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| **Name:**<br>**Enrolment No:** | |

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, December 2022**

**Course: Introduction to Metrology** **Semester: I**
**Program: B. Sc (H) - Physics** **Time: 03 hrs.**
**Course Code: PHYS 1028** **Max. Marks: 100**

**Instructions: Use of calculator is permitted**

**SECTION A**
**(5Qx4M=20Marks)**

| S. No. | | Marks | CO |
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| Q 1 | 1 The maximum angle that can be set using a sine bar is limited to<br>(a) 15° (b) 45° (c) 30° (d) 60°<br><br>2. Which of the following statements is false with respect to a bevel protractor?<br>(a) If the angle of a work part is being measured in II quadrant, the actual angle is given by the supplement.<br>(b) If the angle of a work part is being measured in IV quadrant, the actual angle is given by the supplement.<br>(c) The angle measured in II quadrant is always an obtuse angle.<br>(d) The angle measured in IV quadrant is always an acute angle.<br><br>3. Which type of bevel protractor has a vernier scale as well as an acute angle attachment?<br>(a) Type A (c) Type C (b) Type B (d) Type D<br><br>4. The purpose of providing relief holes in sine bars is to<br>(a) improve accuracy (c) reduce weight (b) improve precision (d) reduce wear | **4 (1X4)** | **CO1** |
| Q-2 | What are material standards? List their disadvantages. | **4** | **CO1** |
| Q-3 | With the help of a block diagram, explain the hierarchical classification of standards. | **4** | **CO2** |
| Q-4 | The main scale in a vernier instrument is graduated in millimeters, with the smallest division being 1mm. Ten divisions on the vernier scale correspond to nine divisions on the main scale.<br>Answer the following questions:<br>(a) Is the vernier scale a forward vernier or a backward vernier?<br>(b) What is the least count of the instrument?<br>(c) If the main scale reads 13mm and the fifth division on the vernier scale coincides with a division on the main scale, what is the value of the dimension being measured? | **4 (1+1+2)** | **CO2** |
| Q-5 | Write the short notes on<br>a) Calibration<br>b) Threshold | **4 (2+2)** | **CO3** |

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| **SECTION B<br>(4Qx10M= 40 Marks)** | | | |
| Q-6 | Discuss the different reasons for the occurrence of systematic errors. How it is different from random error. Give example to explain it. | **10** | **CO2** |
| Q-7 | Give the differences among the following: visual collimator, digital collimator, and laser collimator | **10** | **CO3** |
| Q-8 | For the following hole and shaft assembly, determine<br>(a) hole and shaft tolerance and<br>(b) type of fit.<br>Hole = 20 (+0.000mm, +0.025mm) and<br>shaft = 20 (+0.005mm, +0.080mm)<br><br>Or<br><br>With suitable example explain define Absolute and Relative Error.<br>We measure the period of oscillation of simple pendulum. In successive measurement, the reading turn out to be 2.63 s, 2.56 s, 2.42 s, 2.71 s,2.80 s. Calculate absolute error and relative error | **10** | **CO3** |
| Q-9 | a) What is the working principle of a universal bevel protractor?<br>b) What are the precautions to be taken while using it?<br>c) The vernier scale in a bevel protractor is read in the same direction as the dial. Why? | **10<br>(4+3+3)** | **CO2** |
| **SECTION-C<br>(2Qx20M=40 Marks)** | | | |
| Q-10 | With the help of suitable diagram explain the effective functioning of each part of autocollimator. Also with the help of a plot how straightness of a machine guideway is assessed using an autocollimator.<br><br>OR<br>How does an angle dekkor differ from an autocollimator?<br>Discuss the applications of an angle dekkor in metrology. | **20<br>(12+8)** | **CO2** |
| Q-11 | a) What is the basic difference between sine bars, sine plates, and sine tables?<br>b) In a sine bar, when should the set-up be made for the complement of an angle?<br>c) Discuss the essential requirements for maintaining accuracy in the construction of a sine bar. | **20<br>(7+7+6)** | **CO3** |