

AMIETE – ET (New Scheme)

Time: 3 Hours

June 2019

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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. In a buck converter the inductor current is composed of DC and AC components that accounts for which of the followings.
- (A) Capacitor voltage & load current (B) Load current & capacitor voltage
(C) Load current (D) Capacitor voltage
- b. A buck converter is operating at 100 kHz, 10V input, having a duty cycle of 0.16. The r.m.s output voltage is
- (A) 1.6V (B) 4V
(C) 10V (D) None of these
- c. 3-phase, 4 wire voltage source supplied to a load which is highly non-linear load as a result of rectifier in the power supply of the equipment. The wave shape of neutral current is square wave and the r.m.s current in each phase conductor is $20\sqrt{2}$ A. Find the r.m.s neutral current.
- (A) $\sqrt{2} \times 34.64$ A (B) $\sqrt{2} \times 60$ A
(C) $\sqrt{2} \times 11.547$ A (D) None of these
- d. Determine the r.m.s value of
 $V(t) = 6 + 10 \sin(\omega t + 10^\circ) + 10 \sin(2\omega t + 60^\circ)$ V
- (A) 10.86 V (B) 15.36 V
(C) 11.66 V (D) None of these
- e. voltage source of $V(t) = 300 \sin(314t)$ V is applied to a non-linear load resulting as non-sinusoidal current. Which is expressed in Fourier series form as $I(t) = 10 + 30 \sin(314t + 60^\circ) + 6 \cos(2 \times 314t + 45^\circ) + 4 \sin(3 \times 314t + 60^\circ)$ determine the power absorbed by load in kW
- (A) 5.25 (B) 2.25
(C) 5250 (D) 2250
- f. Find the average load current of half wave rectifier having a load resistance of 10Ω and input of 360V (r.m.s) at 50Hz.
- (A) 11.45 A (B) 16.2 A
(C) 8.1 A (D) None of these

- g. Determine the firing angle of full wave rectifier to produce average voltage of 80V across a 300Ω load resistor from a 240 V (r.m.s) at 50Hz (assume continuous conduction)
- (A) 42.2° (B) 58.48°
(C) 72.4° (D) 68.27°
- h. A single-phase AC voltage controller has 230V(r.m.s), 50Hz source and the load resistance of 20Ω. Find the r.m.s source current, when power deliver to load is 1000W.
- (A) 3.535 A (B) 14.14 A
(C) 7.07 A (D) None of these
- i. A fly back has following circuit parameters $V_s = 20V$, $R=5\Omega$, $f=50Hz$, $N_1/N_2 = 3$, $C=500\mu F$, $V_o= 5V$, find duty ratio in percentage.
- (A) 42.8 (B) 7.69
(C) 20 (D) None of these
- j. Find the critical inductance of boost converter which has input of 20V, duty ratio 0.2 and operating frequency is 50 kHz. The peak-peak inductor current given by 0.8A
- (A) 0.1mH (B) 1 mH
(C) 10 mH (D) 0.01mH

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

- Q.2** a. Explain the two types of SCR protection. (8)
- b. What are the various turn-on methods of thyristors? Explain any one in detail. (8)
- Q.3** a. What are different types of power diodes? Explain them briefly. (8)
- b. With the help of neat diagram and equivalent circuit explain the basic structure of IGBT. (8)
- Q.4** a. A 420V r.m.s at 50Hz controlled full-wave rectifier has $R=2\Omega$, $L=40mH$, and $V_{dc}= 150V$. The delay angle $\alpha= 60^\circ$. Determine
- (i) Expression for current
(ii) The power absorbed by the resistor. (8)
- b. A boost converter has to deliver 3A into the 15Ω load. The battery voltage is 15V, $L= 30 \mu H$, $C=150 \mu F$ and converter frequency is 20 kHz. Find ON-time of chopper, Average battery current, and r.m.s load current. (8)
- Q.5** a. A chopper has an inductive load of 2Ω resistance and 20mH inductance. Source voltage is 20V. The frequency of chopper is 20 kHz and T_{on} is 20μsec. Determine the average, Maximum and minimum load current, and ripple output voltage. (8)
- b. What are the various methods for the improvement of thyristor characteristics? Explain any one method. (8)

- Q.6** a. Explain operation of full bridge controlled rectifier for RLE load with neat waveforms. Also derive (assume continuous conduction)
(i) Output average voltage
(ii) Output r.m.s voltage (8)
- b. A controlled full-wave bridge rectifier has a source of 230 Vrms at 50 Hz, $R = 10 \Omega$, $L = 80 \text{ mH}$ and $\alpha = 60^\circ$ and load current is ripple free. Find
(i) Average load current, load voltage
(ii) r.m.s source current
(iii) Power absorbed by load (8)
- Q.7** a Explain the working principle of 3ϕ full wave controlled rectifier. (8)
- b. Explain briefly along with switching waveforms of 3-phase inverter for 120° conduction mode? (8)
- Q.8** a. Explain the sinusoidal pulse modulation (SPWM) w.r.t Inverters. (8)
- b. With the help of neat circuit and waveforms, explain the principle of cyclo converter operation. (8)
- Q.9** Write notes on the following
(a) Induction heating (8)
(b) HVDC Transmission (8)