KATHMANDU UNIVERSITY
End Semester Examination
August/September, 2017

Mark Scored:

Level : B. E.
Year : III

Course : EPEG 318
Semester : II

Exam Roll No. :

Time: 30 min

F. M. : 10

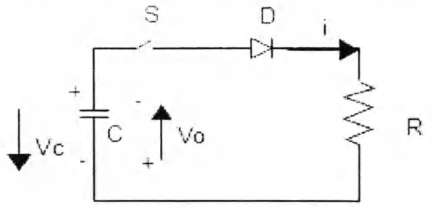
Registration No.:

Date : SEP 07 2017

SECTION "A"
[20 Q × 0.5=10 marks]

Choose the most appropriate answer.

1. The voltage across capacitor, v_c and current, i when switch, S is closed at t=0 , if capacitor is initially charged with voltage V_0 with upper plate positive as shown in figure is



a. 0, V_0/R.
b. $-V_0$, V_0/R.
c. $-V_0$, $-V_0/R$.
d. V_0, V_0/R.

2. A single phase one pulse diode rectifier is feeding an RL load with freewheeling diode across the load. For conduction angle, β the main diode and free-wheeling diode would conduct respectively for
a. π, π-β. b. π, β. c. β-π, π. d. π, β-π.

3. The number of p-n junction in a thyristor is
a. 1. b. 2. c. 3. d. 4.

4. Commutation or turn-off of a thyristor in a forced commutation circuit requires that
a. anode current is reduced below holding current.
b. anode voltage is reduced to zero.
c. thyristor will turn off itself.
d. anode voltage is increased.

5. For normal SCRs, turn-on time is
a. less than turn-off time, t_q.
b. more than t_q.
c. equal to t_q.
d. about half of t_q.

6. In a thyristor
a. Latching current, I_L is associated with turn off process and holding current, I_H with turn on process.
b. Both I_L and I_H are associated with turn off process.
c. I_L is associated with turn on process and holding current, I_H with turn off process.
d. Both I_L and I_H are associated with turn on process.

7. For a half wave controlled rectifier circuit transferring power to load , R= 10Ω through a single phase transformer with secondary voltage of 230V, 50Hz, the average output voltage for a firing angle of 60^0 is
a. 0 Volts. b. 38.82 Volts. c. 77.64 Volts. d. 155.28 Volts.

8. For a three phase half wave converter, the average output voltage is given as
a. $\frac{3V_{ml}}{2\pi}(1+\cos\alpha)$ b. $\frac{3V_{ml}}{\pi}(1+\cos\alpha)$ c. $\frac{V_{ml}}{3\pi}(\cos\alpha)$ d. $\frac{3V_{ml}}{2\pi}(\cos\alpha)$

9. For a three phase converter, which of the following offers four quadrant operation
a. Half wave converter. b. Semi converter.
c. Full converter. d. Dual converter.

10. The firing sequence for a three phase full converter with firing angle $\alpha = 0^0$ is
a. $60^0, 120^0, 180^0, 240^0, 300^0, 360^0$.
b. $120^0, 180^0, 240^0, 300^0, 360^0, 420^0$.
c. $150^0, 210^0, 270^0, 330^0, 390^0, 450^0$.
d. $210^0, 270^0, 330^0, 390^0, 450^0, 510^0$.

11. A step down chopper is operated in the continuous conduction mode in steady state with a constant duty ratio, D. if V_o is the magnitude of the dc output voltage and V_s is the magnitude of dc input voltage, the ratio V_o/V_s is given by
a. D. b. 1-D. c. 1/1-D. d. D/1-D.

12. In type D chopper
a. the load voltage is always negative but the load current may be positive or negative.
b. the load voltage and the load current are both positive.
c. the load current is always positive but load voltage can be positive or negative.
d. the load voltage and load current are both negative.

13. The maximum value of phase voltage for a three phase 180^0 voltage source inverter is
a. $V_s/3$. b.$2V_s/3$. c. V_s. d. $V_s/2$.

14. The fundamental component of output voltage and amplitude of other lower order harmonics in a multiple pulse modulated (MPM) inverters and single pulse modulated (SPM) inverter
a. lowers in SPM on comparison over MPM.
b. lowers in MPM on comparison over SPM.
c. increases in both MPM and SPM.
d. no effect in both MPM and SPM.

15. In a sinusoidal pulse modulated (SPWM) inverter there a N pulses per half cycle if
a. triangular carrier wave peak coincides with zero of reference sinusoid waveform.
b. triangular carrier wave zero coincides with zero of reference sinusoid waveform.
c. triangular carrier wave peak coincides with peak of reference sinusoid waveform.
d. sinusoid reference wave peak coincides with zero of carrier triangular waveform.

16. The rms value of fundamental voltage, V_{01} for a single phase bridge inverter, fed from 230V dc connected to load, R=10Ω and L=10mH is
a. 230V. b.162.63V. c. 207.10V. d. 0V.

17. A single phase bridge type cycloconverter feeds a load R. If the output frequency equal to one third of input frequency, the total number of positive half cycles of supply frequency voltage for one half cycle of fundamental frequency voltage is
    a. 3 half cycles.
    b. 6 half cycles.
    c. 12 half cycles.
    d. 1 half cycle.

18. A three phase cycloconverter converts three phase supply at frequency of 50Hz to single phase supply at frequency of 6.25 Hz by progressively varying the firing angle of three thyristor in a three phase half wave thyristor circuit. The magnitude of progressive change in firing angle is
    a. 0 degree.
    b. 15 degree.
    c. 30 degree.
    d. 90 degree.

19. A 3 phase to 3 phase cycloconverter requires
    a. 18 SCRs for 3 pulse device.
    b. 18 SCRs for 6 pulse device.
    c. 6 SCRs for 6 pulse device.
    d. 36 SCRs for 6 pulse device.

20. Bulk power transmission over long HVDC lines are preferred on account of
    a. low cost of HVDC terminals.
    b. no harmonic problems.
    c. minimum line power losses.
    d. simple protection.

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SECTION "B"
[5 Q × 8=40 marks]

Attempt ANY FIVE questions. Assume anu suitable data if required.

1. a. A diode circuit as shown in Figure 1 below has R = 10 Ω and C = 0.01 μF. The capacitor has an initial voltage $V_{c0} = V_o (t=0) = 12$ V. If switch S is closed at t = 0. Determine: (i) the peak diode current (ii) the energy dissipated in the resistor R, and (iii) the capacitor voltage at t = 1 μs. [1+1+1=3]

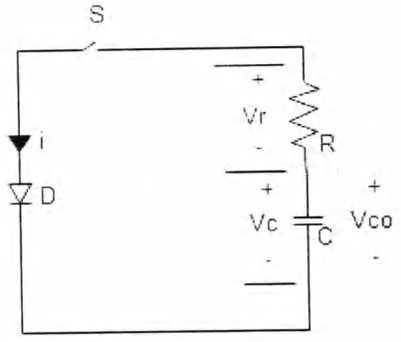

Figure 1. Diode circuit with RC load

b. A single phase full bridge diode rectifier is supplied from 230V, 50 Hz source. The load consists of R=10Ω and a large inductance so as to render the load current constant. Determine: (i) average values of output voltage and output current (ii) average and rms values of diode current (iii) rms values of source currents and (iv) supply power factor. [1+1+1+2=5]

2. a. Describe the gate triggering method of turning on of a thyristor showing I-V characteristics. [3]

b. A three phase ac switch with configuration as shown in Figure 2 is used between a three phase 400V, 50 Hz supply and a three phase star (Y) connected load. The load power is 10kW at a 0.85 lagging pf. Determine the (i) line current (ii) peak thyristor current (iii) average thyristor current (iv) rms thyristor current (v) PIV of thyristor. [1+1+1+1+1=5]

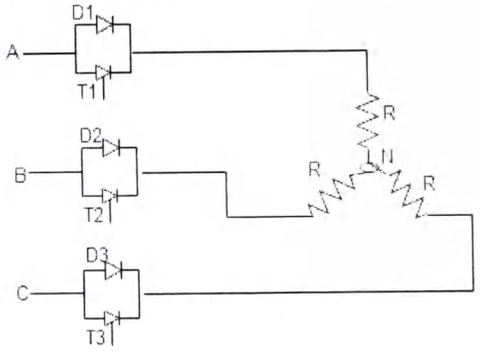

Figure 2. Three phase ac thyristor switch

3. a. Explain the working principle of a single phase full converter with RL load for discontinuous load current. Consider, firing angle, $\alpha = 15^0$ and extinction angle, $\beta = 190^0$. [4]
   b. A single phase half wave controlled rectifier is connected to a 120V source. Calculate the firing angle necessary to deliver 150W power to a 10Ω load. [4]

4. a. A step-up chopper has input voltage of 220V and output voltage of 660V. If the conducting time of thyristor is 100 μs, compute the pulse width of output voltage. [4]
   b. Explain the working principle of three phase 180^0 mode bridge voltage source inverter, illustrating the waveform of output phase voltage V_{ao} for one complete cycle. [4]

5. a. A single phase bridge type cyclo-converter feeds a load R. For an output frequency equal to one third of input frequency, sketch output voltage waveform for a firing angle of $\alpha = 30^0$. [4]
   b. A single phase bridge inverter, fed from 230V dc, is connected to a load R=10 Ω, and L=0.03H. Determine the power delivered to load in case the inverter is operating at 50 Hz with square wave output. Consider upto 5^{th} order harmonics. [4]

6. a. Explain the operating principle of an Uninterruptible Power Supply (UPS). [4]
   b. A three phase full converter, fed from 3-phase, 440V, 60Hz source, is connected to load R= 10 Ω, E = 200V and large inductance so that output current is ripple free. Calculate, (i) power delivered to load and (ii) input power factor for firing angle of 45^0. [2+2=4]