

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF BACHELOR OF SCIENCE IN MINING
PHYSICS

GPHY 353 – MINERALS ENGINEERING AND PROCESS CONTROL

STREAMS: BSC

TIME: 2 HOURS

DAY/DATE: TUESDAY 17/12/2024

11.30 A.M. – 1.30 P.M

Instructions;

Answer Question ONE and any other two questions.

Question one.

- a) Why is it difficult to use friction sawing on nonferrous metals? Explain. (4 marks)
- b) Below is a list of metals and alloys: Plain carbon steel, Magnesium, Brass, Zinc, Gray cast iron, Tool steel, Platinum, Aluminum, Stainless steel, Tungsten, Titanium alloys. Select from this list the one metal or alloy that is best suited for each of the following applications, and cite at least one reason for your choice:
 - i) The block of an internal combustion engine
 - ii) Condensing heat exchanger for steam
 - iii) Jet engine turbofan blades
 - iv) Drill bit
 - v) Cryogenic (i.e., very low temperature) container

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- vi) As a pyrotechnic (i.e., in flares and fireworks)
- vii) High-temperature furnace elements to be used in oxidizing atmospheres (14 marks)

- c) List the objectives of Process control (2 marks)
- d) Define Manipulated variable and Controlled Variable (2 marks)
- e) Define controller tuning. (2 marks)
- f) List the types of tuning methods (2 marks)
- g) What is the purpose of the actuators (2 marks)
- h) Mention the types of control valves used in industries (2 marks)

Question two.

- a. Explain the following processes;
 - (i) Annealing
 - (ii) Case hardening
 - (iii) Work hardening (6 marks)

- b. Give the dynamics of first order level and flow process (2 marks)

- c. What is self-regulation? (2 marks)

- d. Compare interacting and non-interacting systems (2 marks)

- e. Derive the transfer function of first order level process (2 marks)

- f. Mention the name of various modelling approaches used in process control (2 marks)

- g. Differentiate between malleability and brittleness. (4 marks)

Question Three

- a. Give the distinctive features, limitations, and applications of the following alloy groups:
 - I titanium alloys,

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- Ii refractory metals,
- Iii superalloys, and
- Iv noble metals. (10 marks)

(b) What is moulding? Describe the following plastic molding processes:

- i - Injection moulding
- ii - Compression moulding
- iii - Blow moulding (10 marks)

Question four

- (a) List the four classifications of steels. For each, briefly describe the properties and typical applications. (8 marks)
- (b) Cite three reasons why ferrous alloys are used so extensively. (3 marks)
- (c) Cite three characteristics of ferrous alloys that limit their utilization.(3 marks)
- (d) Compare linear valve and equal percentage valve (2 marks)
- (e) Why equal percentage valve is mostly preferred than other type of valves? (2 marks)
- (f) Define control valve sizing (2 marks)

Question Five

- a. Explain briefly about the interacting and non-interacting system. (4 marks)
- b. Explain briefly about the batch and continuous process with an example (4 marks)
- c. Describe the dynamics involved in second order process (4 marks)
- d. Problems in interacting and non-interacting system(Refer class notes) (4 marks)
- e. Derive the transfer function of first order level, pressure and flow process (4 marks)

