CEL&ETL - Electricity and Automation

T089

Friday, 11/11/2016

08:30-11:30

WORKFORCE DEVELOPMENT AUTHORITY

P.O. BOX 2707 Kigali, Rwanda Tel: (+250) 255113365

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2016, TECHNICAL AND PROFESSIONAL STUDIES

EXAM TITLE: Electricity and Automation

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

DURATION: 3hours

INSTRUCTIONS:

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

Section I: Twelve (12) 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.

Section I. Twelve (12) Compulsory questions **55marks**

01. State the main parts of a simple electrical circuit. **5marks**

02. Give the difference between direct current and alternating current. **4marks**

03. Explain the working principle of a solenoid. **3marks**

04. What is the role of solenoid in electropneumatic control systems? **4marks**

05. Why do we use relay in electropneumatic control? **4marks**

06. What are the conditions to be met prior to synchronizing (or paralleling) AC generators? **6marks**

07. What is the purpose of:

a. Voltage Regulator?

b. Amplification circuit?

c. Feedback circuit? **6marks**

08. What is the purpose of a magnetic proximity switch in a one-cycle reciprocation system? **4marks**

09. Explain the principle of the stepper motor. **4marks**

10. Briefly explain the automatic sequencing circuit. **5marks**

11. Explain the plugging operation of three phase induction motor. **4marks**

12. A three-phase, 20 hp, 208 V, 50 Hz, four pole, Delta connected induction motor delivers 15 kW at a slip of 5%.

Calculate:

a) Synchronous speed;

b) Rotor speed;

c) Frequency of rotor current. **6marks**

Section II. Choose and answer any three (3) questions. **10marks each**

13. Calculate for how long a 3 kW immersion heater must be energized to heat 137 litres of water from 10°C to 70°C. The efficiency of the system is 80%. (SH of water = 4200 J/kg/°C and 1 litre has a mass of 1 kg.) **10marks**

14. 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 reactance are 1.0Ω 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. **10marks**

15. What are the advantages of pneumatics? **10marks**

16. With a sketch, give the essential components of pneumatic system. **10marks**

17. A double-acting cylinder is used to press together glued component. Upon operation of a push button, the clamping cylinder extends. Once the fully advanced position is reached, the cylinder is to remain a time of T= 6 seconds and then immediately retract to the initial position. The cylinder retraction is to be adjustable. A new start cycle is only possible after the cylinder has fully retracted. Design its pneumatic circuit. **10marks**

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

18. A 3-phase 440-V, 50Hz 40-pole Y-connected induction motor has rotor resistance of 0.1Ωand reactance 0.9Ωper phase the ratio of stator to rotor turns is 3.5

Calculate:

a) Gross output at a slip of 5%

b) The maximum torque in synchronous watts and the corresponding slip.

19. According different points of view classify and divide the A.C. motors in various groups.

20. Give the comparison between magnetic and electric circuits.