



**COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)**

**SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING**

**ELECTRICAL SERVICEMAN'S COURSE-STAGE 2**

**EEE221 APPLIED ELECTRICITY II**

**FINAL EXAMINATION PENSTER 2, 2016**

**DATE/DAY: TBA                      TIME: TBA**

**ROOM: BA CAMPUS                  DURATION: 2HRS, 10MINS**

**INSTRUCTIONS TO STUDENTS**

1. You are allowed **10 minutes** extra **reading time** during which you are **NOT** to write.
2. Begin each **SECTION** on a fresh page and use both sides of the sheet.
3. Write your candidate number at the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with a string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and **ATTACH** these to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. Use of programmable calculator(s) is prohibited.
8. **ANSWER ALL QUESTIONS**
9. Show all working where necessary.
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM**

**SECTION A****3 PHASE SYSTEM****30 MARKS**

1. With aid of diagrams explain briefly how a three-phase supply is generated. (5 marks)
2. State the national standard phase sequence for a three-phase supply. (1 mark)
3. Name three advantages of three-phase systems over single-phase systems. (3 marks)
4. Three loads, each of resistance  $30\Omega$ , are connected in star to a 415V, 3-phase supply, determine.  
(a) The system phase voltage  
(b) The phase current and  
(c) The line current. (6 marks)
5. Three loads, each of resistance 50 are connected in delta to a 400V, 3-phase supply, determine.  
(a) The phase voltage,  
(b) The phase current and  
(c) The line current. (6 marks)
6. Three  $12\Omega$  resistors are connected in star to a 415V, 3-phase supply. Determine the total power dissipated by the resistors. (4 marks)
7. The input power to a  $3\phi$  a.c. motor is measured as 5kW. If the voltage and current to the motor are 400V and 8.6A respectively, determine the power factor of the system. (4 marks)
8. State the relationships between line and phase currents and line and phase voltages for a star-connected system. (3 marks)

**SECTION B****3 PHASE MOTORS****30 MARKS**

1. Name three advantages that a three-phase induction motor has when compared with a DC motor. (3 marks)
2. Explain briefly, with the aid of diagrams, the principle of operation of a three-phase induction motor. (3 marks)
3. The speed at which the magnetic field of a three-phase induction motor rotates is called the \_\_\_\_\_ speed. (1 mark)
4. The type of rotor, most widely used in a three phase induction motor. (1 mark)
5. Sketch a typical speed-torque characteristic for an induction motor. (3 marks)

6. State two methods of starting squirrel-cage induction motors. (2 marks)
7. Draw the block diagram that summarizes losses and the how the power transferred in induction motors. (5 marks)
8. Three advantages of wound rotor induction motors are? (3 marks)
9. Three advantages of squirrel-cage induction motors are? (3 marks)
10. A stator winding supplied from a three-phase, 60 Hz system is required to produce a magnetic flux rotating at 900 rev/min. Determine the number of poles. (2 marks)
11. A 3-phase, 60 Hz induction motor has 2 poles. If the slip is 2% at a certain load, determine.
  - (a) The synchronous speed,
  - (b) The speed of the rotor, and
  - (c) The frequency of the induced e.m.f.'s in the rotor (4 marks)

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**SECTION C** **TRANSFORMERS** **30 MARKS**

1. With aid of diagrams state the principle of operation transformer. (5 marks)
2. An ideal transformer has a turn's ratio of 8:1 and the primary current is 3A when it is supplied at 240V. Calculate the secondary voltage and current. (3 marks)
3. A single-phase, 50 Hz transformer has 25 primary turns and 300 secondary turns. The cross-sectional area of the core is 300 cm<sup>2</sup>. When the primary winding is connected to a 250V supply, determine
  - (a) The maximum value of the flux density in the core, and
  - (b) The voltage induced in the secondary winding. (5 marks)
4. A 5 kVA, 200V/400V, single-phase transformer has a secondary terminal voltage of 387.6 volts when loaded. Determine the regulation of the transformer. (5 marks)
5. There are broadly two sources of losses in transformers on load, these being **copper losses** and **iron losses**, explain the two losses. (5 marks)
6. A 200 kVA rated transformer has a full-load copper loss of 1.5kW and an iron loss of 1kW. Determine the transformer efficiency at full load and 0.85 power factor. (5 marks)
7. With aid of diagram explain, what is an auto-transformer? (3 marks)

1. If the input for the bridge rectifier is 24V ac with 60Hz and the load resistance is  $320\Omega$ , calculate:
- the load
  - the load current
  - the ripple voltage
  - the ripple frequency
  - the peak reverse voltage.
- (10 marks)

**THE END**