ELIZADE UNIVERSITY, ILARA-MOKIN, ONDO STATE, NIGERIA

DEPARTMENT OF MECHANICAL ENGINEERING

FIRST SEMESTER EXAMINATIONS
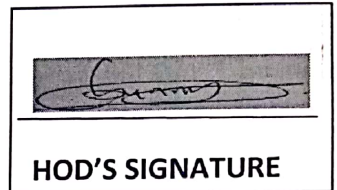
2019/2020 ACADEMIC SESSION

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

CLASS: 400 Level Mechanical Engineering

TIME ALLOWED: 3 Hours

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

HOD'S SIGNATURE

Date: February, 2020

Question 1 (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 involved in systematic design.
c) A change in displacement of a transducer's input from 47.53 mm to 47.54 mm results in the consequent change of the output from 1.0 volts to 1.5 volts. Calculate the sensitivity of the sensor.

Question 2 (12 MARKS)

a) As a Mechanical Engineering student, list and explain the four factors you would consider before selecting a material for your final year project.
b) With the aid of appropriate sketches, explain the working principle of two (2) types of hydraulic pumps.

Question 3 (12 MARKS)

a) Briefly explain the following (i) Design for Manufacture (ii) Design for Serviceability (iii) Design for Reliability.
b) Differentiate between Design for Manufacture (DFM) and Design for Assembly (DFA)
c) Determine the polar moment of inertia and torque for a spring with diameter 48 mm and coil radius 15 mm, if the force acting on the spring is 350N. (Take $\pi = 22/7$).

Question 4 (12 MARKS)

a) Explain the following defects that may occur during casting (i) Porosity (ii) Shrinkage (iii) Hot tear (iv) Cold Shot (v) Blowholes

b) A tensile force of 200 N pulls an extension spring of diameter 40 mm and coil diameter of 20 mm. Calculate the following:
   i.   Shear stress in spring due to torsion,
   ii. Average stress in spring due to force, and
   iii. Maximum shear stress

Question 5 (12 MARKS)

a) Given Figure 1 below, derive an expression for the maximum shear stress acting on the spring assuming spring index $k_s = 1 + \dfrac{1}{2c}$. Where T = Torque acting on spring, F = Force, D = Diameter of spring and d = diameter of coil. Take τ_F and τ_T as stress in spring due to force and torsion respectively.
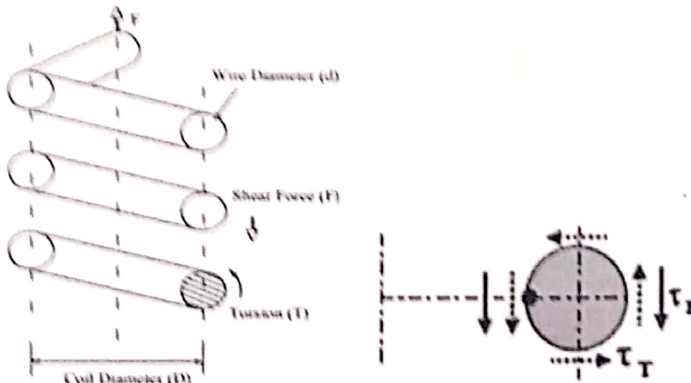

Fig. 1

b) With schematic diagrams, list and explain four (4) types of followers.

Question 6 (12 MARKS)

a) Explain briefly the following terms:
   i.   Hydraulic Pumps,
   ii. Pump Lift, and
   iii. Pressure Regulation.

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) Explain briefly three (3) major design considerations in casting.

b) With the aid of clear sketches, explain the following types of cams:
   i.   Radial or disc cam
   ii. Cylindrical cam

c) Explain briefly the following performance parameters of a sensor:
   i. Sensitivity   ii. Linearity   iii. Range   iv. Accuracy