

**KADI SARVA VISHWAVIDYALAYA**  
**B.E. SEMESTER IV EXAMINATION MAY 2014**

ME 405

DATE:15/05/2014

MECHANICAL MEASUREMENT AND METROLOGY

TIME:10:30am-1:30pm

TOTAL MARKS: 70

Instructions:

- Answer each section in separate answer sheet.
- Use of scientific calculator is permitted.
- All questions are compulsory.
- Indicate clearly the options you attempted along with its respective question number.
- Use the last page of main supplementary for rough work.
- Symbols and notations carry usual meaning.

**Section-1**

- Q.1 All compulsory
- A Explain working of thermal conductivity gauge for pressure measurement with sketch. 05
- B Explain the construction and working of a gas filled system for measuring temperature with neat sketch. 05
- C Explain the construction and working of bourdon tube pressure gauge (along with tube materials) with neat sketch. 05
- OR
- C Derive an expression of gauge factor for resistance strain gauge. 05
- Q.2 Answer the following question 05
- A Explain the working of hot wire anemometer with sketch. 05
- B Discuss with sketch working of seismic accelerometer. 05
- OR
- Q.2 A Explain briefly with neat sketch rope brake dynamometer. 05
- B State advantages and limitations of manometers & state the ideal characteristics of manometric liquid. 05
- Q.3 Answer the following question 05
- A How will you use an elastic transducer to measure force? Give three configurations for such measurement. 05
- B What is temperature compensation and how is it achieved when using bonded strain gauge. 05
- OR 05
- Q.3 A Explain with a sketch the three wire method of measuring the effective diameter of a screw thread 05
- B Why is the assessment of surface texture important? Explain (i) Waviness (ii) Lay (iii)Roughness 05

## Section-2

- Q.4 All compulsory
- A Explain the construction and working of vernier height gauge with neat sketch. 05
- B A Mcleod gauge has volume of bulb of measuring capillary equal to  $110 \times 10^{-6} \text{ m}^3$  and measuring capillary diameter of 1.1 mm. Calculate (i) The pressure indicated when the reading of the measuring capillary is 28 mm in case approximate formula is used.  
(ii) What is the error if exact formula is used for pressure measurement? 05
- C State the various possible errors on the gear. Explain how circular pitch measuring machine measure circular pitch error of gear 05
- OR
- C Describe briefly the different types of standards for linear measurements. 05
- Q.5 Answer the following question
- A A hole and shaft system has the following dimensions  $50H_8/c_8$ . The standard tolerance is given by  $i=0.45(D^{1/2}) + 0.001D$ . The diameter range lies between 50 to 80mm. The multiplier for tolerance grade 8 is 25. The F.D for shaft c is given by  $-(95+0.8D)$  microns & F.D for H hole is 0. Sketch the fit and show these upon the actual dimensions of hole and shaft. 05
- B Discuss the characteristics of line and end standards. 05
- OR
- Q.5 A What is meant by alignment test? Explain the following alignment test with sketch to be performed on lathe.
1. True running of spindle.
  2. Axial slip of spindle.
- B Enlist different types of micrometers. What precaution should be observed while using the micrometer? Draw the sketch indicating reading of
1. 23.78 mm and
  2. 73.78 mm on micrometer.
- Q.6 Answer the following question
- A Discuss the method of measuring straightness of a lathe bed using autocollimator. 05
- B Describe in brief the construction and working of SIGMA Mechanical comparator. 05
- OR
- Q.6 A Describe gear tooth caliper and explain how it is used to check gears. Calculate the settings required for a straight spur gear having 50 teeth of module 3mm. 05
- B What are the essential properties a light should have for interference work? What are the common sources of light used for interferometry work? 05

All the best

KADI SARVA VISHWAVIDYALAYA  
B.E. MECHANICAL SEMESTER IV EXAMINATION 2014

Sub: Mechanical Measurement & Metrology

Sub Code: ME:405

Time: 10:30am-1:30pm

Date: 08/11/14

Maximum marks: 70

## Instructions:

1. Use of scientific calculator is permitted.
  2. Assume suitable data if necessary clearly stating the same.
  3. Answers to both sections should be written separately.
  4. Symbols and notations carry usual meanings.
  5. Figures to the right indicate full marks.

## SECTION I

- |     |   |                |
|-----|---|----------------|
| Q.1 | <p>A Define Metrology. Explain clearly difference between primary, secondary and working standards.</p> <p>B What are the various possible sources of errors in measurements? What do you understand by systematic errors and random errors?</p> <p>C Explain the difference between a bellow gauge and a diaphragm gauge.</p>  | 05<br>05<br>05 |
|     | <b>OR</b>   |                |
|     | <p>C A bimetal strip is constructed of strips of nickel chrome iron alloy and invar bonded together at <math>25^{\circ}\text{C}</math>. The strips are 50 mm long and each material has a thickness of 1 mm. Calculate the radius of curvature produced when the strip is subjected to a temperature of <math>200^{\circ}\text{C}</math></p> <p>Assume the following data:</p> $\alpha_1 = 1.7 \times 10^{-6} / ^{\circ}\text{C}$ $E_1 = 1.5 \times 10^{-6} \text{ kgf/cm}^2$ $\alpha_2 = 12.5 \times 10^{-6} / ^{\circ}\text{C}$ $E_2 = 2.2 \times 10^{-6} \text{ kgf/cm}^2$ | 05             |
| Q.2 | <p>A Describe in brief the construction and working of SIGMA Mechanical comparator.</p> <p>B Explain the terms "Primary texture" and "Secondary texture State the factors affecting surface texture.</p>  | 05<br>05       |
|     | <b>OR</b>   |                |
| Q.2 | <p>A Explain briefly the construction and working of a resistance thermometer, stating its advantages and disadvantages.</p> <p>B Explain construction and working of Mcleod gauge (with sketch).</p>   | 05<br>05       |
| Q.3 | <p>A Explain how angle of a work piece is measure with the help of angle dekkor and angle gauge.</p> <p>B Explain in brief with neat sketch the working of "Tool maker's microscope". Give its applications.</p>  | 05<br>05       |
|     | <b>OR</b>   |                |
| Q.3 | <p>A Mercury has boiling temperature at <math>350^{\circ}\text{C}</math>. Is it possible to design mercury filled in glass thermometer capable to measure <math>500^{\circ}\text{C}</math>? Justify your answer.</p> <p>B Explain with sketch working of optical pyrometer.</p>   | 05             |

## SECTION II

- Q.4 A Explain the autocollimator method for measurement of straightness. 05  
B Explain the principle of thermo couple. Also explain their calibration method. 05  
C Why is it not preferable to use sine bar for angles greater than  $45^\circ$ ? 05  
OR  
C Explain proving ring in brief with sketch. 05
- Q.5 A Enlist different types of micrometers. What precaution should be observed while using the micrometer? Draw the sketch indicating reading of 1) 23.78 mm and 2) 73.78 mm on micrometer. 05  
B A shaft and hole have a nominal diameter of 1 in. The shaft has a tolerance of 0.003in, the hole has a tolerance of 0.004in and the allowance is set at 0.001in. The dimensions are based on the Basic Hole System. Show the deviations for the shaft and the hole from nominal size; calculate the maximum and minimum clearance for two mating parts. 05  
OR  
Q.5 A Explain the alignment test on lathe machine with neat sketch to check the true running of spindle. 05  
B State the need of precision measurement. Explain two standards of linear measurement briefly. 05
- Q.6 A Briefly explain with sketch the two wire and three wire method of measuring effective diameter of thread. 05  
B Describe with neat sketch working of piezoelectric accelerometer. 05  
OR  
Q.6 A What are the desirable characteristics of a manometric fluid 05  
B Define Metrology. Explain clearly difference between primary, secondary and working standards 05

**KADI SARVA VISHWAVIDYALAYA**  
**B.E.(MECH/AUTO ENGG) SEMESTER IV EXAMINATION 2015**

Sub: Mechanical Measurement & Metrology

Sub Code: ME405

Time: 10:30am-1:30pm

Date: 07/05/2015

Maximum marks: 70

**Instructions:**

1. Use of scientific calculator is permitted.
2. Assume suitable data if necessary clearly stating the same.
3. Answers to both sections should be written separately.
4. Symbols and notations carry usual meanings.
5. Figures to the right indicate full marks.

**SECTION I**

- Q.1 A Explain the procedure to measure the angle with help of sine-bar when  
1) Job is bigger than sine bar 2) Job is smaller than sine bar. 05
- B Explain in brief with neat sketch the working of Tool maker's microscope 05  
. Give its applications.
- C Calculate the angle of taper and minimum diameter of internal taper from 05  
the following readings. Diameter of bigger ball = 10.25 mm. Diameter of  
smaller ball = 6.07 mm. Height of bigger ball from datum = 30.13 mm.  
Height of smaller ball from datum = 10.08 mm
- OR
- C Determine the dimensions with tolerance specifications of the mating 05  
components of a 30 mm clearance fit with a maximum clearance of 70  
microns and a minimum clearance of 10 microns. Assume shaft  
tolerance to be 5 times the hole tolerance.  
Develop from Taylor's principle of gauging the configuration and  
dimensions with tolerance specifications of the full form shaft gauge both  
GO and NO GO ends, suitable for gauging the above shaft. The length  
of the shaft is 100 mm.
- Q.2 A The scale of a back pressure type air gauging system is linear between 05  
values of pressure ratio from 0.6 to 0.8. The linear relationship found is  
 $P_2/P_1 = -0.5 A_m/A_c + 1.1$ . The diameter of the control jet is 0.38mm,  
measuring jet diameter is 0.64mm and the supply pressure is 3 bar. The  
measuring indicator displaces 1.6 mm per  $10^{-3}$  bar change in pressure.  
Find (i) range of linear scale  
(ii) Overall sensitivity of the equipment
- B What is wringing of slip gauges? What are the errors in a micrometer? 05
- OR
- Q.2 A What is meant by the term magnification as applied to a mechanical 05  
comparator? What are the basic methods to find magnification in  
comparators?
- B Explain the significance of following alignment test carried on lathe 05  
(1) True running of head stock centre  
(2) Axial slip of main spindle

- Q.3 A How will you calibrate a 100 mm sine bar when it is known that: The error in the centre distance of the roller does not exceed  $2.5\mu\text{m}$  & error in slip gauge pile does not exceed  $1\mu\text{m}$ . 05
- B Describe the principle of an angle dekkor and mention its various uses. 05  
 OR
- Q.3 A Explain with neat sketch three wire method of measuring effective diameter of screw thread. 05
- B Make a schematic diagram of a surface profile containing both roughness and waviness characteristics and explain how choice of sampling length can affect the value of a surface finish parameter. State the significance of lay. 05

## SECTION II

- Q.4 A Define the tooth thickness of simple spur gear .Mention special feature of a gear tooth caliper. Does a gear tooth vernier actually measure the defined tooth thickness? 05
- B Explain with neat sketch the arrangement for power measurement of a given I.C.Engine by rope brake dynamometer. Also derive the equation for power. 05
- C Write an account of the metallic diaphragm, capsule and bellows elements with sketch. Include details of materials used pressure deflection characteristics. 05  
 OR
- C Give the details of the hot wire anemometer. 05
- Q.5 A Discuss the method of calibrating a thermometer. 05
- B A bimetallic strip is made f strips of nickel-chromium alloy and invar bonded together at  $25^\circ\text{C}$ . Each strip has a thickness of 1mm and the composite element has one end fixed and other end free. The length of cantilever is being 50mm.Calculate (1) radius of curvature when the strip is subjected to  $200^\circ\text{C}$ . (2) Movement of free end in a perpendicular direction from the initial line. Coefficient of thermal expansion for invar is negligible and for nickel-chromium alloy is  $12.5 \times 10^{-6}$  per degree celcius. 05  
 OR
- Q.5 A Explain the measurement of vibration by reed vibrometer and stroboscope. 05
- B List the different means for torque measurement .Discuss optical means of torque measurement. 05
- Q.6 A Name the materials of which thermistors are made and explain the working of a thermistor in the act of temperature measurement. 05
- B Explain the working of pneumatic load cell to measure force with sketch. 05  
 OR
- Q.6 A List the various methods to measure low pressure (vacuum) and explain any one. 05
- B Explain the proving ring in brief.(with sketch) 05

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**KADI SARVA VISHWAVIDYALAYA**  
**B.E. (MECH/AUTO ENGG) SEMESTER IV EXAMINATION 2015**

Sub: Mechanical Measurement & Metrology

Sub Code: ME405

Time: 10:30am-1:30pm

Date: 29/10/2015

Maximum marks: 70

**Instructions:**

1. Use of scientific calculator is permitted.
2. Assume suitable data if necessary clearly stating the same.
3. Answers to both sections should be written separately.
4. Symbols and notations carry usual meanings.
5. Figures to the right indicate full marks.

**SECTION I**

- Q.1 A Explain clearly difference between primary, secondary and working standards. 05  
 B Explain the working and construction of glass filled thermometers. 05

C	Actual Pressure, kgf/cm <sup>2</sup>	05	10	15	20	25	30	25	20	15	10	05
	Gauge reading, kgf/cm <sup>2</sup>	4.5	9.6	14.2	18.0	22.5	28.0	26.0	21.0	16.2	11.4	7.0

Draw the calibration, error and correction curve.

OR

- C Explain with sketches: (i) Hysteresis (ii) Threshold (iii) Repeatability (iv) Overshoot 05

- Q.2 A Describe the construction and working of venturimeter stating its advantages and disadvantages. 05  
 B A McLeod gage has a volume of 100 ml and a capillary of 0.5 mm diameter. Estimate the pressure indicated by a reading of 25 mm of mercury. What will be the error if the approximate formula is made use of? 05

OR

- Q.2 A Name the instrument used for force, torque and displacement. Explain prony brake dynamometer with neat sketch. 05  
 B Explain the law of intermediate temperatures and the law of intermediate metals used in thermocouples (with sketch). Discuss the influence of these laws on industrial usage of thermocouples. 05
- Q.3 A Briefly explain how pressure can be measured with elastic transducer. 05  
 B State advantages and limitations of manometers & state the ideal characteristics of manometric liquid. 05

OR

- Q.3 A Discuss with block diagram generalized measurement system with examples for each stage elements. 05  
 B State the possible source of error in micrometer. Name any four types of micrometer and state their specific uses. 05

## SECTION II

- Q.4 A Explain with a neat sketch, Imperial standard yard & International prototype meter. 05  
B A spur gear of 8 mm module has 50 teeth calculate following proportion:  
Pitch circle diameter, Addendum and Dedendum, Tooth working height and base pitch.  
Assume clearance to be 0.25 module. Spur gear has pressure angle of  $20^{\circ}$ .  
C How to check the composite errors of the gear by using Parkinson gear testing machine?  
Explain it in detail. 05
- OR
- C What are the types of errors on screw threads and explain the reason for the same. 05
- Q.5 A Explain the significance of following alignment test carried on lathe 05  
1. True running of head stock centre  
2. Axial slip of main spindle  
B With the help of sketch, define the following : Zero line, Basic size, Limits, Allowances, Deviation, Upper deviation, Lower deviation and Fundamental deviation. 05
- OR
- Q.5 A Explain with neat sketch the working of Talysurf instrument for surface finish measurement. 05  
B What are the salient features of a comparator? Explain SIGMA mechanical comparator with neat sketch. 05
- Q.6 A Describe with neat sketch working of piezoelectric accelerometer. 05  
B Explain in brief:  
1. Straightness  
2. Flatness  
3. Parallelism 05
- OR
- Q.6 A Determine the type of fit for 70H9/e7 after deciding the fundamental deviations and tolerances in the following. Diameter step (50-80), FD for H= 0, FD for e = -11D0.41, IT7=16i, IT9=40i & i = 0.46(D) $^{1/3}$  + 0.001(D), microns 05  
B Make a schematic diagram of a surface profile containing both roughness and waviness characteristics and explain how choice of sampling length can affect the value of a surface finish parameter. State the significance of lay. 05

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