KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May, 2023

Marks Scored:

Level : B.E.
Year : II

Course : MEEG 219
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration N.:

Date : 04 APR 2023

SECTION "A"
[20Q. × 1 = 20 marks]

Mark [X] in the most appropriate option.

1. The maximum angle that can be measured with limited error using a sine bar is
[ ] 15° [ ] 45° [ ] 30° [ ] 60°

2. In a shaft basis system, the lower limit of the size of shaft is
[ ] nominal size [ ] nominal size + tolerance of shaft
[ ] nominal size - tolerance of shaft [ ] 0

3. Which type of fit is represented by hole and shaft pair designated by S8/h7?
[ ] Clearance fit [ ] Interference fit [ ] Running fit [ ] Transition fit

4. Where is the vernier scale present in a universal bevel protractor?
[ ] Base plate [ ] Circular plate [ ] Adjustable plate [ ] Main body

5. Which of the following is not a type of direct measuring instrument?
[ ] Micrometer [ ] Vernier caliper [ ] Divider [ ] All of these

6. The minimum number of slip gauges required to build a length of 79.578 mm using M112 set as shown is:

(3) Set M 112		
Range (mm)	Steps (mm)	No. of blocks
1.001 – 1.009	0.001	9
1.01 – 1.49	0.01	49
0.5 – 24.5	0.5	49
25 – 100	25	4
1.0005	—	1

[ ] 3 [ ] 4 [ ] 5 [ ] 6

7. Which of the following is the closest conversion of 0.6550 radians to degrees:
[ ] 41 seconds [ ] 39 minutes 18 seconds
[ ] 37.50 degrees [ ] 37 degrees 31 minutes 44 seconds

8. The angle formed between a flank of the thread and the perpendicular to the axis of the thread, which passes through the vertex of the fundamental triangle, is called
[ ] a helix angle [ ] an included angle [ ] a flank angle [ ] a lead angle

9. Which of the following part features is easiest to measure with a vernier calliper?
[ ] Large distances between outside planes [ ] Heights from a surface plate
[ ] Cylindrical features [ ] Concave features

10. Interpretation of repeated measurement results on the same feature is considered the instrument's:
[ ] accuracy [ ] sensitivity [ ] range [ ] precision

11. Which of the following is **NOT CORRECT** about wavelength standard?
[ ] Wavelength of monochromatic light is an invariable unit of length
[ ] Wavelength standard is a physical standard
[ ] It is a natural unit of length
[ ] It is a reproducible standard

12. Why are pitch errors observed in threads?
[ ] Interference between mating parts
[ ] Lack of inspection
[ ] Incorrect ratio of tool work velocity
[ ] None of these

13. According to Taylor's principle, GO ring gauges are designed to check?
[ ] Higher Limit of Shaft
[ ] Higher Limit of Hole
[ ] Lower Limit of Shaft
[ ] Lower Limit of Hole

14. Which of the following can't be done by 'Go' plug gauges?
[ ] Ensure bore alignability
[ ] Controls diameter
[ ] Check straightness of hole
[ ] Check degree of ovality

15. The angle subtended by each tooth of a gear is equal to:
[ ] Pi / Number of teeth
[ ] Pressure Angle / Number of teeth
[ ] Pi / Pressure Angle
[ ] Pressure Angle / (2 X Number of teeth)

16. Which of the following parameter is measured during composite test of gears?
[ ] error in tooth thickness
[ ] error in pitch of gears
[ ] specific type of errors in gear
[ ] variation in centre distance

17. In which type of gears do we have to deal with lateral axial thrust?
[ ] Helical Gears
[ ] Herring Bone Gears
[ ] Worm and Worm Wheel
[ ] Spur Gears

18. Which of the following is a cause of primary texture formation?
[ ] vibrations of machine tools
[ ] lack of straightness of guide ways
[ ] misalignment of centers
[ ] tool feed rate

19. Profilometer uses the principle of
[ ] induction in coils placed in fields of permanent magnet
[ ] variation of carrier signal due to variation in air gap of pivoted coils
[ ] demodulation of electrical signal
[ ] mechanical motion of stylus transferred to lapped cylinder and diamond scriber

20. Which method is used to measure the minor diameter of internal thread?
[ ] Rollers and Slip Gauges
[ ] Two V pieces Method
[ ] Thread Micrometer
[ ] Bench Micrometer with Fiducial Indicator

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Year : II
Time : 2 hrs. 30 mins.

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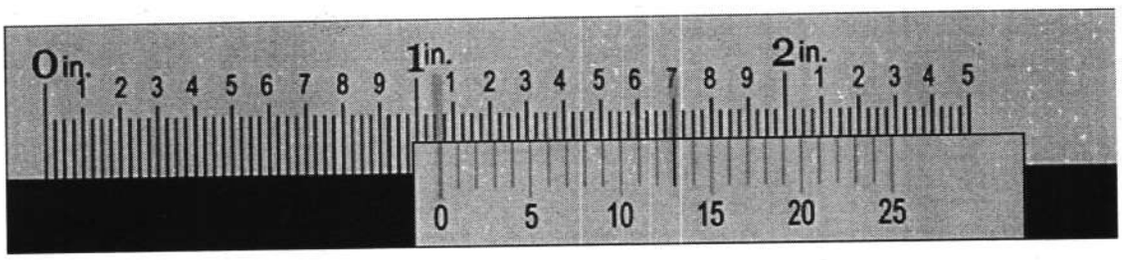
Semester : I
F.M. : 55

SECTION "B"

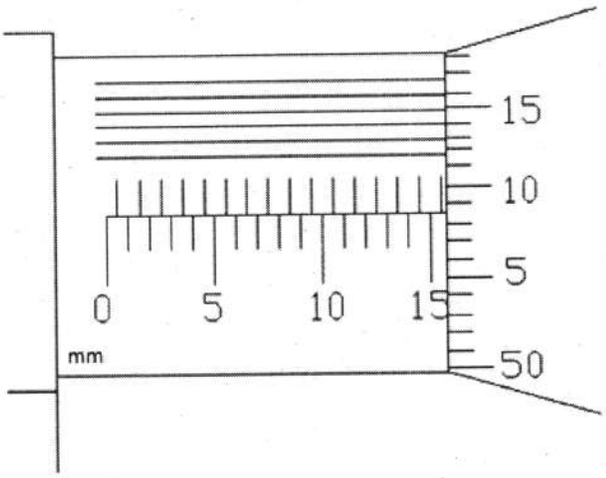
Attempt *ALL* questions. Assume suitable data if missing.

1. Tabulate the differences between Line Standard, End Standard and Wavelength Standard based on their characteristics, advantages and disadvantages. [5]

2. Calculate least count and reading of the given vernier caliper. Show your working. [3]



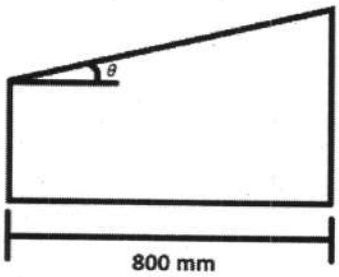
3. Calculate least count and reading of the given micrometer. Show your working. [3]



4. Explain the working mechanism of stylus probe instruments with the help of clear and labeled figures. Provide an example of a stylus probe instrument. [3+1]

5. Calculate Center Line Average (CLA) value of roughness for a graph having 100 horizontal magnification and 10000 vertical magnification for a sampling length 1.5 mm. The area above the datum are: 150, 110, 130, 50 mm^2 and below the datum are: 70, 50, 130, 80 mm^2. [3]

6. As an engineer at a metrology laboratory you are to assign your subordinate to measure the unknown angle 'θ' of the following component using a 150 mm sine bar. Prepare the detailed list of procedures with clear figures for your subordinate to follow starting from the collection of all the tools and instruments required for the measurement. [5]



7. When measuring effective diameter of an external metric screw thread: thread angle 60°, 3 mm pitch, a 25 mm diameter cylindrical standard and two 2 mm wires were used. The micrometer readings over standard and wires and over the screw thread and wires were 15.246 and 14.152 mm respectively. Calculate effective diameter of screw thread. [3]

8. Calculate the base tangent length from the given formula and data: [4]

$$Base\ Tangent\ Length\ (d) = N.m\cos\emptyset\left[\tan\emptyset - \emptyset - \frac{\pi}{2N} + \frac{\pi S}{N}\right]$$

Diameter of gear = 100 mm; Diametral Pitch = 0.5 per mm; Number of teeth between anvil = 3; Angle subtended by each tooth = 0.0628 radians; Circular Pitch = 6.283 mm; Pressure angle =14.5°; Number of teeth = 50

9. Give dimensional examples of pairs of hole and shaft of basic size 25 mm for each of clearance fit, interference fit and transition fit in the form: $A^{+a}_{-b}\ mm$ and $B^{+c}_{-d}\ mm$. [3]

10. A clearance fit has to be provided for a shaft and bearing assembly having a diameter of 40 mm. Tolerances on hole and shaft are 0.006 and 0.004 mm, respectively. The tolerances are disposed unilaterally. If an allowance of 0.002 mm is provided, find the limits of size for hole and shaft basis system is used. [4]

11. Write short notes on:
    a. Calibration [1]
    b. Threshold [1]
    c. Chordal Tooth Thickness [1]
    d. Backlash [1]
    e. Effective Diameter of Screw [1]
    f. Measurement method of Minor Diameter of Internal Thread [1]
    g. Maximum Metal Limit [1]
    h. Wear Allowance [1]

12. Design the general type of GO and NO GO gauges for components having 30 F7/h8 fit and state the type of fit of the pair. [9+1]

a. $i = 0.453\sqrt[3]{D} + 0.001D$

b. 30 mm falls in the diameter step of 18-30 mm

Grade	IT5	IT6	IT7	IT8	IT9	IT10	IT11	IT12	IT13	IT14	IT15	IT16
Tolerance in μm (For all size) $10^{0.2(N-1)}.i$	7i	10i	16i	25i	40i	64i	100i	160i	250i	400i	640i	1000i

Upper Deviation (es)		Lower Deviation (ei)	
Shaft Designation	In microns (for D in mm)	Shaft Designation	In microns (for D in mm)
a	$= -(265 + 1.3D)$ for $D \le 120$ and $= -3.5D$ for $D > 120$	j	No formula
b	$= -(140 + 0.85D)$ for $D \le 160$ $= -1.8D$ for $D > 160$	js	IT1/2
c	$= -52D^{0.2}$ for $D \le 40$ $= -(95 + 0.8D)$ for $D > 40$	k4 to k7	$= +0.6\sqrt[3]{D}$
cd	G.M. of values for c and d	k for grade ≤ 3 and ≥ 7	
d	$= -16D^{0.44}$	m	$= +(IT7 - IT6)$
e	$= -11D^{0.41}$	n	$= +5D^{0.34}$
ef	G.M. of values for e and f	p	$= +IT7 + 0$ to 5
f	$= -5.5D^{0.41}$	r	= geometric mean of values for p and s
fg	G.M. of values for f and g	s	$= IT8 + 1$ to 4 for $D \le 50$ $= +IT7$ to $+0.4D$ for $D > 50$
g	$= -2.5D^{0.34}$	t	$= +IT7 + 0.63D$
h	$= 0$	u	$= +IT7 + D$
		v	$= +IT7 + 1.25D$
		x	$= +IT7 + 1.6D$