Code: AE26 **Subject: POWER ELECTR**
Time: 3 Hours **Max. Marks:**

JUNE 2011

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. On insertion of an inductance in anode circuit of an SCR, the turn on time

(A) decreases **(B)** increases
(C) remains the same **(D)** does not change much

b. The sharing of the voltages between thyristors operating in series is influenced by their

(A) $\frac{di}{dt}$ capabilities **(B)** $\frac{dv}{dt}$ capabilities
(C) Junction temperatures **(D)** Static v-i characteristics and leakage current

c. A three phase half wave controlled converter feeds a resistive load. The load current will be continuous for all firing angles.

(A) True **(B)** False

d. A type-A chopper is operating at a frequency of 2 kHz on a 400 V supply. If the load voltage is 300 volts, the conduction period of the thyristor in each cycle is:

(A) 0.375 ms **(B)** 0.375 sec
(C) 0.375 μs **(D)** none of these

e. A single phase voltage controller uses ON/OFF technique for controlling power fed to a resistive load. If the supply voltage is V and a duty ratio is k, the RMS output voltage will be

(A) V **(B)** $\frac{V}{2}$
(C) $V\sqrt{k}$ **(D)** kV

f. A 3-phase to 3-phase cycloconverter requires:

(A) 18 SCRs for 3-phase device **(B)** 18 SCRs for 6-pulse device
(C) 36 SCRs for 3-phase device **(D)** 36 SCRs for 3-pulse device

g. The speed of dc shunt motor above normal speed can be controlled by

(A) Armature voltage control method
(B) Flux control method
(C) Both **(A)** & **(B)**
(D) None of the above

h. PWM switching is preferred in voltage source inverters for the purpose of

(A) Controlling output voltage **(B)** Output harmonics
(C) Reducing filter size **(D)** All of the above

i. A free-wheeling diode is used in a controlled rectifier circuit in case of:

(A) Resistive load **(B)** Inductive load
(C) Capacitive load **(D)** None of above

j. A 3-phase voltage source inverter is operated in 180^o conduction mode. Which one of the following statement is true?

(A) Both pole voltage and line-voltage will have 3^{rd} harmonic component
(B) Pole voltage will have 3^{rd} harmonic component but line voltage will be free from 3^{rd} harmonic.
(C) Line voltage will have 3^{rd} harmonic component but pole voltage will be free from 3^{rd} harmonic.
(D) Both pole voltage and line-voltage will be free from 3^{rd} harmonic component

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Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Discuss the two- transistor model of a thyristor. Using this model, describe the various mechanisms of turning on a thyristor. **(10)**

b. What is GTO? Discuss its advantages over a normal thyristor? Describe the turn-off process of GTO. **(6)**

Q.3 a. Describe the working of a single phase full converter in the inverter mode with RLE load. Illustrate your answer with waveform for source voltage, E, load voltage & current, source current, current through and voltage across one SCR. Assume continuous conduction. Find also the circuit turn-off time. **(8)**

b. A 3- phase fully controlled bridge converter with 415V supply, 0.04 ohm resistance - per phase and 0.25ohm reactance per phase is operating in the inverting mode at a firing advance angle of 35^o. Calculate the mean generator voltage when the current is level at 80A. The thyristor voltage drop is 1.5V. **(8)**

Q.4 a. State the principle of chopper operation highlighting the operation of step down and step up chopper? Obtain the expression for the minimum and maximum currents for type-B chopper. **(8)**

b. Draw and explain current and voltage waveforms for Impulse-comm
choppers.

Q.5 a. State the conditions for commutation of thyristor? **(6)**

b. Develop the design equation for obtaining the values of L and C in resonant pulse commutating circuit. **(10)**

Q.6 a. What is cycloconverter? Explain principle of a single phase cycloconverter. **(6)**

b. Explain the circulating current mode operation of four quadrant cycloconverter. **(10)**

Q.7 a. State different methods for voltage control of three phase inverter. **(8)**

b. Explain, how does a single phase center-tapped inverter operates? Derive an expression for source current in center-tapped inverter. **(8)**

Q.8 a. Explain on-off and phase control principle of AC voltage controllers. **(8)**

b. Describe the operation of a single phase full wave ac voltage controller with resistive load and derive expression for average and RMS output voltages. **(8)**

Q.9 a. Explain the operation of chopper drive for a dc separately excited motor in

(i) Regeneration braking mode
(ii) Rheostatic braking mode **(8)**

b. Write notes on application of microprocessors in the control of electrical drives. **(8)**