**Khulna University of Engineering & Technology**

*Department of Mechanical Engineering*

B. Sc. Engineering 3rd Year Backlog Examination, 2019

ME 3225

(Measurement and Industrial Instrumentation)

Time: 3 hours | Total Marks: 210

N. B.: 1) Answer any THREE questions from each section in separate scripts.

2) Figures in the right margin indicate full marks.

3) Assume reasonable data if any missing

## SECTION-A

1(a) Define measurement and instrumentation. Describe active and passive measurement with necessary examples. 13

1(b) State abbe's alignment principle. Show that error for alignment of spherical end gauges, 12

$$\frac{h^2}{2(R_1+R_2)};$$ Where symbols have their usual meanings.

1(c) What are the different random errors? Explain parallax error with figure. 10

2(a) What is line standard and end standard? Show the uses of Sine bar schematically. 10

2(b) What are the different types of temperature measurement devices? Describe the working principle of a gas pressure thermometer. 10

2(c) Write short notes on i) Thermocouple, ii) Sling Psychrometer, and iii) Strain gauge load cell. 15

3(a) What thermo-anemometer? What are different modes of HWA. Show schematically. 11

3(b) Briefly explain the basic principle of operation of mechanical thermometer. Also explain the working principle of pressure thermometer. 14

3(c) What are different ways of measuring relative humidity? Explain any one. 10

4(a) Explain the working principle of pneumatic load cell with necessary sketch. 11

4(b) How the Bourdon tube pressure gauge works? Explain. 11

4(c) Write down the basic equation for $P^H$ measurement with notation. Apply Taylor's principle to a part with dimension: 13

" $38^{+0.70}_{-0.00}$ "

## SECTION-B

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|---|---|---|
| 5(a) | Define sensors and transducers. Write short notes on, i) Accuracy, ii) Precision, iii) Sensitivity and iv) Resolution. | 16 |
| 5(b) | What is proximity sensor? Write some examples of proximity sensors with application area. | 07 |
| 5(c) | Briefly explain the working principle of Ultrasonic sensor and give comparison with infrared sensor. | 12 |
| 6(a) | Define metrology. Draw block diagram of an automation system showing typical components. | 10 |
| 6(b) | Briefly describe the working principle of potentiometer sensor with its applications. | 13 |
| 6(c) | Describe the working principle of infrared distance sensor. | 12 |
| 7(a) | Mention the different linear velocity measurement devices. Explain the working principle of any linear velocity measurement sensor. | 13 |
| 7(b) | Describe the working principle of RTD and Thermistor. Compare their key features (sensitivity, range etc.) by using graphs. | 14 |
| 7(c) | Write a short note on Open loop and Closed loop control system with block diagram. | 08 |
| 8(a) | What is LVT? Describe working principle of LVT. | 12 |
| 8(b) | What is SONAR? Explain, how it works? | 11 |
| 8(c) | Discuss the working of double series magnetic suspension system. | 12 |

**Khulna University of Engineering & Technology**

*Department of Mechanical Engineering*

B. Sc. Engineering 3rd Year Backlog Examination, 2019

ME 3215

(Engineering Metallurgy)

Time: 3 hours | Total Marks: 210

N. B.: 1) Answer any THREE questions from each section in separate scripts.

2) Figures in the right margin indicate full marks.

3) Assume reasonable data if any missing

## SECTION-A

| | | |
|---|---|---|
| 1(a) | Write a short notes on:<br>(i) Ductility (ii) Malleability (iii) Tensile strength. | 09 |
| 1(b) | What is NDT? Describe magnetic particle test for detection of crack. | 10 |
| 1(d) | Explain how to determine various tensile properties of brittle and ductile materials. | 16 |
| 2(a) | What is alloy? Classify it. | 08 |
| 2(b) | Draw neat sketches of the arrangement of atoms in the following types of crystal lattice:<br>(i) Body centered cubic (BCC)<br>(ii) Face centered cubic (FCC)<br>Also calculate the number of atoms per unit cell for each of the above crystal lattices. | 12 |
| 2(c) | Describe how to draw Type I phase diagram and how to find chemical compositions and relative amount of phases in two phase region. | 15 |
| 3(a) | Why delta region of Iron-Iron carbide diagram is insignificant in heat treatment? | 07 |
| 3(b) | If you have to design a stapler pin manufacturing process, which heat treatment process you may choose to apply there and why? | 08 |
| 3(c) | Describe slow cooling of 1% carbon steel with cooling curve and evolution of microstructure. | 20 |
| 4(a) | What are the objectives of heat treatment? | 05 |
| 4(b) | Lead melts at 326°C and tin melts at 232°C. They form a eutectic containing 62 percent tin at 182°C. The maximum solid solubility of tin in lead at this temperature is 19 percent; of lead in tin 3 percent. Assume the solubility of each at room temperature is 1 percent.<br>(a) Draw the equilibrium diagram to scale on piece of graph paper labeling all points, lines and areas.<br>(b) For an alloy containing 40 percent tin;<br>(i) give the temperature of initial solidification;<br>(ii) give the temperature of final solidification;<br>(iii) give the chemical composition and relative amount of the phases present at a temperature of 35°C below (i). | 30 |

## SECTION-B

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|---|---|---|
| 5(a) | Describe the manufacturing process of pig iron from iron ore. | 15 |
| 5(b) | Write short note on: (i) Ductile cast iron and (ii) Malleable cast iron. | 10 |
| 5(c) | Explain the difference in microstructure and application of grey cast iron and white cast iron. | 10 |
| 6(a) | Classify steel. What are the limitations of carbon steel? | 10 |
| 6(b) | What are the attributes for choosing steel in construction industries? Describe briefly. | 09 |
| 6(c) | Discuss the following alloying elements effect on steel properties – (i) Manganese, (ii) Nickel, (iii) Chromium, (iv) Tungsten. | 16 |
| 7(a) | What are the essential properties of bearing metals? Explain briefly | 08 |
| 7(b) | Write down the compositions and uses of the following alloys – (i) Gun metal, (ii) Duralumin, (iii) Hastelloy X. | 12 |
| 7(c) | Explain the Bayer process of production of Aluminium. | 15 |
| 8(a) | What is powder metallurgy? Write down the advantages and disadvantages of powder metallurgy. | 09 |
| 8(b) | What is green strength and compressibility? Explain the Sintering process briefly. | 11 |
| 8(c) | What is meant by metal spraying? Explain the working principle of flame wire metal spraying. | 15 |

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