

T012

Friday, 24/11/2017

08:30-11:30 AM



**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2017,
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.

Section I. Fifteen (15) Compulsory questions**55 marks**

- 01.** What are the different systems for the distribution of ac power?
3 marks
- 02.** A lamp giving out 1200 lm in all directions is suspended 8m above the working plane. Calculate the illumination at a point on the working plane 6m away from the foot of the lamp.
3 marks
- 03.** What are the parameters that depend on the amount of the generated electric energy of hydroelectric power plant?
2 marks
- 04.** What are the differences between hydraulic and pneumatic systems?
3 marks
- 05.** Explain different methods of heat transfer.
6 marks
- 06.** The voltage and current waveforms of an electric load are:
$$v = 150 \sin (377t + 0.2) \quad i = 25 \sin (377t - 0.5)$$
Compute the following:
- a) Frequency of the supply voltage
 - b) Phasor voltage
 - c) Phasor current
 - d) Real power of the load
 - e) Reactive power of the load
- 5 marks**
- 07.** Briefly State the first 4 steps of working principle of a microwave.
4 marks
- 08.** Explain different steps followed in Maxwell's mesh current method.
4 marks
- 09.** A 6 pole, 12kW, 240V DC machine is wave-connected. If the same machine is lap-connected, all other things remain the same, calculate its voltage, current and power ratings.
5 marks
- 10.** Indicate the mathematical expressions (formulas) corresponding to the theoretical air compressions.
4 marks
- 11.** Indicate the components of Air consuming pneumatic system. **3 marks**
- 12.** Calculate the required size of a receiver that must supply air to pneumatic system consuming 20scfm for 6 minutes between 100 and 80psi before the compressor resumes operation. What size is required if the compressor is running and delivering air at 5scfm?
3 marks

13. The kinematic viscosity of hydraulic oil is 0.9 strokes. If it is flowing in a 35 mm diameter pipe at a velocity of 4 m/s, what is the Reynolds number? Is the flow laminar or turbulent? **3 marks**
14. A circuit that has a relay does not work but the relay can be heard to click when activated. Technician A says the coil of the relay could be open. Technician B says that the coil of the relay could be shorted. Which technician is correct? Explain your answer. **4 marks**
15. How does a two pressure valve work? Give one application in pneumatic system. **3 marks**

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

16. A discharge lamp is suspended from a ceiling 4m above a bench. The illuminance on the bench below the lamp was 300 lux.
- (a) Find:
- (1) The luminous intensity of the lamp,
 - (2) The distance along the bench where the illuminance falls to 153.6 lux.
- (b) What is the light and how can it be produced? **10 marks**
17. Find the efficiency of a 10kVA, 1000/200V single phase transformer supplying a full load at 0.8 p.f lagging. Its total resistance transferred to secondary is 0.1Ω and its no load current measured on the H.V side is 2A at 0.3 p.f lagging. **10 marks**
18. A 440 V, 20 HP 3-ph motor operates at full load, 88% efficiency and 0.65 power factor lagging:
- A. Find the current drawn by the motor
 - B. Find the real and reactive power absorbed by the motor
- 10 marks**
19. 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.

10 marks

20. Give the advantages and disadvantages of compressed air. **10 marks**

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

21. An electrohydraulic system operator has reported that the actuator fails to move. What will be the reasons of that failure and propose the possible solutions to remove that trouble.

22. Consider the function:

$$Y = (A \cdot B) + \overline{(A \cdot C)} \cdot \overline{B}$$

(a) Draw a combinational logic circuit that implements this function.

(b) Draw a truth table for this function.

(c) Write a sum-of-products representation of Y.

(d) Write a product-of-sums representation of Y.

23. Explain the main guiding factors to select a driving motor (electric motor).