



**College of Engineering Science and Technology (CEST)**

School of Electrical and Electronics Engineering

**ADVANCED DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING**

**EEE602 - ELECTRICAL TECHNOLOGY.**

**FINAL EXAMINATION - SEMESTER I - 2012.**

**DAY/DATE: MONDAY, 04:06:12 TIME: 2.00 - 5.10 P.M. ROOM: APT/T**

**INSTRUCTIONS TO STUDENTS:**

1. You are allowed 10 minutes **EXTRA** as 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 foolscap, 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 through 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. Answers to all questions must be written in **INK** on the Answer Sheet provided.
8. Diagrams and graphs can be drawn in pencil.
9. Non- programmable calculators are allowed.
10. Attempt all questions.

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**SECTION - A [30 MARKS]**

- Q1. (a) What is the significance of rectifying devices?  
(b) With the aid of diagrams to show the characteristic and symbol of the PNP device; outline its behaviour briefly. (4 marks)
- Q2. Discuss the four sources of loss in power semi-conductor devices. (2 marks)
- Q3. For the circuit shown as Fig QA3, draw a fully labeled diagram to show the relative potential levels for every point. (5 marks)
- Q4. Outline the four criteria with which transformers are selected. (4 marks)
- Q5. A feedback control system has an intrinsic gain of 7 and a feedback gain of 4.  
(a) Draw a diagram to show the system.  
(b) Work out the CLTF, and;  
(c) Draw a single equivalent block of your finding (5 marks)
- Q6. Name the four principal methods used in practice to reduce the leakage flux in a transformer. (2 marks)
- Q7. Name any four transducers that are commonly used in practice. (2 marks)
- Q8. With aid of diagrams identify the four standard types of input test signals used for transient response of an instrument. (2 marks)
- Q9. Draw a complete equivalent circuit of a practical transformer and label it. (4 marks)

**SECTION - B [70 MARKS ]**

Q1. (a) With the help of diagrams outline the characteristics and operations of the following:

- (i) Diode
- (ii) Zener Diode
- (iii) Light Emitting Diode
- (iv) Variable Capacitance Diode

(8 marks)

(b) Draw a fully labeled diagram of the v-I characteristics of a thyristor.

(4 marks)

Q2. We wish to build a 140V, 30A dc power supply using a single-phase bridge rectifier and an inductive filter. The peak-to-peak current ripple should be about 15%. If a 50 Hz ac source is available, calculate the following:

- (a) The effective value of the ac voltage
- (b) The energy stored in the inductor
- (c) The inductance of the inductor
- (d) The peak-to-peak current ripple.

(10 marks)

Q3. A three phase bridge rectifier has to supply power to a 500 kW, 240 V dc load. If a 3300 V, 50 Hz, 3-phase feeder is available, calculate the following:

- (a) Voltage rating of the 3-phase transformer
- (b) DC current per diode
- (c) PIV across each diode
- (d) Peak to peak ripple in the output voltage and its frequency
- (e) The inductance of the smoothing choke required if the peak to peak ripple in the current is not to exceed 7 percent.

(10 marks)

Q4. (a) Fuses are used to for current protection, outline four of the necessary requirements.

(2 marks)

(b) What is a snubber network?

(1 mark)

Q5. Determine the relative low-order harmonic content compared to the mean level of the voltage output of a controlled six-pulse rectifier when the firing delay angle is  $30^\circ$ , for the conditions of:

- (a) Neglecting overlap
- (b) Assuming an overlap angle of  $15^\circ$ .

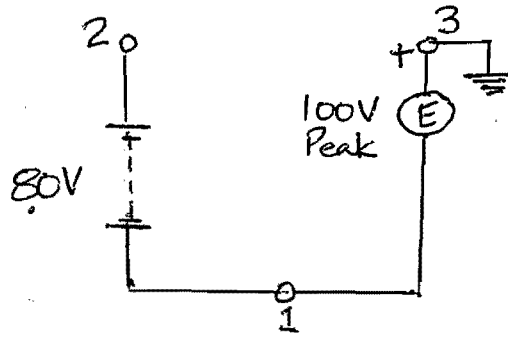
Hint: To determine a particular harmonic, the mathematics is made easier by treating the 300 Hz component as the fundamental. Use  $V_{\text{mean}} = 0.827V_{\text{max}}$ .

(10 marks)

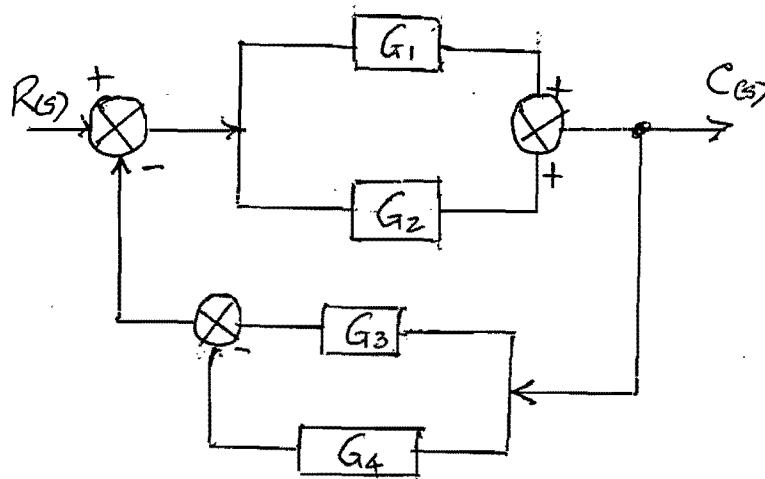
- Q6. For the diagram shown as Fig QB6 simplify the block diagram shown and obtain the closed loop transfer function  $C(s) / R(s)$ . (5 marks)
- Q7. Three single-phase step-up transformers rated at 100MVA, 11kV/33kV are connected in delta-wye on 11kV transmission line. If they feed a 240MVA load, calculate the following:
- (a) The secondary line voltage
  - (b) The currents in the transformer windings
  - (c) The incoming and outgoing transmission line currents, and:
  - (d) Draw a fully labeled diagram of this system. (10 marks)
- Q8. The circuit shown as Fig QB8 is for a scale model of a simple dc transmission line system which delivers 1000 A at a potential of 100 kV. Use the model to design a dc transmission line operating at 150 kV carrying a current of 400 A. Hence calculate the approximate value of the following:
- (a) The ac line voltage at each converter station
  - (b) The ac line current
  - (c) The active power absorbed by the rectifier
  - (d) The reactive power absorbed by each converter (10 marks)

Appendix

1. Fig QA3



2. Fig QB6



3. Fig QB8

