Measurements -MDP 4133
Final exam 1st semester 2019/2020
Date: 6/1/2020
full mark 60
Time: Three hours

Kafrelsheikh University
Faculty of Engineering
Mechanical Engineering Dept.
4th year Production Eng.

Answer all questions in the given space- use the back of the paper if required
No. of questions is 5 -No of pages is 11-

Question 1 [15 marks]

a) The main scale in a vernier instrument is graduated in mm, with the smallest division being 1 mm. Ten divisions on the vernier scale correspond to 9 divisions on the main scale. Answer the following questions:

(ii) What is the least count of the instrument?
(iii) If the main scale reads 15 mm and the 7th division on the vernier scale coincides with a division on the main scale, what is the value of the dimension being measured? Show your answer using simple sketch.

b) The barrel scale of a vernier micrometer has graduations in millimeters, with each division measuring 1 mm. The thimble scale has 100 equal divisions, and one complete rotation of the thimble moves it by one division over the barrel scale. If 10 divisions on the vernier scale attached to the micrometer correspond to 11divisions on the thimble, calculate the least count of the instrument. Show your answer using simple sketch.

c) A selection of slip gauges is required to build a height of 36.248 mm. Propose the best combination of gauges using the 56-gauge set.

The set of 56 slip gauges consists of the following:
1. One piece of 1.0005 mm
2. Nine pieces ranging from 1.001 to 1.009 mm in steps of 0.001 mm
3. Nine pieces ranging from 1.01 to 1.09 mm in steps of 0.01 mm
4. Nine pieces ranging from 1.0 to 1.9 mm in steps of 0.1 mm
5. 25 pieces ranging from 1 to 25 mm in steps of 1.0 mm
6. Three pieces ranging from 25 to 75 mm in steps of 25 mm

d) If it is required to set a height difference of 0.33 mm to set the sine bar to a known angle. How will you select the combination of slip gauges to set the sine bar using a set of 56 slip gauges? Show your answer graphically.

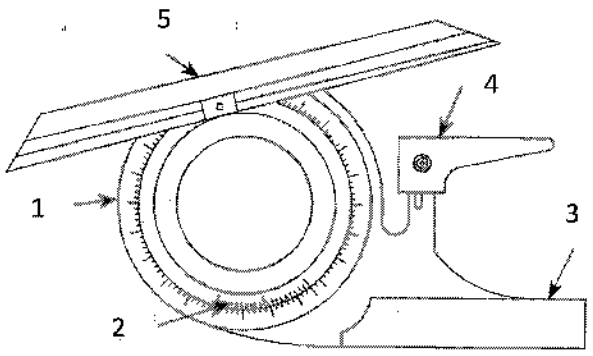
Question 2 [15 marks]

a) Using the given set of 16 angle gauges, how can we set the angle **18°43'15"**? Show your answer analytically and using simple sketch.

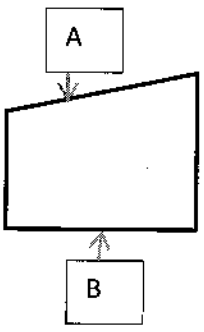
Six blocks of 1°, 3°, 5°, 15°, 30°, and 45° Five blocks of 1', 3', 5', 20', and 30' Five blocks of 1", 3", 5", 20", and 30"

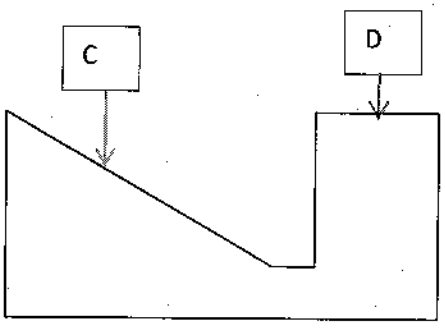
b) For the universal bevel protractor shown in the given, complete the following table.

Item No.	Name
1	
2	
3	
4	
5	



c) Show graphically how to use the universal bevel protractor to measure the angles θ1 between A and B and θ2 between C and D surfaces.





d) For a universal bevel protractor the value of one main scale division = 1° , the vernier scale has 24 divisions, which correspond to 46 divisions on the main scale. The divisions on the vernier scale are numbered from 0 to 60' on either side of the zeroth division

i. Using simple sketch show the main and the vernier scale
ii. Show that the least count of the instrument is equal to 5 minutes

iii. Consider the situation that the zeroth division of the vernier scale is just past the 10° division on the main scale. The 7^{th} division on the left hand side of the vernier scale coincides with a division on the main scale. What is the reading? Show your answer using simple sketch.

e) For 100 mm-long sine bar, calculate the heights to set it at 15°, 30°, 45°, and 60°. Assume there is an error of +0.10 mm in height of slip gauges.

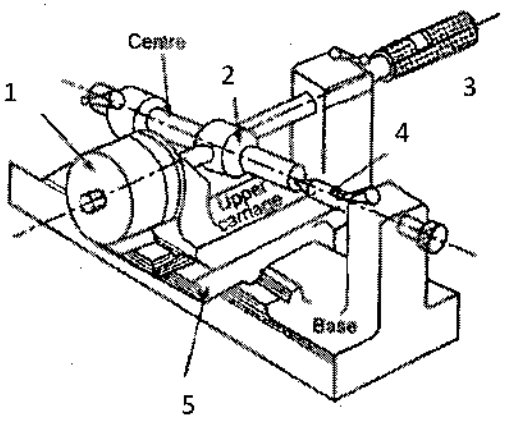
i. Complete the given table
ii. Write your conclusion

Angle to set (degrees)	Height of slip gauges (mm)	Height of slip gauges with error (mm)	Measured angle (degree)	Error in measurement (degree)
15				
30				
45				
60				

Question 3 [7 marks]

a) For the shown floating carriage micrometer complete the following table

Item No.	Name
1	
2	
3	
4	
5	



b) A floating carriage micrometer is an instrument that is used for accurate measurement of 'thread plug gauges'. List three gauge dimensions that could be measured using floating carriage micrometer.

c) For the shown pitch measuring instrument, complete the followings:-

1-These instruments enable the measurement

of ----------pitch between successive pairs of teeth.

2-The instrument comprises a ----------

and a ----------, which can be set to two

identical points on adjacent teeth along the

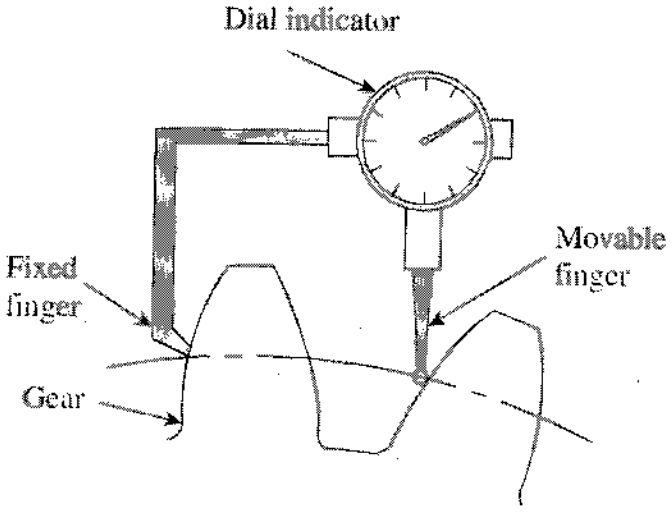
----------. The pitch ---------- is displayed

on a ---------- attached to the instrument.

3-A major limitation of this method is that readings are

influenced by ---------- variations as well as

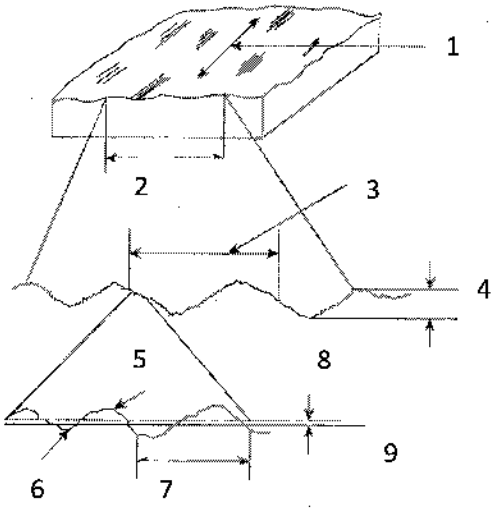
---------- of the gear.



Question 4 [8 marks]

a) For the shown Figure complete the following table

Item No	Name
1	
2	
3	
4	
5	
6	
7	
8	
9	



b) With the help of a neat sketch, explain the Taylor–Hobson talysurf.

Question 5 [15 marks]

1. Which of the following defines **parallax error**?
   (a) Same as observational error
   (b) Apparent shift of an object when the position of the observer is altered
   (c) Error caused by the distance between the scale and the measured feature
   (d) Mean of the values of measurements when the object is observed from the right and from the left

2. Interpretation of repeated measurement results on the same feature is considered the instrument's
   (a) accuracy (c) range
   (b) precision (d) sensitivity

3. Accuracy is defined as
   (a) a measure of how often an experimental value can be repeated
   (b) the closeness of a measured value to the real value
   (c) the number of significant figures used in a measurement
   (d) none of these

4. Systematic errors are
   (a) controllable errors
   (b) random errors
   (c) uncontrollable errors
   (d) none of these

5. Random errors can be assessed
   (a) experimentally
   (b) by performing sensitivity analysis
   (c) statistically
   (d) empirically

6. In the hierarchical classification of standards, the accuracy in the standards
   (a) is degraded
   (b) is improved
   (c) does not change
   (d) is not related to hierarchical classifications

7. Granite surface plates are free from burrs or protrusions because of
   (a) lower coefficient of expansion
   (b) light weight
   (c) very fine grain structure
   (d) none of these

8. The preferred instrument for measuring grooves, and recesses is depth of holes,
   (a) plain scale (c) slip gauge
   (b) vernier calliper (d) depth gauge

9. Which of the following best describes wringing of slip gauges?
   (a) Squeezing the oil out from between two gauges
   (b) Causing blocks to adhere by molecular attraction
   (c) Effect of atmospheric pressure
   (d) Process of removing minute burrs

10. Which of the following statements with reference to a micrometer is false?
   (a) It is not as precise as a vernier calliper.
   (b) It can be used for end measurement only.
   (c) It has no parallax error.
   (d) It has a shorter measuring range compared to a vernier calliper.

11. While measuring the angle of a workpiece using a universal bevel protractor in clockwise direction, in which quadrants can the angle be read directly from the scale?
   (a) Quadrants I and II
   (b) Quadrants I and III
   (c) Quadrant I only
   (d) All the quadrants

12. Which of the following statements is false with respect to a bevel protractor?
   (a) If the angle of a work part is being measured in II quadrant, the actual angle is given by the supplement.
   (b) If the angle of a work part is being measured in IV quadrant, the actual angle is given by the supplement.
   (c) The angle measured in II quadrant is always an obtuse angle.
   (d) The angle measured in IV quadrant is always an acute angle.

13. The purpose of providing relief holes in sine bars is to
   (a) improve accuracy
   (b) improve precision
   (c) reduce weight
   (d) reduce wear

5. The maximum angle that can be set using a sine bar is limited to
   (a) 15°
   (b) 30°
   (c) 45°
   (d) 60°

14. Which of the following statements is true?
   (a) The longer the sine bar, the better the accuracy.
   (b) The shorter the sine bar, the better the accuracy.
   (c) Accuracy of a sine bar does not depend on an ambient temperature.
   (d) A sine bar cannot measure unknown angles.

15. Which of the following is correct if the 5° angle block is reversed and combined with the 30° angle block?
   (a) The resulting angle becomes 25°.
   (b) The resulting angle becomes 35°.
   (c) The resulting angle remains 30°.
   (d) Such a combination is not possible.

16. A balanced dial in a dial gauge has
(a) graduations in both metric and British systems
(b) graduations starting from zero and extending to the end of the recommended range
(c) graduations marked both ways of zero
(d) graduations in logarithmic scale

17. Contact point is most preferred in dial gauges, since it presents point contact to the mating surface irrespective of whether it is flat or cylindrical.
(a) Spherical (c) Tapered
(b) Flat (d) Button

18. The indicator that enables the application of a pressure already decided upon on the screw thread in a bench micrometer is called
(a) a fiducial indicator
(b) a pressure indicator
(c) a span indicator
(d) none of these

19. In wire methods, the diameter of the wire selected should be such that it makes contact with the screw along the
(a) outer diameter (c) root diameter
(b) pitch cylinder (d) axis of the screw

20. In a two-wire method, diameter of the best-size wire is given by
(a) $d = (p/2) \sec (x/2)$
(b) $d = (p/4) \sec (x/2)$
(c) $d = (p/2) \operatorname{cosec} (x/2)$
(d) $d = (p/2) \cot (x/2)$

21. The pitch error that occurs whenever the tool–work velocity ratio is incorrect but constant is referred to as a
(a) cyclic error (c) progressive error
(b) velocity error (d) non-progressive error

22. Thread gauges that are used to inspect external thread forms are called
(a) plug screw gauges (c) external screw gauges
(b) ring screw gauges (d) all of these

23. A NOT GO screw gauge will primarily check for
(a) outer diameter and nothing else (c) effective diameter and nothing else
(b) inside diameter and nothing else (d) all of these

24. Surface texture depends to a large extent on
(a) material composition (c) skill of the operator
(b) type of manufacturing operation (d) accuracy of measurement

25. Peaks and valleys of surface irregularities are called
(a) waves (c) asperities
(b) manifolds (d) perspectives

26. While roughness is referred to as a primary texture, --------is called a secondary texture.
(a) waviness (c) error of form
(b) lay (d) error of geometry

27. The direction of the predominant surface pattern, ordinarily determined by the production process used for manufacturing the component, is referred to as
(a) lay (c) waviness
(b) flaw (d) none of these

28. Irregularities that occur in isolation or infrequently because of specific causes such as scratches, cracks, and blemishes are called
(a) surface texture (c) waviness
(b) lay (d) flaws

29. The direction of a lay is
(a) the direction that the stylus trace is made
(b) the direction of the asperities
(c) perpendicular to the asperities
(d) any selected straight line taken as reference

30. The average height from a mean line of all ordinates of the surface, regardless of sign, is the
(a) RMS value (c) Rz value
(b) Ra value (d) Rm value

31. The datum created by a skid or shoe is the locus of its as it slides along the workpiece surface.
(a) centre of curvature (c) centre line
(b) centre of its bottom (d) all of these

End of exam paper

Best wishes- Dr. M. Eltaib