

Roll No.

| | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST - 1

Even Semester: 2018-19

Course Code: EEE 214

Course Name: Power Electronics

Programme & Sem: B.Tech (EEE) & VI Sem

Date: 05 March 2019

Time: 1 Hour

Max Marks: 40

Weightage: 20%

Instructions:

- (i) **Answer all the questions.**

Part A

Answer **all** the Questions. **Each** question carries **six** marks.

(2Qx6M=12)

1. Each question carries 1 marks

- a) Which of the following diodes uses a metal-semiconductor junction?
- General purpose diodes
 - Fast recovery diodes
 - Schottky diode
 - None of the mentioned
- b) An SCR is considered to be a semi controlled device because
- It can be turned OFF but not ON with a gate pulse.
 - It conducts only during one half cycle of an alternating current wave.
 - It can be turned ON but not OFF with a gate pulse.
 - It can be turned ON only during one half cycle of an AC.
- c) In forward blocking mode of a thyristor
- Junction J_2 is in reverse bias and J_1, J_3 is in forward bias.
 - Junction J_3 is in forward bias and J_1, J_2 is in reverse bias.
 - Junction J_1, J_3 is in reverse bias and J_2 is in forward bias.
 - Junction $J_1,$ and J_2 is in forward bias and J_3 is in reverse bias.
- d) Let of a thyristor V_{c1}, V_{c2}, V_{c3} are forward break over voltage for gate current I_{g1}, I_{g2}, I_{g3} respectively. Then
- $V_{c1} > V_{c2} > V_{c3}$ when $I_{g1} > I_{g2} > I_{g3}$
 - $V_{c1} > V_{c2} > V_{c3}$ when $I_{g1} < I_{g2} < I_{g3}$
 - $V_{c1} = V_{c2} = V_{c3}$ any value of I_g .
 - $V_{c1} > V_{c2} > V_{c3}$ when $I_{g1} = I_{g2}$
- e) If holding current of a thyristor is 2 mA then latching current should be
- 0.01A.
 - 0.002A
 - 0.009A
 - 0.004A

- f) A power BJT is used as a power control switch by biasing it in the cut off region (off state) or in the saturation region (on state). In the on state
- i. both the base-emitter & base-collector junctions are forward biased
 - ii. the base-emitter junction is reverse biased, and the base collector junction is forward biased
 - iii. the base-emitter junction is forward biased, and the base collector junction is reversed biased
 - iv. both the base-collector & the base-emitter junctions are reversed biased
2. Sketch the static V-I characteristic of an SCR and explain
- (a) Latching current b) Holding current c) Break over voltage

Part B

Answer **all** the Questions. **Each** question carries **eight** marks. (2Qx8M=16)

3. Draw the switching characteristics of power diode and explain.
4. Mention the different turn on methods employed to switch on the SCR. Explain forward voltage turn on method.

Part C

Answer the Question. Question carries **twelve** marks. (1Qx12M=12)

5. What is auxiliary thyristor commutation? Describe this type of commutation with a circuit diagram and appropriate waveform.

Roll No.

| | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST - 2

Even Semester: 2018-19

Course Code: Power Electronics

Course Name: EEE 214

Program & Sem: B.Tech & VI Sem

Date: 15 April 2019

Time: 1 Hour

Max Marks: 40

Weightage: 20%

Instructions:

(i) *Read the questions and answer accordingly*

Part A

Answer **both** the Questions. **Each** question carries **six** marks. (2Qx6M=12)

1. Explain how thyristors are protected against high di/dt.
2. Explain working principle for MOSFET with its structure diagram.

Part B

Answer **both** the Questions. **Each** question carries **eight** marks. (2Qx8M=16)

3. Explain with waveform the Resistance triggering circuits to turn on in the phase control circuits.
4. The voltage and current rating in a particular circuit are 5kV and 100 Amp. SCRs with a rating of 1000V and 150 Amps are available. Minimum de-rating factor is 20%. Calculate the number of series connected SCRs required to handle given source voltage and current. If maximum leakage current of SCR is 10mA and $\Delta Q_{max} = 20\mu C$ then calculate the static resistor and dynamic capacitor for equalization and power across SCR.

Part C

Answer the Question. The Question carries **twelve** marks. (1Qx12M=12)

5. Explain the operation of half wave converter with RL load and freewheeling diode and also reduce the expression for average load current.



| | | | | | | | | | | | | | | | | | | | | | | |
|---------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Roll No | | | | | | | | | | | | | | | | | | | | | | |
|---------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

**PRESIDENCY UNIVERSITY
BENGALURU**
SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Even Semester: 2018-19

Course Code: EEE 214

Course Name: Power Electronics

Program & Sem: B Tech & VI Sem

Date: 23 May 2019

Time: 3 Hours

Max Marks: 80

Weightage: 40%

Instructions:

(i) *All parts of the question paper are compulsory to answer*

Part A

Answer **all** the Questions. Each question carries **one** mark.

(20Qx1M=20M)

1. Select the appropriate answer for the following questions;

- Reverse recovery current in a diode depends upon
 - Forward field current
 - Storage charge
 - Temperature
 - PIC
- As compared to power MOSFET, a BJT has
 - Lower switching losses but higher conduction loss
 - Higher switching losses and higher conduction loss.
 - Higher switching losses but lower conduction loss
 - Lower switching losses and lower conduction loss
- When a thyristor gets turned on, the gate drive
 - Should not be removed as it will turn-off the SCR
 - May or may not be removed
 - Should be removed
 - Should be removed to avoid increased losses and higher junction temperature
- For a SCR, dv/dt protection is achieved through the use of
 - RL in series with SCR
 - RC across SCR
 - L in series with SCR
 - RC in series with SCR
- SCR is considered to be a semi controlled device because
 - It can be turned OFF but ON with a gate pulse
 - It conducts only during one half cycle of an alternating current wave
 - It can be turned ON but not OFF with gate pulse
 - It can be turned ON only during one half cycle of an alternating voltage wave
- Practical way of obtaining static voltage equalization in series connected SCRs is by the use of
 - One resistor across the string
 - Resistors of different values across each SCR
 - Resistors of the same value across each SCR
 - One resistor in series with string

- vii. When an UJT is used for triggering an SCR, the waveshape of the voltage obtained from UJT circuit is a
- (a) Sine wave (c) Trapezoidal wave
(b) Saw-tooth wave (d) Square wave
- viii. Triac is equivalent to:
- (a) Both are unidirectional device
(b) One thyristor and one diode in parallel
(c) Two thyristor in parallel
(d) Two thyristor in antiparallel.
- ix. Commutation or turn-off of a thyristor requires that
1. Anode current is reduced below holding current
 2. Anode voltage is reduced to zero
 3. Anode current is allowed to reverse
 4. Anode voltage gets reversed
 5. Reverse voltage is applied to it
- From these, the correct statements are
- (a) All (c) 1,3,4,5
(b) 1,3,4 (d) 1,2,4
- x. In a commutation circuit employed to turn-off an SCR, satisfactory turn-off obtained when
- (a) Circuit turn-off time < device turn-off time
(b) Circuit turn-off time > device turn-off time
(c) Circuit time constant > device turn-off time
(d) Circuit time constant < device turn-off time
- xi. In a single phase semiconverter, for continuous conduction, each SCR conducts for
- (a) α (c) $\alpha + \pi$
(b) π (d) $\pi - \alpha$
- xii. In a 3-phase semiconverter, for firing angle less than or equal to 60° , freewheeling diode conducts for
- (a) 30° (c) 90° ,
(b) 60° , (d) zero degree
- xiii. For a single phase two pulse phase controlled rectifier, with a freewheeling diode across RL load
- (a) The instantaneous output voltage v_0 is always positive
(b) v_0 may be positive or zero
(c) v_0 may be positive, zero or negative
(d) v_0 is always zero or negative
- xiv. A chopper, where voltage as well as current remain negative, is known as
- (a) Type A (c) Type C
(b) Type B (d) Type D
- xv. In DC choppers the waveform for input and output voltages are respectively
- (a) Discontinuous, continuous
(b) Both continuous
(c) Both discontinuous
(d) Continuous, discontinuous

- xvi. A single-phase full bridge inverter can operate in load commutation mode in case load consists of
- (a) RL (c) RLC overdamped
(b) **RLC underdamped** (d) RLC critically damped
- xvii. A VSI will have better performance of its
- (a) Load inductance is small and source inductance is large
(b) Both load inductance and source inductance are small
(c) Both load inductance and source inductance are large
(d) Load inductance is large and source inductance is small
- xviii. Output voltage of a single phase bridge inverter fed from fixed dc source is varied by
- (a) varying the switching frequency
(b) pulse width modulation
(c) pulse amplitude modulation
(d) all the above
- xix. when a single phase ac voltage controller supplies power to an inductive load, control is lost if
- (a) $\alpha < \beta - \pi$ (c) $\alpha > \beta - \phi$
(b) $\alpha = \beta$ (d) $\alpha = \beta - \phi$
- xx. The cycloconverter (CCs) requires natural or forced commutation as under:
- (a) Natural commutation in both step-up and step down CCs
(b) Forced commutation in both step-up and step down CCs
(c) Forced commutation in step-up CCs
(d) Forced commutation in step down CCs

Part B

- Answer **all** the Questions. **Each** question carries **ten** marks. (3Qx10M=30M)
2. Draw RC half wave trigger circuit for one SCR and discuss the function of the various components used. Describe with the help of waveforms, how the output voltage is controlled by varying the resistance. Draw the voltage waveform across SCR also.
 3. Describe working of class C type of commutation used for thyristors with appropriate current and voltage waveforms.
 4. What is meant of step-up chopper? Explain the operation. Sketch the input voltage, input current output voltage and output current waveforms. State the various assumption made.

Part C

- Answer **all** the Questions. **Each** question carries **ten** marks. (3Qx10M=30M)
5. A single phase CSI is fitted with ideal SCRs. Describe its working when its load is a capacitor C. Show that the frequency of input voltage to CSI is twice frequency of triggering the thyristor.
 6. A 3-phase semiconverter is connected to RLE load. For firing angle delay of 120° , draw output voltage and load current waveforms in case load current is continuous. Also indicate the conducting elements of the semi converter during periodic times of the output voltage.
 7. Describe operating principle of single phase to single phase step up cyclo-converter with the help of mid-point. Illustrate your answer with appropriate circuit and waveform. The conduction of various thyristors must also be indicated on the waveforms.

Roll No.

| | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

SUMMER TERM / MAKE UP END TERM EXAMINATION

Semester: Summer Term 2019

Date: 24 July 2019

Course Code: Power Electronics

Time: 2 Hours

Course Name: EEE 214

Max Marks: 80

Program & Sem: B.Tech & V Sem (2015 Batch)

Weightage: 40%

Instructions:

- (i) Read the question properly and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted.

Part A

Answer **all** the Questions. **Each** question carries **five** marks.

(4Qx5M=20)

1. Draw the circuit diagram of single phase half-bridge VSI with R-L load explain the working of the circuit.
2. Draw the waveforms of output voltage and output current for a single phase half bridge inverter feeding R-L load.
3. A single phase bridge inverter delivers power to a series connected RLC load with resistance of 2 ohms and inductive reactance of 10 ohms. The time period is 0.1 msec. What value of C should the load have in order to obtain load commutation for the SCRs. The thyristor turn off time is 10 micro-seconds. Assume circuit turn off time as $1.5 t_q$. Assume that load current contains only fundamental component.
4. Write the equations of output voltage, output current, load impedance at frequency ω and phase angle for single phase half bridge and full bridge inverter.

Part B

Answer **all** the Questions. **Each** question carries **ten** marks.

(4Qx10M=40)

5. Draw the output phase and line voltage waveforms for a 3 phase inverter supplying R load and the conduction mode is 180 degrees.

6. For a single phase full bridge inverter using SCRs, $V_s = 230$ V dc, $T = 1$ ms. The load consists of RLC in series with Resistance of 1 Ohm, inductive reactance of 6 ohms and capacitive reactance of 7 ohms.
- a) Find the power delivered to load due to fundamental component
7. A single-phase full bridge inverter is fed from a dc source such that fundamental component of output voltage is 230 V. Find the rms value of thyristor and diode currents for $R = 2$ ohms $\omega L = 8$ Ohms and $1/\omega C = 6$ Ohms
8. A single phase half wave AC voltage controller feeds an R load of 20 ohms with an input voltage of 230 V, 50 Hz. Firing angle of thyristor is 45 degrees. Determine a) rms value of output voltage b) power delivered to load and input pf

Part C

Answer **both** the Questions. **Each** question carries **ten** marks. (2Qx10M=20)

9. A 3 phase bridge inverter delivers power to a resistive load from a 450 V DC source. For a star Connected load of 10 Ohms per phase, determine for 180° mode
- i) rms value of load current ii) rms value of transistor current iii) load power iv) average value of source current v) average value of output phase and line voltages
10. Explain the operation of voltage commutated chopper with the help of circuit diagram.