


Name:			
Enrolment No:			
UPES End Semester Examination, December 2023			
Course: Experimental Methods Program: Integrated BSc + MSc Physics Course Code: PHYS 3033		Semester: V Time: 03 hours Max. Marks: 100	
Instructions: Use of scientific calculators is permitted.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	When a train is at speed V , the resistance between its wheels and the track is R . Find the constants a and b such that a law of the type $R = a + bV^2$, can be fitted to the following data (V, R) by the method of least squares. (10, 8), (20, 10), (30, 15), (40, 21), (50, 30)	4	CO1
Q 2	List the basic conditions to be satisfied for faithful amplification.	4	CO2
Q 3	Calculate the resolution in volts of a 10-bit D/A converter whose full-scale output is 5 volts.	4	CO2
Q 4	Define the following terms in the context of a vacuum system: (i) Gas Pressure (ii) Mean Free Path (iii) Molecular Incidence Rate (iv) Monolayer Formation Time	4	CO3
Q 5	Mention two advantages and two disadvantages of the Penning gauge.	4	CO3
SECTION B (4Qx10M= 40 Marks)			
Q 6	If $u = f(x, y, z)$; then derive a general formula for the relative error E_R in u . Hence find the relative error in $u = (5xy^2)/z^3$ at $x = y = z = 1$ when the errors in each of x, y and z is 0.001.	10	CO1

Q 7	<p>A random variable X has the following probability function as given below. Find/evaluate (i) the value of k, (ii) $P(X < 6)$, (iii) $P(X \geq 6)$ and (iv) $P(0 < X < 5)$.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> </tr> <tr> <td>$f(x)$</td> <td>0</td> <td>k</td> <td>$2k$</td> <td>$2k$</td> <td>$3k$</td> <td>k^2</td> <td>$2k^2$</td> <td>$7k^2 + k$</td> </tr> </tbody> </table>	x	0	1	2	3	4	5	6	7	$f(x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$	10	CO1
x	0	1	2	3	4	5	6	7													
$f(x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$													
Q 8	<p>Describe any three simple methods of leak detection in a vacuum system.</p> <p style="text-align: center;">OR</p> <p>Discuss the various flow regimes of a gas when a system is brought from the atmospheric pressure to 'high' vacuum.</p>	10	CO3																		
Q 9	<p>(a) Differentiate between Synchronous Counter and Asynchronous Counter.</p> <p>(b) A 5-bit D/A converter gives an output voltage of 10 V for a digital input of 10100. Determine the output voltage if the digital input is changed to 11101.</p>	5 + 5	CO2																		
<p>SECTION-C (2Qx20M=40 Marks)</p>																					
Q 10	<p>Draw and explain the internal architecture of the Intel 8085 microprocessor.</p> <p style="text-align: center;">OR</p> <p>With the help of neat diagrams, explain the working of an OP-AMP as</p> <p>(i) Adder (ii) Subtractor (iii) Differentiator (iv) Integrator</p>	20	CO2																		
Q 11	<p>(a) Describe the construction & working, with suitable diagrams wherever necessary, of an ion pump. Also list one advantage and one disadvantage of ion pumps.</p> <p>(b) Calculate the conductance of a <i>long tube</i> of diameter 2 cm and length 10 cm at room temperature. What will be the conductance of two such tubes connected in parallel?</p>	15 + 5	CO3																		