

**FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA**  
**SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY**  
**DEPARTMENT OF MECHATRONICS ENGINEERING**  
**FIRST SEMESTER 2018/2019 B.Eng. DEGREE MID-SEMESTER EXAMINATION**  
**COURSE: MCE 411(Mechatronics Systems Design II)**  
**INSTRUCTION: Attempt All Questions**  
**TIME ALLOWED: 2 Hours.**

**Question 1 (20 Marks)**

- a) Kindly, provide a brief description of your MCE 411 Project, stating the problem it is envisaged to solve as well as a brief methodology. (Use appropriate diagrams and illustrations where necessary). (15 Marks)
- b) Describe five (5) areas of applications of fluid power. (5 Marks)

**Question 2 (20 Marks)**

- a) Sketch a simple circuit of a Hydraulic system showing all the basic components and explain the function of each of the components. (15 Marks)
- b) Why are non-return Valves necessary in a Hydraulic Power System? (5 Marks)

**Question 3 (20 Marks)**

- a) Following the peace deal reached with the US government, the Democratic People's Republic of North Korea as started dismantling all the Nuclear Weapon Stations in the country. Thus, in quest to complete the task effectively it is required to design a power actuating system to help lift dismembered components within each facility. Putting into consideration, that the temperature of the environment is  $-2^{\circ}\text{C}$ . Task, you are to propose a suitable actuation system to be used for this operation, stating the advantages and disadvantages that may be applicable. (15 Marks)
- b) What are the factors that affects the speed of a synchronous AC Motor? (5 Marks)

**Question 4 (20 Marks)**

- a) SSS3 students of the Model School during their JETS club experiment discovered a box with a label Component A containing 2 devices suspected to be sensors. It is believed that the two devices are of same type. In the quest to identify these devices they found out that: one of the device resistances increases with decrease in temperature and for the other device the resistance increases as the temperature increases.

- i. As a Mechatronics student please help these students identify what type of devices are these. (5 Marks)
  - ii. Also give them some applications of these devices as well as some advantages and disadvantages of using these devices. (5 Marks)
- b) Compare and Contrast RTD, Thermocouple and Thermistor. (5 Marks)

**Question 5 (20 Marks)**

- a) The Council of Engineers at its 129<sup>th</sup> AGM passed a communiqué that henceforth all building in the country exceeding 4 levels must have sensors/transducers in place to detect and alert occupants of the building of possible collapse of the building. This is to forestall any unforeseen circumstance such as that of the recent building collapse. In a bid to comply with the new regulation, the head of projects in an indigenous firm as contact you to help with the criteria to achieve this.(10 Marks)
- b) Photovoltaic Cells are active transducers while the loudspeaker is a passive transducer, explain this concept. (10 Marks)