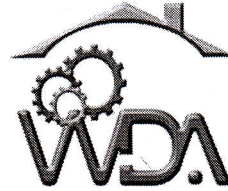


T012

Friday, 23/11/2018

08:30-11:30 AM



**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2018,
TECHNICAL AND PROFESSIONAL STUDIES**

EXAM TITLE: ELECTRICITY AND AUTOMATION

**OPTIONS: Computer electronics (CEL)
Electronics and Telecommunication (ETL)**

DURATION: 3 hours

INSTRUCTIONS:

The paper is composed of **three (3) main Sections** as follows:

Section I: Fifteen (15) compulsory questions. 55 marks

Section II: Attempt any three (3) out of five questions. 30 marks

Section III: Attempt any one (1) out of three questions. 15 marks

The use of geometric material and scientific calculator is accepted

Note:

Every candidate is required to carefully comply with the above instructions. Penalty measures will be applied on their strict consideration.

- 01.** Copy and complete the following sentences with the correct statement you choose bellow: **(4 marks)**
- a) A residual current device (RCD) will
- operate if a short occurs between phase and neutral
 - operate if a small overload occurs
 - reconnect if the fault clears
 - operate if phase and neutral are out of balance
- b) The earth for an 11kV to 400V star delta transformer is formed by
- connecting the core of the transformer to earth
 - connecting a primary winding to earth
 - connecting the primary and secondary star points together
 - connecting the star point to the earth
- c) A pure capacitor of $100\mu\text{F}$ is connected to a 230V 50Hz supply. The power dissipated will be (7.2W 32W 2300W 0W)
- d) For a workshop measuring 10m x 12m needs to be lit to 500lx, if the light loss factor was 0.65 and the utilization factor was 0.75, the required lumen output would be(123076 lumens, 492 lumens, 29250 lumens, 0.117 lumens)
- 02.** Explain the function of the following basic electrical instruments: **(a)** ammeter; **(b)** voltmeter; **(c)** ohmmeter; **(d)** multimeter; **(e)** oscilloscope. **(5 marks)**
- 03.** Determine the power dissipated by the element of an electric fire of resistance 20 Ohms when a current of 10 A flows through it. If the fire is on for 6 hours determine the energy used and the cost of 1 unit of electricity costs 200FRW. **(3 marks)**
- 04.** Eight cells, each with an internal resistance of 0.2 Ohms and an e.m.f of 2.2V are connected **(a)** in series, **(b)** in parallel. Determine the e.m.f and the internal resistance of the batteries so formed. **(2 marks)**
- 05.** State the laws of electromagnetic induction. **(3 marks)**
- 06.** A 4 poles, 3 phase induction motor operates from a supply whose frequency is 50Hz. Calculate:
- a)** The speed at which the magnetic field of stator is rotating
- b)** The speed of rotor when the slip is 0.04

- c) The frequency of rotor currents when the slip is 0.03
 d) The frequency of the rotor currents at standstill.

(2 marks)

07. What are the various losses occurring in a dc generator? (5 marks)

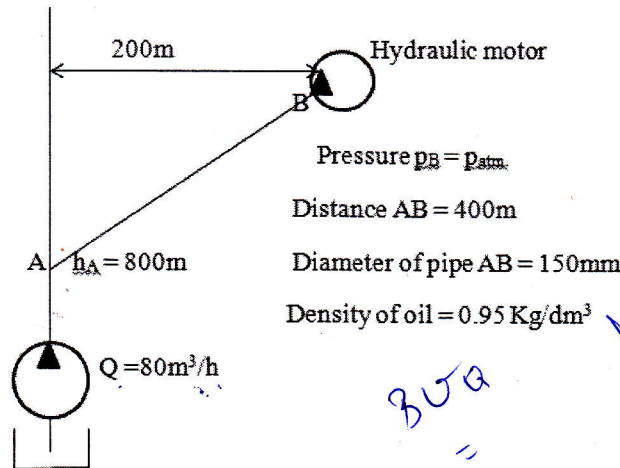
08. At what factors depends upon the force on a current-carrying conductor in a magnetic field. (4 marks)

09. A transformer has 600 primary turns and 150 secondary turns. The primary and secondary resistances are 0.25Ω and 0.01Ω , respectively, and the corresponding leakage reactances are 1Ω and 0.04Ω , respectively.

- Determine: (a) the equivalent resistance referred to the primary winding,
 (b) the equivalent reactance referred to the primary winding,
 (c) the equivalent impedance referred to the primary winding and
 (d) the phase angle of the impedance.

(4 marks)

10. Determine in bar the pressure oil outlet the pump. Neglect the pressure losses. (5 marks)



11. 6.2 liters of an ideal gas are contained at 3.0 atm and 37°C . How many moles of this gas are present? (2 marks)

12. Rank the following from highest pressure to lowest pressure upon the ground:

- The atmosphere at sea level;
- A 7000-kg elephant with total area 0.5 m^2 in contact with the ground;
- A 65-kg lady in high heels with total area 0.005 m^2 in contacting with the ground;
- A 1600-kg car with a total tire contact area of 0.2 m^2 .

(4 marks)

13. The power used on the outstroke of a double acting cylinder is 500 W. The rod diameter is 50 mm and the speed on the outstroke is 40 mm/s. The system pressure needed equals to 2.5 MPa. The flow rate is the same in the two directions of the piston displacement.

Calculate: (a) The outstroke force; (b) The pulling force; (c) The retraction speed and (d) The piston diameter. (5 marks)

14. What is the information must be supplied to size an air motor? (4 marks)
15. What are the types of hydraulic fluid according to their characteristics and composition? (3 marks)

Section II. Choose and answer any three (3) questions. 30 marks

16. Make a list of materials and tools that you will need to install a single switch to control one lamp. (10 marks)
17. If you are asked to install an electrical generator, which factors do you have to take into considerations as far as its sizing is concerned? (10 marks)
18. List at least ten (10) tasks that you have to perform for preventive maintenance of a generator set. (10 marks)
19. Explain the ideal dependent (or controlled) sources and give their possible types. (10 marks)
20. With the help of electrical circuit diagram for direct control of a single-acting cylinder drawing, explain in brief its working principle. (10 marks)

Section III. Choose and answer any one (1) question. 15 marks

21. State the Advantages & Disadvantages of Synchronous motors. (15 marks)
22. a) What solution can you give to an actuator of an electrohydraulic system which fails to move?
b) Give the possible reasons of such failures in (a). (15 marks)
23. A circuit presents a source voltage of 220 V with frequency of 50 Hz and a LC parallel circuit that has $X_C = 16 \Omega$ and $X_L = 8 \Omega$.

Calculate: (a) The total Impedance v ; (b) Current through the capacitor;
(c) Current through the inductor;
(d) The impedance (Z) with respect to source voltage. 15 marks