UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2018

COURSE NO: EL 374

COURSE NAME: ELECTRICAL DRIVES SYSTEMS

CLASS: EL III TIME: 3 HOURS

Name**:** _____Index Number: _____

Answer All Questions

Question 1

a. Give the equivalent circuit of the separately excited DC motor and state the governing equations of its operation. **(15 Marks)**

b. Give the block diagram representation of the state model of a linear multi-input multi-output system. Define all variables and matrix elements. **(20 Marks)**

Question 2

a. With the aid of schematic diagrams, equations and speed-torque characteristics, account for speed control of the induction motor by the variation of stator pole pairs. **(15 Marks)**

b. Three masses with inertia J_1, J_2, J_3 with the rotational stiffnesses C_{12} and C_{23} between masses 1 and 2 and masses 2 and 3, respectively, constitute a 3-mass electromechanical system having elastic coupling. Taking ω_1, ω_2, ω_3, T_{12} and T_{23} as state variables and T_1, T_{r1}, T_{r2} and T_{r3} as the inputs, and neglecting all friction, obtain the state space equation of the system. **(20 Marks)**

Question 3

a. i. Give the functional block diagram of an electrical drive system. **(15 Marks)**

ii. Give four requirements of an electrical drive system. **(4 Marks)**

b. A 75 kW, 415 V, 4-pole, 3-phase, 50 Hz induction motor is delivering rated torque at 5% slip driving a load whose torque varies as the speed. The motor delivers maximum torque at 10% slip. A 3-phase AC regulator controls the r.m.s. supply voltage to effect limited speed control. Assume the speed-torque characteristics of the motor in the stable region to be linear. Calculate the r.m.s. voltage at which motor runs at 1350 rpm. **(16 Marks)**

Examiners: E. Normanyo*/I. Aidoo*