ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE, NIGERIA

DEPARTMENT OF MECHANICAL ENGINEERING

HOD'S SIGNATURE

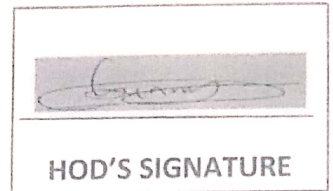### FIRST SEMESTER EXAMINATIONS

2018/2019 ACADEMIC SESSION

COURSE: MEE 401 – Mechanical Engineering Design II (3 Units)

CLASS: 400 Level Mechanical Engineering

TIME ALLOWED: 3 Hours

INSTRUCTIONS: Answer any **FIVE (5)** questions

Date: March, 2019

Question 1 (12 MARKS)

(A) Which of the following is not among the casting design steps
  (a) pattern production for molds and cores (b) material selection for part to be cast (c) analyze the best solution (d) evaluation of cast product

(B) With aid of a simple sketch only, explain the term draft angle.

(C) For low and moderate speed engines, the cam follower should move with
  (a) uniform velocity (b) simple harmonic motion (c) uniform acceleration and retardation (d) cycloidal motion

(D) The size of a cam depends upon the based circle True/False

(E) In casting, state the equation for the estimate mold cavity filling time?

(F) List the casting processes that you know?

(G) What is full meaning DFSS?

(H) What is the main function of a pressure regulator in a hydraulic system?

(I) What is cavitation?

(J) Gas in a pneumatic system behaves like a spring since it is compressible True/False

(K) When a system requirement is high speed, medium pressure (usually 6 to 8 bar) and less accuracy of position, which working system is recommend?

(L) The selection of material for machine tool structures depend upon three factors. What are they?

Question 2 (12 MARKS)

(a) Define the following terms:
  (i) Design,
  (ii) Engineering design, and
  (iii) Engineering design process.

(b) With the aid of a chart, briefly explain the steps involve in systematic design.

Question 3 (12 MARKS)
A cam is to be designed for a knife edge follower with the following data:
1. Cam lift = 50 mm during 120° of cam rotation with simple harmonic motion.
2. Dwell for the next 30°.
3. During the next 150° of cam rotation, the follower returns to its original position with simple harmonic motion.
4. Dwell during the remaining 60°.
(a) Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft, and
(b) Draw the profile of the cam when the line of stroke is offset 25 mm from the axis of the cam shaft.
(c) If the radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 220 r.p.m.
(d) Draw the displacement, velocity and acceleration diagrams for one complete revolution of the cam.

Question 4 (12 MARKS)
(A) Explain the following defect that may occur during casting (i) Porosity (ii) Shrinkage (iii) Hot tear
(B) A client brought Packets of textile needles to Elizade workshop for heat treatment. The motive was to reduce its decarburization. (i) What treatment approach will you recommend and why? (ii)Explain the processes involve.

Question 5 (12 MARKS)
(A) Derive an expression for the minimum and maximum volume of metal required to ensure that the deflection of a simple machine tool bed under loading condition does not exceed the permissible level.
(B) The optimum ratio l/h for every machine structure depend on two factors. What are they?

Question 6 (12 MARKS)
(A) As a mechanical engineering student, list and explain the four different steps you would take in selecting a material for your final year project.
(B) List any six of the general broad rules used in the selection of a working medium in hydraulic and pneumatic circuit.

Question 7 (12 MARKS)
(A) Differentiate between DFM and DFA
(B) Briefly explain the following (i) DFA (ii) Design for Maintainability (iii) Design for Reliability