



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)  
SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING  
CERTIFICATE IV IN ELECTRICAL AND ELECTRONICS ENGINEERING

***EEC420- THREE PHASE SYSTEMS & RECTIFIERS***

***FINAL EXAMINATION – QUARTER 1, 2019***

**DURATION – 2 HOURS AND 10 MINUTES**

**TOTAL MARKS – 100**

**TOTAL NUMBER OF PAGES - 4**

**Day / Date / Time / Room: As per timetable**

**INSTRUCTIONS TO STUDENTS**

1. You are allowed 10 minutes Extra reading time during which you are NOT to write.
2. Begin each answer 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 string
5. For all sheets of paper on which rough/draft work has been done, cross it though and you MUST ATTACH to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. ANSWER ALL QUESTIONS.
8. Show all workings where necessary.
9. Do not use programmable calculators, especially the ones that do the conversions of number systems.
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!**

**Section A****Three Phase Circuits****35 Marks**

1. Illustrate the three phase wave form from 0 – 360 degrees. (5 marks)
  
2. In relation to neutral conductor in a three phase four wire system briefly explain the function of neutral conductor and in which condition would there be no current in the neutral. (3 marks)
  
3. State three advantages of three-phase systems over single-phase systems. (3 marks)
  
4. Three coils each having resistance  $3\Omega$  and inductive reactance  $4\Omega$  are connected in **Star** and in **Delta** to a 415V, 3-phase supply. Calculate for each connection
  - a. the line and phase voltages and
  - b. the phase and line currents (10 marks)
  
5. The power taken by an inductive circuit when connected to a 120V, 50 Hz supply is 400W and the current is 8A. Calculate
  - (a) the resistance,
  - (b) the impedance,
  - (c) the reactance,
  - (d) the power factor, and
  - (e) the phase angle between voltage and current (10 marks)
  
6. State the national standard phase sequence for a three-phase supply (2 marks)
  
7. The input power to a 3-phase 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. (2 marks)

**Section B****Power Factor Improvements****35 Marks**

1. Describe why A.C machines are rated in K.V.A and not in K.W. (5 marks)
  
2. Provide the formulas and measuring units for:
  - a) Active Power
  - b) Reactive Power
  - c) Apparent Power (5 marks)
  
3. State five advantages of power factor improvement. (5 marks)
  
4. The power being supplied to a factory is 800KW and apparent power is 1000KVA, calculate the power factor. (3 marks)
  
5. A 400V alternator is supplying a load of 42kW at a power factor of 0.7 lagging. Calculate
  - a) the kVA loading
  - b) the current taken from the alternator.
  - c) If the power factor is now raised to unity find the new kVA loading (5 marks)
  
6. The power taken by an inductive circuit when connected to a 120V, 50 Hz supply is 400W and the current is 8A. Calculate
  - a) the resistance,
  - b) the impedance,
  - c) the reactance,
  - d) the power factor,
  - e) the phase angle between voltage and current. (7 marks)
  
7. A single phase 200volts A.C generator delivers a power of 3KW. Calculate the current when
  - a) The power factor is 0.5

- b) The power factor is unity (5 marks)

**Section C**

**Rectifiers**

**30 Marks**

1. A 5.0V stabilized power supply is required to be produced from a 12V DC power supply input source. The maximum power rating  $P_Z$  of the zener diode is 2W. Using the zener regulator circuit above calculate:

- a) The maximum current flowing through the zener diode.
- b) The minimum value of the series resistor,  $R_S$
- c) The load current  $I_L$  if a load resistor of  $1k\Omega$  is connected across the zener diode.
- d) The zener current  $I_Z$  at full load.

(8 Marks)

2. Relate to Diode and illustrate its characteristics Curve and label appropriately.  
(5 Marks)

3. State 5 advantages of 3 phase rectifiers over single phase rectifiers. (5 Marks)

4. Illustrate the circuit of a single phase half wave rectifier and a 3 phase full wave rectifier also showing the input and the output waveforms for each. (12 Marks)