ARKAJAIN University
Jharkhand

5th Semester Examination –2021-22

Subject	**: Power Electronics**	**Roll No**	**: .....**
Course	**: B.Tech (EEE)**		
Full Marks	**: 70**	**Time**	**: 3 Hours.**

Instructions to the Candidates:

- **Read the question paper very carefully.**
- **Candidates are required to give their answers in their own words as far as practicable.**
- **Question Paper is divided into Three Parts –A, B & C.**
- **Part-A is containing 12 multiple choice questions.**
- **Part- B containing SIX questions out of which FOUR questions are to be answered.**
- **Part C containing FOUR questions out of which TWO questions are to be answered.**
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PART A

MULTIPLE CHOICE QUESTIONS **(12X1=12)**

1. In a three-phase half-wave rectifier, each diode conducts for a duration of
   a. 180° b.120° c. 90 d. 60°

2. RC snubber circuit is used to limit the rate of
   a. Rise of current in SCR
   b. Rise of voltage across SCR
   c. Conduction period
   d. All of the above

3. If the firing angle in an SCR rectifier is decreased, the output voltage is
   a. Increased b. Maximum c. Decreased d. Remain Unaffected

4. Which of the following is true for a bridge rectifier?
   a) The peak inverse voltage or PIV for the bridge rectifier is lower when compared to an identical center tapped rectifier
   b) The output voltage for the center tapped rectifier is lower than the identical bridge rectifier
   c) A transistor of higher number of coil is required for center tapped rectifier than the identical bridge rectifier
   d) All of the mentioned

5. The Form factor (FF) is the ratio of
   a. Average value/RMS value
   b. Average value/Maximum value
   c.. RMS value/Average value
   d. Maximum value/RMS value

6. The type of commutation when the load is commutated by transferring its load current to another incoming thyristor is:

a. Class A or load commutation
b. Class B or resonant commutation
c. Class C or complementary commutation
d. Class D or impulse commutation

7. In case of a single-phase half-wave circuit with RL load, with firing angle α and extinction angle β, the conduction angle γ can be written as:-

a. $\gamma = \beta+\alpha$ b. $\gamma = \beta-\gamma$ c. $= \beta/\alpha$ d. $\gamma = \alpha/\beta$

8. In case of controlled rectifiers, the nature of the load current (continuous or discontinuous) depends upon the:-
a Type of load and firing angle
b. Only on the type of load
c. Only on the firing angle
d. It is independent of all the parameters

9. A single phase full converter has discontinues load current. The converter is supplying a dc shunt motor (R-L-E) load. When the current falls to zero the output voltage is:-

a) Zero b. Vo c. Vm d. E

10. Find the output voltage for a step-up chopper when it is operated at a duty cycle of 50 % and Vs = 240 V.

a. 240 V b. 480 V c. 560 V d. 120 V

11. The output of a single-phase half bridge inverter on R load is ideally:-

a) a sine wave
b) a square wave
c) a triangular wave
d) constant dc

12. Safe commutation can be achieved in case of the _____ operating mode.

a) 180°
b) 120°
c) 360°
d) none of the mentioned

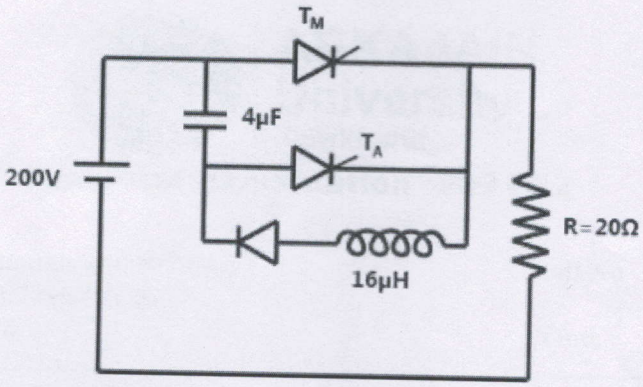
PART B

ANSWER ANY FOUR OUT OF SIX **(4x7=28)**

1. Explain turn on method of SCR. Why circuit turn-off time should be greater than the thyristor turn-off time?

2. Explain class B commutation with waveform.

3. Draw the circuit diagram of Buck-Boost chopper. In the circuit showing in fig. The circuit turn off time for main and auxiliary SCRs in microsecond are_____ ?



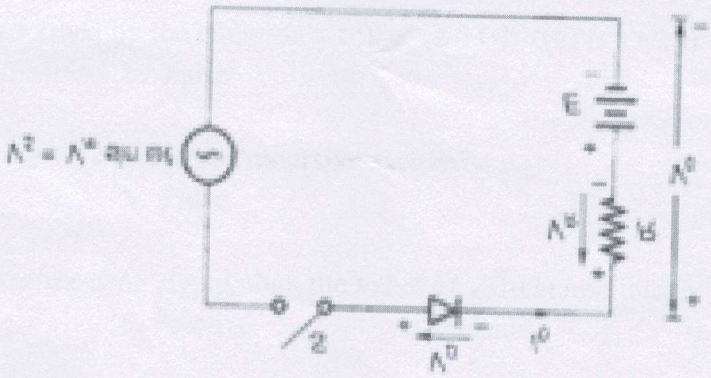
4. Explain single phase half wave controlled rectifier RL load and derive various expressions.
5. Discuss single phase full bridge inverter with waveform and formula.
6. Compare VSI and CSI. List the different types of PWM techniques.

PART C

ANSWER ANY TWO OUT OF FOUR **(2x15=30)**

1. What is SCR. Explain operating mode of SCR with its V-I characteristics. Also discuss holding and latching current. What is snubber circuit?

2. A DC battery of constant emf E is being charged through a resistor as shown in figure for source voltage of 230 V, 50HZ and for R=10 ohm, E=150



a) Find the value of average current
b) Find the power supplied to battery and that dissipated in the resistor
c) Calculate the supply power factor.
d) Find the charging time in case battery capacity is 1000 Wh
e) Find rectifier efficiency and PIV of the diode.

3. What are ac voltage controllers and give few applications? Explain the operation of multistage control of AC voltage controllers with neat diagram. What are ac voltage controllers and give few applications?
4. Discuss 3 phase full bridge inverter with waveform for 180 deg mode and formula.

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5th Semester Examination –2021-22

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PART A

MULTIPLE CHOICE QUESTIONS (12x1=12)

1. The system described by the equation y (n)=ay(n-1)+b x(n) is a recursive system.
   a. True b. False

2. An FIR system is also called as "recursive system".
   a. True b. False

3. If x (n) is a discrete-time signal, then the value of x (n) at non integer value of 'n' is?
   a. Zero b. Positive c. Negative d. Not defined

4. The discrete time function defined as u (n) =n for $n \geq 0$;u(n)=0 for $n<0$ is an _____
   a. Unit sample signal b. Unit step signal c. Unit ramp signal d. None of the mentioned

5. The signal given by the equation $\sum_{n=-\infty}^{\infty}|x(n)|2$ is known as _____
   a. Energy signal b. Power signal c. Work done signal d. None of the mentioned

6. Time scaling operation is also known as _____
   a. Down-sampling b. Up-sampling c. Sampling d. None of these

7. The function given by the equation x (n) =1, for n=0; x (n)=0, for $n \neq 0$ is a _____
   a. Step functionb. b. Ramp function c. Triangular function d. Impulse function

8. The even part of a signal x (t) is?
   a. x (t)+x(-t) b. x (t)-x (-t) c. (1/2)*(x(t)+x(-t)) d. (1/2)*(x(t)-x(-t))

9. All energy signals will have an average power of _____
   a. Infinite b. Zero c. Positive d. Cannot be calculated

10. Find the Laplace transform of δ (t).
   a. 1 b. 0 c. ∞ d. 2

11. Discrete-time signals are _____
   a. Continuous in amplitude and continuous in time
   b. Continuous in amplitude and discrete in time
   c. Discrete in amplitude and discrete in time
   d. Discrete in amplitude and continuous in time

12. What are the conditions called which are required for a signal to fulfil to be represented as Fourie series?
   a. Dirichlet's conditions b. Gibbs phenomenon
   c. Fourier conditions d. Fourier phenomenon

PART B

ANSWER ANY FOUR OUT OF SIX **(4x7=28)**

1. Check causality of the system given by,
   i. $y(n) = x(n-no)$
   ii. $y(n) = 3x(n-2) + 3x(n+2)$
2. Derive and Proof the Linearity Property of Laplace transform
3. Derive the Nth Order Derivative in Laplace Transform.
4. Determine the z-transform of unit step sequence.
5. Define following terms:
   (a) Unit ramp (b) Unit step
6. What are of even and odd signals? Explain with equations.

PART C

ANSWER ANY TWO OUT OF FOUR **(2x15=30)**

1. Define z-transform and inverse z-transform. Also Explain ROC (Region of convergence) in detail.
2. Define discrete time unit step &unit impulse signal.
3. Find the even and odd components of the following signals:

(a) $x(n) = \left\{-3, 1, \underset{\uparrow}{2}, -4, 2\right\}$

(b) $x(n) = \left\{-2, 5, \underset{\uparrow}{1}, -3\right\}$

4. State and prove the following properties of z-transform.
   i) Time shifting ii) Time reversal

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5th Semester Examination –2021-22

Subject	**: Power System Analysis-I**	**Roll No**	**: .....**
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PART A

MULTIPLE CHOICE QUESTIONS

(12x1=12)

1. What will be the per unit impedance of a synchronous motor having a rating of 100 kVA, 13.2 kV and having a reactance of 75 Ω / ph?
   a. 0.043 pu b. 0.057 pu c. 0.036 pu d. 0.298 pu

2. The pu impedance value of an alternator corresponding to base values 13.2 kV and 30 MVA is 0.2 pu. The pu value for the base values 13.8 kV and 50 MVA will be
   a. 0.306 pu b. 0.33 pu c. 0.318 pu d. 0.328 pu

3. When a 50 MVA, 11 kV, 3-phase generator is subjected to a 3-phase fault, the fault current is –j5 pu. When it is subjected to a line-to-line fault, the positive sequence current is j4 pu. The positive and negative sequence reactance are respectively
   a. j0.2 and j0.05 pu b. j0.2 and j0.25 pu c. j0.25 and j0.25 pu d.j0.05 and j0.05 pu

4. Three phase short circuit MVA to be interrupted by a circuit breaker in a power system is given by
   a. √3 x post fault line voltage in kV x SC current in kA
   b. 3 x pre fault line voltage in kV x SC current in kA
   c. √3 x pre fault line voltage in kV x SC current in kA
   d. (1/√3) x pre fault line voltage in kV x SC current in kA

5. The following sequence currents were recorded in a power system under a fault condition $I_{positive} = j\ 1.753$ pu, $I_{negative} = -j\ 0.6$ pu, $I_{zero} = -j\ 1.153$ pu. The fault is
   a. Line to ground b. Three-phase c. Line to line to ground d. Line to line

6. For limiting the short circuit current
   a. Reactors are used
   b. Capacitors are used
   c. Resistors are used
   d. Any of above

7. The Critical Clearance time of a fault in the power system is related to
   a. Reactive power limit
   b. Steady state stability limit
   c. Short Circuit limit
   d. Transient stability limit

8. The positive, negative and zero sequence impedances of a solidly grounded system under steady state condition always follow the relations
   a. $Z_1 > Z_2 > Z_0$ b. $Z_1 < Z_2 < Z_0$ c. $Z_0 < Z_1 < Z_2$ d. None of the above

9. The equal area criteria of stability is used for:
   a. No load on the busbar
   b. One machine and infinite busbar
   b. More than one machine and infinite busbar
   d. None of the above

10. The value of expression $1 + \alpha + \alpha^2$
    a. 0 b. 1 c. -1 d. 2

11. In which of the following faults, all the sequence voltages are equal?
    a. LL fault b. LLG fault c. LG fault d. LLL fault

12. Which of the following is true about the sequence reactance of transformer?
    a) Negative and positive sequence reactance's are equal to the leakage reactance
    b) Negative sequence reactance is larger than positive sequence reactance
    c) Negative sequence reactance is smaller than positive sequence reactance
    d) None of the above.

PART B

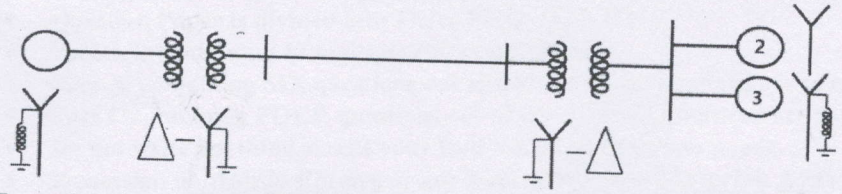
ANSWER ANY FOUR OUT OF SIX **(4x7=28)**

1. When is a power system said to be transiently stable? What are the methods by which steady state stability limit can be improved?
2. Derive the expression for LG fault & draw equivalent circuit.
3. What are the methods by which steady state stability limit can be improved? Give the expression For swing equation. Explain each term along with their units.
4. A 30 MVA, 3 phase 11 kV, 50 Hz alternator having the neutral solidly grounded is operating at no load. It has a positive sequence reactance of 2.5 ohms and the negative and zero sequence reactance are 80% and 30% of the positive sequence value respectively then the current through ground is _____ KA for LLG fault.
5. A 50 Hz, 4-pole, turbo-alternator rated 20 MVA, 13.2 KV has an inertia constant of H = 9 KW-sec/KVA. Find the K.E stored in the rotor at synchronous speed. Find the accelerating torque if the shaft input less the rotational losses is 26,800 HP (metric) and the electrical power developed is 16000KW.
6. Explain about equal area criterion. Define critical clearing angle.

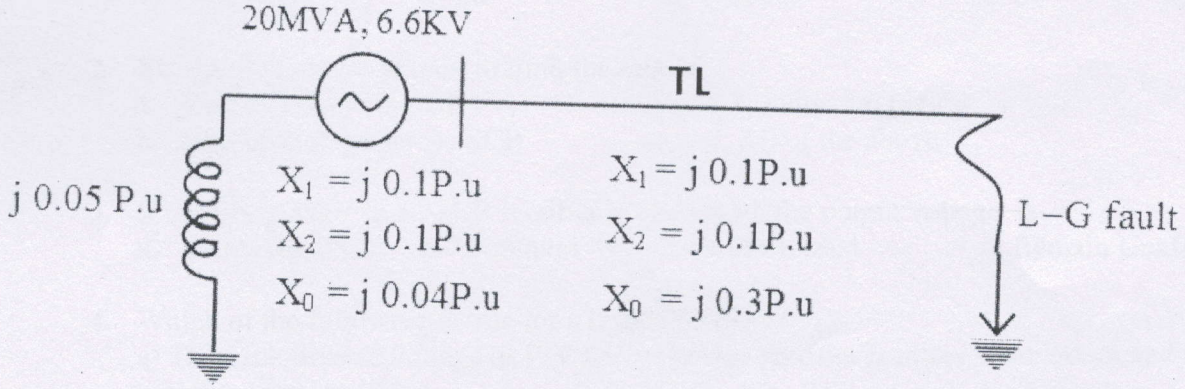
PART C

ANSWER ANY TWO OUT OF FOUR **(2x15=30)**

1. Draw swing curve for single machine tied to infinite bus with two parallel lines and explain each curve.
2. A 25MVA, 11KV, 3ph synchronous generator has a sub-transient reactance of 20%. The generat supplies 2 motor over a TL with transformer at both ends. The motor have rated KVA of 15 & 7 MVA, both 10KV with 25% sub transient reactance. Both transformer have 30MVA, 10.8/121KV delta star connection with leakage reactance of 10%, series reactance of line=100Ω. Draw all sequenc networks. Assume equal positive, negative and zero sequence impedances for all components.



3. How are the faults classified? A 20-MVA, 6.6-kV, 3-phase alternator is connected to a 3-phas transmission line. The per unit positive-sequence, negative-sequence and zero-sequence impedance o the alternator are j0.1, j0.1 and j0.04 respectively. The neutral of the alternator is connected to ground through an inductive reactor of j0.05 p.u. The per unit positive, negative and zero-sequence impedance of the transmission line are j0.1, j0.1 and j0.3, respectively. All per unit values are based on the machine ratings. A solid ground fault occurs at one phase of the far end of the transmission line. The voltage o the alternator neutral with respect to ground during the fault is



4. Define negative sequence and zero sequence components. Discuss about zero sequence reactance diagram of transformer with examples.