**SHANTILAL SHAH ENGINEERING COLLEGE-BHAVNAGAR**

**PRODUCTION ENGINEERING DEPARTMENT**

**QUESTION BANK**

SUBJECT CODE: 2141901

SUBJECT: MECHANICAL MEASUREMENT & METROLOGY

| **Sr. No.** | **Detail** | **GTU Year** | **Marks** |
| --- | --- | --- | --- |
| **1. MECHANICAL MEASUREMENT** | | | |
|  | Explain the various modes of measurements with two examples. | Sum. 14 | 7 |
|  | Draw a block diagram of a generalized measurement system (GMS) and explain the various elements of it in detail. | Sum. 13+Win. 12 | 7 |
|  | What are the various possible sources of errors in measurements? What do you understand by systematic errors and random errors? | Sum. 12 | 7 |
|  | What are the various possible sources of errors in measurement? Define static error and explain any two static errors with example. | Sum. 14 | 7 |
|  | Define detector-transducer. Discuss briefly different types of mechanical detector-transducer with neat sketch. | Win. 14 | 7 |
| **2. LINEAR AND ANGULAR MEASUREMENTS** | | | |
|  | Explain the construction of a Vernier Calliper. | Win. 16+Win. 15 | 3 |
|  | Describe construction, working principle and applications of Vernier height gauge. | Sum. 16+Sum. 13+Win. 12 | 7 |
|  | State the advantages and limitations of vernier caliper, vernier height gauge, external micrometer and dial indicator. | Win. 12 | 4 |
|  | Sketch micrometer. Label all important parts of it. Also explain least count of micrometer with suitable example. | Win. 14+Win. 13 | 7 |
|  | State the types of different micrometers and give their application in metrology. | Sum. 15 | 7 |
|  | Describe working principle and construction of vernier micrometer with neat sketch. Find out least count of vernier caliper | Sum. 14 + Win. 13+Sum. 12 | 7 |
|  | What precautions should be taken while using micrometer. | Win. 12 | 3 |
|  | What are the precautions to be taken while using a micrometer? State the possible sources of error in micrometers. | Sum. 12 | 7 |
|  | Explain the construction and working of the following with neat sketch. ( i ) Telescopic gauge (ii) Universal bevel protractor . | Win. 16+Sum. 13 | 7 |
|  | Explain the construction and working of the following with neat sketch. ( i ) Telescopic gauge (ii) Dial bore gauge | Win. 15 | 7 |
|  | Explain hemispherical bore gauge with applications. | Sum. 16 | 4 |
|  | Describe followings with neat sketch.  (i) Slip Gauge (ii) Dial Indicator | Win. 14 | 7 |
|  | Enlist methods of measurements. Explain Slip gauges with wringing process. | Win. 16 + Win. 15 | 7 |
|  | Describe with neat sketch the construction and working of Vernier bevel protractor. | Win. 15 | 7 |
|  | What is sine bar? Explain with the help of diagram the principle of sine bar. | Win. 12 | 4 |
|  | Explain with neat sketch Method of measurement of Taper plug using sine bar | Win. 13+Sum. 12 | 7 |
|  | Explain how sine bar is used to measure.  i. Angle of component of small size ii. Angle of component of large size | Sum. 15 | 7 |
|  | Why sine bar is not preferred for angles greater than 45⁰ Explain. | Sum. 16+Sum. 13 | 4 |
|  | What are angle gauges? How are they used? | Win. 12 | 3 |
|  | Write applications and limitations of angle gauges. | Sum. 14 | 3 |
|  | Write a short note on: Spirit level | Win. 16+Sum. 16 + Win. 13 | 4 |
|  | Explain following method for measurement of straightness  (i) The Auto- collimator method (ii) Precision sprit level method | Win. 16 | 7 |
|  | Explain construction and applications of Micrometer clinometer. | Win. 16+Sum. 16 | 3 |
|  | Explain with the help of neat sketches the principle and construction of an auto-Collimator. | Win. 16 + Win. 15 + Win. 13 | 7 |
|  | Discuss methods to measure angle in tapered shafts and holes. | Win. 12 | 7 |
|  | The following observations were obtained while checking angle of tapered piece on one side with the help of two discs (Rollers), slip gauge and dial indicator.  Diameter of larger disc = 40 mm, Diameter of smaller disc = 24 mm  Slip gauge placed between the discs = 30 mm  The dial indicator shows no variation when traversed along the surface of the piece placed over the discs. Draw the sketch of the set up and find angle of taper. | Sum. 14 | 4 |
|  | Calculate the angle of taper and minimum diameter of internal taper from 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 | Sum. 15 | 7 |
| **3. MEASUREMENT OF FORCE, TORQUE AND STRAIN:** | | | |
|  | Explain any one Method used for force measurement. | Sum. 16+Sum. 12 | 3 |
|  | Explain proving ring with sketch | Sum. 16+Sum. 13 | 4 |
|  | Classify torque and power measurement techniques. Explain torsion bar dynamometer. | Sum. 15 | 7 |
|  | Explain in brief the following with neat sketch  i) Prony brake dynamometer and ii) Rope brake dynamometer | Sum. 14+Win. 12 | 7 |
|  | Describe with sketch eddy current dynamometer stating speed, power limit, advantages and limitations. | Sum. 15 | 7 |
|  | Explain the followings:  i) Optical strain gauges ii) Gauge factor | Win. 15 | 7 |
|  | Describe strain gauge. Define gauge factor of strain gauge. What are Rosette gauges explain with advantages, limitations & application? | Sum. 12 | 7 |
| **4. DISPLACEMENT, VELOCITY/SPEED, AND ACCELERATION, MEASUREMENT:** | | | |
|  | Explain Working principal of Resistive Potentiometer. | Win. 16 | 4 |
|  | Explain Linear variable differential transducers (LVDT). | Win. 16 | 3 |
|  | Explain the construction and working of LVDT with its advantage and disadvantages. | Win. 15 + Win. 13 | 7 |
|  | Define LVDT. Explain its working with neat sketch. Also state its practical application. | Win. 14 | 7 |
|  | Give the detail classification of Tachometer and explain briefly photoelectric generator. | Win. 15 | 7 |
|  | Explain the flash light stroboscope. | Sum. 16+Sum. 13 | 4 |
|  | Explain the principle, working and method of speed measurement using stroboscope stating an illustration. | Sum. 15 | 7 |
|  | Explain followings briefly.  (i) Stroboscope (ii) Resonance (vibrating reed) tachometer | Win. 14 | 7 |
| **5. TEMPERATURE, PRESSUER AND FLOW MEASUREMENT:** | | | |
|  | Write a short note on: International temperature scale (ITS). | Sum. 16+Sum. 13 | 4 |
|  | Classify temperature measuring instruments with temperature range of each category. Compare temperature scales with diagram. | Win. 12 | 7 |
|  | Describe with sketch bimetal strip thermometer stating salient features. | Win. 15+Sum. 15 | 7 |
|  | List out the various applications of Bimetallic thermometer. | Sum. 16+Sum. 13 | 3 |
|  | Explain Liquid in glass Thermometer. | Win. 16 +Sum. 15 | 4 |
|  | Explain the working principle of pressure actuated thermometer. List the functional elements. Also draw the block diagram for the same. | Sum. 15 | 7 |
|  | Discuss the construction and working of thermocouple with neat sketch. | Sum. 16 | 7 |
|  | What is a ‘Peltier effect’ in thermocouple? | Sum. 12 | 3 |
|  | Explain the thermoelectric pyrometer (Thermocouple) in detail. | Sum. 13 | 7 |
|  | Explain the principle of thermo couple. Also explain their calibration Method. | Win. 16 +Win. 13 | 4 |
|  | Describe with sketch the construction and working of a RTD. Give advantage and disadvantage of RTD. | Win. 15 +Sum. 14+Sum. 12 | 7 |
|  | Write short note on Thermister. | Win. 14 | 7 |
|  | Compare RTD and thermistors as temperature measuring device. | Sum. 15 | 7 |
|  | Explain Radiation Pyrometer. | Sum. 16 | 4 |
|  | Explain optical pyrometer with neat sketch. | Sum. 16 + Win. 15 +Win. 13 | 7 |
|  | A bimetal strip is constructed of strips of nickel chrome iron alloy and invar bonded together at 25°C. 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 200°C. Assume the following data:  α1 = 1.7 \* 10-6 / °C E1 = 1.5 \* 10-6 kgf/cm2  α2 = 12.5 \* 10-6 / °C E2 = 2.2 \* 10-6 kgf/cm2 | Sum. 12 | 4 |
| **6. METROLOGY** | | | |
|  | State necessity and objectives of metrology. Also explain in brief precision and accuracy. | Win. 15+Win. 12 | 7 |
|  | Explain objectives of Metrology. | Sum. 14 | 3 |
|  | What do you understand by line and end measurement? Discuss their relative characteristics. | Sum. 12 | 7 |
|  | Distinguish between Primary, Secondary, and Tertiary working standards of length. | Win. 16+Sum. 15+Win.15 + Win. 13 | 4 |
|  | Explain Light wave length standard | Win. 16+Sum. 16 | 3 |
|  | What are the advantages of wavelength standard? | Sum. 12 | 3 |
| **7. METROLOGY OF GEARS AND SCREW THREADS** | | | |
|  | Discuss the gear tooth terminology with neat sketch. | Sum. 16 | 7 |
|  | Explain various forms of Gear teeth and explain Gear tooth vernier caliper with neat sketch. | Win. 15+Win. 13+Sum. 13+Win. 12 | 7 |
|  | List out various elements to be checked for accuracy of gear and describe any two. | Win. 16+Sum. 16+Win. 15 | 4, 7 |
|  | Explain Tool maker’s Microscope. | Win. 16 +Sum. 15 | 3 |
|  | Draw the neat sketch of a toolmaker’s microscope, label it and explain its working. | Win. 12 | 7 |
|  | Name the instruments which are used for measuring the gear tooth profile. Explain any one of them with neat sketch. | Win. 12 | 7 |
|  | Name the various methods used for measurement of tooth thickness and explain any one of them. | Sum. 12 | 7 |
|  | Explain Parkinson gear tester with neat sketch. | Sum. 14 | 4 |
|  | State the various possible errors on the gear. Explain how circular pitch measuring machine measure circular pitch error of Gear | Win. 16 + Win. 13 | 7 |
|  | Explain the construction and working of standard gear tester with neat sketch. | Sum. 13 | 7 |
|  | 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 20⁰. | Sum. 14 | 3 |
|  | Discuss the elements of screw thread with neat sketch. | Sum. 16 | 7 |
|  | Explain the procedure of measuring ‘Major diameter’ of a screw thread by using a bench micrometer. | Win. 12 | 4 |
|  | Give the classification of threads. Explain the two-wire method of measuring the effective diameter of a screw thread. | Win. 15+Sum. 15 | 7 |
|  | Explain three wire method to measure the effective diameter of given screw thread with neat sketch. | Sum. 14 + Win. 13 +Win. 12 | 7 |
|  | List and explain the different terms related to screw Explain the difference between two wire and three wire method used for screw thread measurement. | Sum. 13 | 7 |
|  | What is the best size wire? Derive the expression for the same in terms of pitch and angle of the thread. | Sum. 12 | 7 |
|  | How the measurement of following elements of internal screw threads can be done? Major diameter, Minor diameter, Effective diameter, Pitch and Thread angle | Win. 12 | 7 |
|  | Explain the measurement of effective diameter for internal screw threads with neat sketch. | Sum. 14 | 4 |
| **8. METROLOGY OF SURFACE FINISH:** | | | |
|  | Explain surface texture and elements of surface roughness. | Sum. 14 | 7 |
|  | Differentiate between first, second, third and fourth order irregularities | Win. 12 | 3 |
|  | Explain the terms “Primary texture” and “Secondary texture”. | Sum. 12 | 4 |
|  | Explain the following terms used in surface finish with sketch:  i. Roughness ii. Waviness iii. Effective profile iv. Centerline of profile | Sum. 15 | 7 |
|  | State the factors affecting surface texture. | Sum. 12 | 3 |
|  | Explain the different surface roughness evaluation methods. | Sum. 13 | 4 |
|  | Describe working and construction of Tomlinson surface tester for surface measurement. | Win. 14 +Sum. 14 +Win. 13 | 7 |
|  | Explain the construction and working of Talysurf surface roughness measuring instrument with neat sketch.. | Sum. 13+Win. 12 | 7 |
|  | Explain adverse effect of poor surface finish | Win 16+Sum 16 | 3 |
| **9. COMPARATORS:** | | | |
|  | What is comparator? Why it required? Give its classification in detail. | Win. 14 | 7 |
|  | List out various characteristics of good comparators. | Win.16+Sum 16 | 3 |
|  | Classify comparators and describe with sketch the construction and working of sigma comparator. | Sum. 16+ Win. 15 | 7 |
|  | Give classification of comparators and explain Dial indicator with sketch. | Sum. 15 | 7 |
|  | Explain with neat sketch the principle, construction and working of Johansson Mikrokator. | Sum. 14 | 7 |
|  | With the help of neat sketch describe the working principle and construction of an optical comparator with its advantages and limitations. | Sum. 14 | 7 |
|  | Explain pneumatic comparator and state the advantages and disadvantages | Sum. 16 | 7 |
| **10. MISCELLANEOUS METROLOGY** | | | |
|  | Define Flatness and describe a method to find out the flatness of a surface plate. | Sum. 14 | 7 |
|  | Explain any two methods of measuring flatness. | Win. 12 | 3 |
|  | Explain the alignment Test on the lathe machine is carried out explain various step in brief. | Win. 13+Sum. 13+Win. 12 | 7 |
|  | Name the various alignment tests to be performed on Milling Machine and describe any three in detail. | Sum. 12 | 7 |
|  | Define squareness. Explain with neat sketch the following methods or measuring the squareness.  i) Indicator method ii) Auto collimator method | Sum. 14 | 7 |
|  | Explain briefly the types of irregularities of a circular part. | Win. 12 | 3 |
|  | Define straightness. Explain any two methods of measuring straightness | Win. 12 | 4 |
| **11. MEASUREMENT OF PRESSURE AND FLOW** | | | |
|  | Explain the construction and working of bourdon tube pressure gauge with neat sketch. | Win. 16+Sum. 16+Sum. 14+Sum. 13 | 7 |
|  | Explain working of Mcleod gauge for pressure measurement. | Win. 16 +Win. 13+Sum. 13+Win. 12 | 7 |
|  | Explain the working principle of Ionization gauge with advantages and disadvantages | Win. 15+16 | 7 |
|  | Sketch and describe the construction and working of Bellows pressure gauge. | Win. 15 | 7 |
|  | Explain working of dead weight tester. How pressure gauge is calibrated on dead weight tester. | Win. 13 | 7 |
|  | Explain the diaphragm pressure gauges in brief. | Sum. 13 | 4 |
|  | Explain the difference between a bellow gauge and a diaphragm gauge. | Sum. 13+Sum. 12 | 7 |
|  | Classify force balance pressure gauges. Explain any one in detail. | Win. 14 | 7 |
|  | Explain with neat sketch ring balance manometer with comment on its field of application. | Sum. 12 | 7 |
|  | Explain the construction and working principle of Rotameter. | Win. 15 | 7 |

**SHORT QUESTIONS**

| **Sr. No.** | **Detail** | **GTU Year** |
| --- | --- | --- |
|  | Explain Range and Span. | Win. 16+Sum. 16+Sum. 13 |
|  | State the different use of Telescopic gauge. | Win. 16 + Sum. 16 |
|  | List out various sources of errors in measurement. | Win. 16+Sum. 16 |
|  | What is Calibration? | Win. 16+Sum. 13 |
|  | Define Sensitivity and Hysteresis. | Win. 16+Sum. 15 +Win. 13 |
|  | Define: (i) Resolution (ii) Threshold. | Win. 16+Sum. 16 + Sum. 15+Sum. 13 |
|  | Define Errors and give their classification. | Win. 16 |
|  | Define Least count of an instrument with example. | Sum. 16 |
|  | Define Pitch circle diameter. | Sum. 16 |
|  | Explain Dead zone and Drift. | Sum. 16 |
|  | Define line and end standard | Win. 15 |
|  | Define systematic error and random error | Win.15 |
|  | Define instrument and measurement | Win. 15 |
|  | Explain the following characteristics of measurement system:  (i) Dead zone (ii) Drift (iii) Sensitivity (iv) Threshold (v) Fidelity (vi) Linearity (vii) Overshoot | Win. 15 |
|  | Define following terms related to screw thread measurement:  (i) Lead, (ii) Pitch, (iii) Crest | Sum. 16 |
|  | Give the classifications of Tachometers. | Sum. 16 |
|  | List out different standards to calibrate thermocouple. | Sum. 16 |
|  | Define Accuracy and precision. | Win. 16+Sum.16 +Sum. 15+Win. 15+Sum. 13+Win. 12 |
|  | Define the following terms for Screw thread:  i) Major Diameter ii) Minor Diameter iii) Pitch iv) Lead v) Flank angle vi) Helix angle | Sum. 14 |
|  | Define terms: (i) Primary texture (ii) Secondary Texture. | Sum. 16 |
|  | Explain Indirect Method of measurement. | Sum. 16 |
|  | Define Comparators. | Sum. 16 |