic system indexed.	10
50.	Indicate how neutron scattering differs from X ray scattering. What are the advantages of neutron scattering over X- ray scattering.	10
51.	How are X rays produced? Explain with a diagram the Bragg-Brentano geometry for X ray diffraction.	10

52. Draw a diagram of the Transmission electron microscope and explain its operation. 10
53. What is the maximum magnification and resolving power that can be obtained in an electron microscope? What is bright and dark field imaging in a transmission electron microscope? 10
54. Draw a diagram of a scanning electron microscope and explain how it operates. What are the advantages of a SEM over a TEM? 10