Aliah University
Electrical Engineering Department
B. Tech 6th Semester End Term Online Examination 2021 (Reg)
Power System II (EE 304)

The figures in the margin indicate full marks. All parts of a question should be answered at one place. Question no 1 & 2 is must. Attempt any five from rest. Symbols and notations have their usual meaning,

1. Attempt any twelve: (**1 x 12**)

(i) In a 100-bus system, there are 5 generator buses. The size of Jacobian matrix:
(A) 95×95 (B) 195×195 (C) 193×193 (D) 94×94

(ii) In Newton-Raphson method used for solving load flow problems, the number of iteration required is
(A) Directly proportional to the number of buses in the system
(B) Independent of the number of buses in the system
(C) Directly proportional to the square of the number of buses in the system
(D) Inversely proportional to the number of buses in the system

(iii) Economic operation of power system applies the criterion of
(A) Equal incremented fuel costs of various units
(B) Minimum cost of generation of units
(C) Maximum efficiencies of different units
(D) All of these

(iv) Steady-state stability limit of a power system can be improved by
(A) Reducing fault clearing time
(B) Using double-circuit line instead of single-circuit line
(C) Single pole switching
(D) Decreasing generator inertia

(v) The most severe type of fault is the
(A) SLG fault (B) LL fault (C) LLG fault (D) LLLG fault

(vi) The mathematical formulation of a load flow problem results in a set of
(A) Algebraic linear equations
(B) Linear differential equations
(C) Algebraic non-linear equations
(D) Non-linear differential equations

(vii) Critical clearing time of a fault in power system is related to
(A) Reactive power limit
(B) Short-circuit current limit
(C) Steady-state stability limit
(D) Transient stability limit

(viii) The three equivalent networks are connected in series for
SLG fault (B) LL fault (C) LLG fault (D) LLLG fault

(ix) The synchronization coefficients between two area of a two-area power system is

(A) $\frac{\partial P}{\partial |V|}$ (B) $\frac{\partial P}{\partial \delta}$ (C) $\frac{\partial P}{\partial f}$ (D) $\frac{\partial P}{\partial Q}$

(x) A square matrix is said to be singular if its
(A) Determinant is zero
(B) Determinant is unity
(C) Determinant is negative
(D) Rank is unity

(xi) For unsymmetrical fault calculation
(A) Only positive sequence network is required
(B) Only positive and negative sequence networks are required
(C) Only positive and zero sequence networks are required
(D) All the sequence networks are required

(xii) The unit of loss coeeficients
(A) MW (B) MW^2 (C) MW^{-1} (D) MW^{-2}

(xiii) The short-circuit currents depends upon
(A) The generating capacity of the generators
(B) The voltage at the faulty point
(C) The total reactance between the generators and the faulty point
(D) All of the above

2. Answer any nine of the following questions with appropriate reasoning and with proper justification. **(2 x 9 = 18)**
(i) Differentiate between symmetrical and unsymmetrical fault.
(ii) What do you mean by inter-circuit fault and evolving fault?
(iii) Can a PQ bus be treated as PV bus?
(iv) It is found that incremental cost function of a generator of a power plant is constant. What does it imply?
(v) 'Y-bus matrix is preferred over Z-bus matrix in load flow analysis' - explain this statement.
(vi) What is principle of de-coupling?
(vii) What is the stopping criterion for Gauss-Siedel algorithm in Load flow studies?
(viii) Differentiate between X_d and X_d''.
(ix) 'Series compensation is preferred to enhance the power transfer capability of a power system' - justify this statement.
(x) Differentiate between PV bus and voltage controlled bus.

3. Classify bus. In Gauss-Siedel method, derive the equation that is used to update voltage at the end of each iteration for PQ bus. What different strategy has been opted for PV bus? What is the stopping criterion in Gauss-Siedel method? **3 + 3 + 3 + 1**

4. A three-phase double-circuit transmission line is shown in Fig 1. Derive its sequence component networks. The ratings of various components are shown in Table I. Assume necessary assumption. **10**

5. Determine economic operating point for the following three units when delivering a load of 850 MW. Cost of coal: *1.1 Rs/ MBtu*, Cost of Oil *1.0 Rs/ MBtu.* **10**

Unit no	Type	P_{max} (MW)	P_{min} (MW)	Input Output Curve
1	Coal fired steam unit	600	150	$H_1 = 510 + 7.2P_{G1} + 0.00142P_{G1}^2\ MBtu/hr$
2	Oil fired steam unit	400	100	$H_2 = 310 + 7.85P_{G2} + 0.00194P_{G2}^2\ MBtu/hr$
3	Oil fired steam unit	200	50	$H_3 = 78 + 7.97P_{G3} + 0.00482P_{G3}^2\ MBtu/hr$

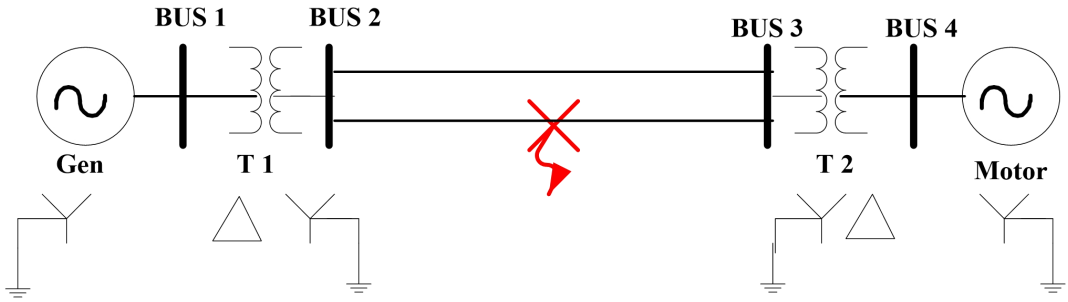


Fig 1

Table I

Component	Rating
Gen	*25 MVA, 11 kV, X_d'' = 20%, X_0 = 6%*
Motor	*20 MVA, 11 kV, X_d'' = 15%, X_0 = 6%*
T1	*15 MVA, 11/132 kV, X_d'' = 8%*
T2	*7.5 MVA, 132/11 kV, X_d'' = 10%*
Line 1 , 2	*100 km, Z_1= 2 Ω/km, Z_0 = 6 Ω/km*

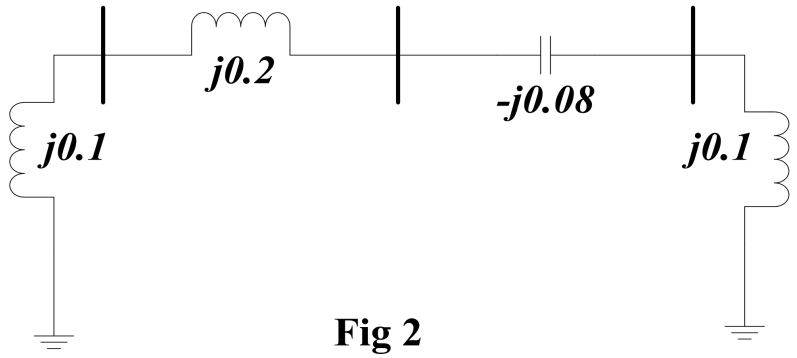


Fig 2

6. (i) A generator with induced voltage of 1.6 pu is delivering power to an infinite bus with internal voltage of 1.0 pu through a double-circuit line having reactance of 1.6 pu on each line. Calculate the maximum amount of power that can be transferred by alternator. **4**

(ii) Deduce an expression of critical clearing time (t_c), when a fault is occurred and cleared on a single-circuit transmission line using equal area criterion. **6**

7. Derive SLFE. For the power system shown in Fig. 2, develop bus admittance matrix. **4 + 6**

8. For the power system shown in Fig. 3, a 3-phase fault occurs at point F. Find the critical clearing angle. The generator may be assumed to deliver 1.0 pu power at the instant preceding the fault.

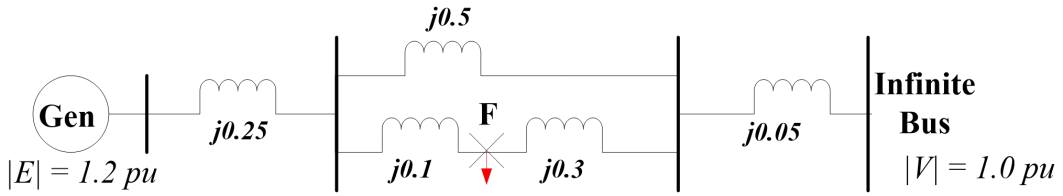


Fig 3

----- END OF QUESTION PAPER -----

Aliah University

Even Semester Examination, August 2021

Subject: Modern Control System; Code: EE308

Department: EE; 3rd Year; 6th Semester

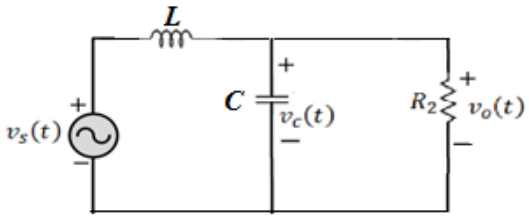
Time: 3 Hrs. Total Marks – 80

(*Notations used have their usual meaning*)

Group-A

Answer any five questions.

1. Obtain the state model of the electrical network shown in figure below. Here $v_s(t)$ is the input and $v_o(t)$ is the output of the network. Here $L = \frac{1}{2}H, C = \frac{1}{2}F$ *and* $R_2 = 10\Omega$. [6]



2. Derive the state model and draw the state diagram for a system with transfer function. [6]
$\frac{Y(s)}{U(s)} = \frac{s^2+3s+3}{s^3+2s^2+3s+1}$.

3. Obtain the transfer function of the system described by the state model [6]
$\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ 8 & -6 \end{bmatrix} X(t) + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(t); y(t) = [1 \quad 0] X(t)$

4. For the following system determine the zero-input response. [6]
$\dot{X}(t) = \begin{bmatrix} 2 & 1 \\ 0 & 2 \end{bmatrix} X(t) + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(t); y(t) = [1 \quad 0] X(t); X(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$

5. Consider a system described by the differential equation $\frac{d^2y(t)}{dt^2} = u(t)$. Check controllability and observability of the system. [6]

6. A linear plant is represented by the state model- [6]
$\dot{X}(t) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix} X(t) + \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} u(t); y(t) = [1 \quad 0 \quad 1] X(t)$
Design a state feedback controller that places the closed-loop poles at $s = -3 \pm j5$ and at s= -8.

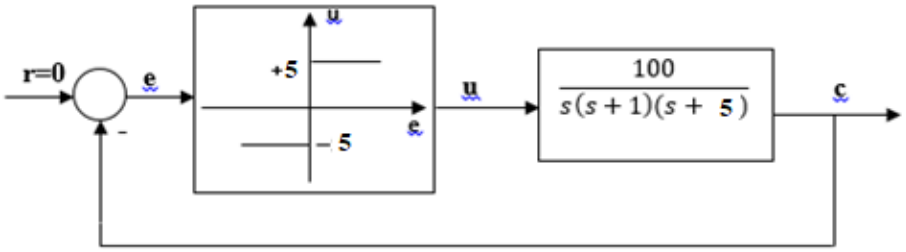
Group-B

Answer any three questions.

7. a) Why describing function method is also known as first harmonic linearization method? [2+8]
   b) Derive the describing function of dead-zone type nonlinearity.

8. Draw the phase trajectory starting from the state (0,5) for a system represented by the state model [10]
   $\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -1 & -1 \end{bmatrix} X(t)$
   Discuss about the stability of the system.

9. Use the describing function analysis to investigate the possibility of a limit cycle for the nonlinear system shown in figure below. If a limit cycle is predicted, determine its amplitude and frequency and investigate its stability. [10]



10. a) Determine the points of equilibrium for the non-linear system described by the differential equation [5+5]

$$\frac{d^2y}{dt^2} + x^2 + \left(\frac{dy}{dt}\right)^2 - 2y + \frac{dy}{dt} = 0$$

Also determine the nature of stability in the neighbourhood of each equilibrium states.

b) A linear system is described by the state equation

$\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} X(t); y(t) = [1 \quad 0] X(t)$

Investigate the stability of this system by Lyapunov's theorem.

Group-C

Answer any two questions.

11. a) Determine the z-transform of $F(s) = \frac{2(s+5)}{s(s+3)}$. [2+3+5]

b) Determine inverse z-transform of $F(z) = \frac{2z}{z^2+1}$.

c) A second order discrete-time system is described by the following difference equation

$y(k+2) - 2y(k+1) + y(k) = 2\delta(k)$

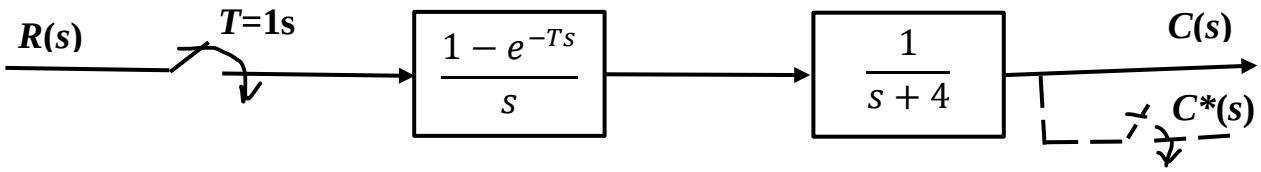
where $y(k) = 0$ for $k < 0$ and $\delta(k)$ is unit impulse sequence.

12. a) Find the transfer function in discrete domain [4+6]

$$y(k+2) + 2y(k+1) + y(k) = u(k)$$

Plot pole and zero in z-plane.

b) Obtain sampled-data transfer function of the following system for T= 1s.



13. a) Write Nyquist sampling theorem. [2+2+6]

b) Write two advantages of digital control system.

c) Consider the characteristic equation of a discrete-time system as- .

$$\boldsymbol{Q(z) = z^3 - 1.1z^2 - 0.08z + 0.2 = 0}$$

Determine the stability of the system using Jury's stability test.

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Aliah University

End-Semester Examination (Spring Semester) - 2021

(For 3rd Year 6th Semester BTech (EE))

Paper Name: Data Communication & Computer Networks **Full Marks: 80**
Paper Code: OCS302 **Time: 3 hrs**

Group-A

(Answer *all* questions) **5 × 2 = 10**

1. How does a LAN differ from a WAN?
2. What is piggybacking? Is it possible in unidirectional communication? If not, why?
3. An IPv4 datagram arrives with fragmentation offset of 0 and and *M* bit (more fragment bit) of 0. Is this a first fragment, middle fragment, or last fragment?
4. What is the significance of NAK (negative acknowledgement) in Selective Repeat ARQ?
5. What is the primary difference between Distance Vector Routing and Path Vector Routing?

Group-B

(Answer *all* questions) **6 × 5 = 30**

1. Briefly discuss about the different guided media that are used in computer networks and make a comparison among them. (5)

2. What do you mean by "vulnerable time" in medium access protocols? What is the vulnerable time of pure ALOHA? Justify it. (5)

3. Why is acknowledgment numbered in Stop and Wait protocol? Discuss the situation when unnumbered acknowledgments can create confusion in the sender and receiver end. (5)

4. What is the advantage of two dimensional parity over simple parity? Explain with suitable example. (5)

5. An IPv4 packet has arrived with offset value 80 (decimal) and value of HLEN field is 10 (decimal). The value of total length field is 200 (decimal).
   i. What are the first and last byte numbers respectively?
   ii. What is the length of the option field in header? (2.5 x 2)

6. Show the shortest form of the following IPv6 addresses.
   i. 2340: lABC:119A: A000: 0000: 0000: 0000: 0000
   ii. 0000:00AA:0000:0000:0000:0000:119A:A231
   iii. 2340:0000:0000:0000:0000:119A:A001:0000
   iv. 0000:0000:0000:2340:0000:0000:0000:0000
   v. 581E: 1450: 2314: ABCD: 0000: 0000: 0000: 1211 (1 x 5)

Group-C

(Answer *any four* questions) **4 × 10 = 40**

1. i. What is the purpose of Guard bands ? In FDM, suppose there are three signal sources each having bandwidth 300 MHz. Find the minimum bandwidth of the path if 10 MHz guard bands are used.
   ii. What is the remainder obtained at sender and receiver side by dividing $x^7 + x^5 + 1$ by generator polynomial $x^3 + 1$ using CRC? **(5+5)**

2. i. What is the difference between bit stuffing and character stuffing?
   ii. "In Go Back N ARQ, sender window size > 2^m–1." Is it correct? Justify.
   iii. Distinguish between a router and a bridge. **(3 + 4 + 3)**

3. i. Suppose a sender wants to send five 4 bit numbers to a destination. For error control it is using checksum technique. If the numbers are 6, 9, 11, 3, 7 respectively, what will be the checksum value send to the receiver?
   ii. A Class B network address 130.50.0.0 is subnetted as follows. The last 10 bits of the host id are allotted for host numbering and the remaining 6 bits are reserved for subnet numbering.
   a. How many subnets and no of hosts in each subnet are possible with the above addressing scheme?
   b. What are the starting addresses of the 1st and 4th subnets? **(5+5)**

4. i. What do you mean by an Autonomous System (AS)? What is the difference between Intra-AS and Inter-AS routings? Give an example of each routing protocol.
   ii. Explain the two node instability problem in RIP. What is the value of infinity to overcome this problem?
   iii. Why do we need a Time to Live (TTL) field in IPv4 datagram header? **(4 + 4 + 2)**

5. i. Compare the TCP header and the UDP header. List the fields in the TCP header that are not part of the UDP header. Give the reason for each missing field.
   ii.TCP opens a connection using an initial sequence number (ISN) of 14,534. The other party opens the connection with an ISN of 21,732. Show the three TCP segments during the connection establishment. **(5+5)**

ALIAH UNIVERSITY

B. TECH. SEM-4th

ELECTRICAL ENGINEERING

ONLINE END-TERM EXAMINATION, DECEMBER 2020

EE202 – ELECTRICAL MACHINES-I

Full Marks: 40] **[Time: 2 Hrs.**

INSTRUCTIONS: -

1. Mention the question number clearly.
2. **Answer briefly and to the point**
3. **Write your roll number in each page**

Answer Any Five (5) Questions (5X8=40)

1. Mention the difference between core and shell type transformers? Define, voltage regulation of a transformer. **[4+4]**

2. Why transformers are rated in kVA? Why do we perform an Open-circuit test and Short-circuit test on the transformer? **[4+4]**

3. The series field winding has low resistance while the shunt field winding has high resistance. Why? Explain the function of Commutator in DC machines. **[4+4]**

4. What do you mean by step-up and step-down transformers? A 1100/400 V, 50 Hz single phase transformer has 100 turns on the secondary winding. Calculate the number of turns on its primary. **[5+3]**

5. What happens if DC supply is applied to the transformer? What will be the result if the field circuit of a DC shunt motor is opened? **[4+4]**

6. What is synchronous speed? Derive synchronous speed for a supply frequency of 60Hz and 16 pole three phase Induction motor. What are the different types of starters used for 3-phase induction motor? **[2+2+4]**

7. State the functions of starter. What are the types of starters used in DC shunt and compound motors? What are the factors which control the speed of a DC motor? Explain briefly. **[4+4]**

8. How does a self-excited generator produce emf at starting? What is residual magnetism? **[4+4]**

9. What will be the rotor frequency at the time of starting and running condition of three phase Induction motor? Explain the reason of your answer. How can you reverse the direction of rotation of three phase Induction motor? **[6+2]**

10. Derive the expression for generated emf in case of a DC generator. State the differences between a dc generator and alternator? **[4+4]**

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Aliah University
Department of Electrical Engineering
B. Tech. 4th semester Examination December -2020

Sub: Electrical & Electronic Measurements **Code- EE 204**
Full Marks: 40 Duration: 2 hrs

Instruction: Use separate script for each group.

Group- A
Answer any four questions: (4 x 5 = 20)

1. Give the name and functions of different types of CRO. 5

2. Write down difference between transducers and inverse transducers? 5

3. Why do we need thermocouple and LVDTs? Give three basic factors for selection of a transducer. 2+3

4. The four arms of a Maxwell capacitance bridge at balance are unknown inductance L_x having inherent resistance R_x. The resistance $R_2 = 1\ k\Omega$ and $R_3 = 1\ k\Omega$ The capacitor of 0.5 mF in parallel with a resistance of 1000 Ω. Derive the equation for the bridge and determine the value of L_x and R_x. 5

5. What are the limitations of Hay bridge? A Lissajous pattern on the oscilloscope is stationary having '8' vertical maximum values and '6' horizontal maximum values. Calculate the frequency of vertical input if the frequency of horizontal input is 1800 Hz? 5

Group - B
Answer any four questions: (4 x 5 = 20)

1. Define ratio error and phase angle error of a current transformer. Draw the phasor diagram of a current transformer. Why secondary side of the current transformer is always shorted? 2 + 2 + 1

2. Define precision, accuracy, sensitivity of an instrument meter. What is meant by absolute error and percentage error? 3 + 2

3. Explain the working principle of PMMC meter. 5

4. Explain one method of measuring low value of resistance. 5

5. Prove that two wattmeters are required to measure total power in a three-phase circuit. 5

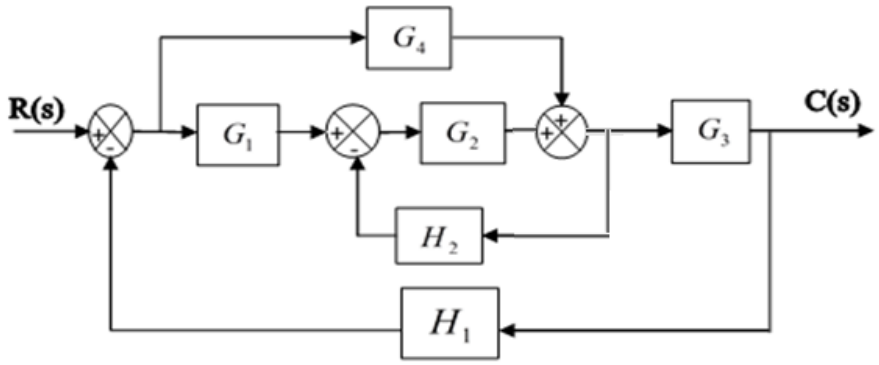
Aliah University
End-Term Examination, 2017
Subject: Control System; Code: EE303
3rd Year; 5th Semester; Department- EE & ECE

Time: 3 Hours Total Marks – 80

. **Answer Q.1 and any seven from the rest**

1. a) Distinguish between closed-loop and open-loop control systems. [2]
   b) The expression of step response of a system is: $c(t) = 1 - e^{-2t}(cos3t + 4sin3t)$. Determine the expression for impulse response of the system. [2]
   c) What is BIBO stability criterion? [2]
   d) Define gain-margin and phase-margin. [2]
   e) The characteristic equation of a system is $s^2 + 2s + 1 = 0$. Calculate the value of maximum overshoot when the system is excited by unit step input. [2]

2. a) State Mason's gain formula. [3+7]
   b) Consider the block diagram of a system as shown in Fig. below. Determine the overall transfer function of the system.



3. a) Develop the block diagram of a field control D.C motor. Also find out the transfer function $G(s) = \frac{\omega(s)}{E_F(s)}$; where, $\omega(s)$ is the angular velocity of the rotor shaft & $E_F(s)$ is the voltage applied to the field winding of the motor. [5+5]
   b) A unity feedback system is characterized by the open-loop transfer function- $G(s)H(s) = \frac{20}{s(s+4)(s+6)}$. Determine its static error constants.

4. Sketch the root locus diagram as K is varied from zero to infinity for the system whose open-loop transfer function is given by $G(s)H(s) = \frac{K}{s(s^2 + 4s + 8)}$. Also find the value of K for which the closed-loop system will have damping ratio ζ=0.5.(Use graph paper) [10]

5. a) State & explain Routh's stability criterion. [4+6]
   b) The characteristic equation of a system is given by -
   $s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$
   Using Routh's stability criterion, establish whether the system is stable or not.

6. Using Nyquist stability criterion, determine the stability of the system whose open loop transfer [10]

function is given by- $G(s)H(s) = \frac{10}{s(s+2)(s+1)}$.

7. Consider the open loop transfer function of a closed-loop control system as [10]
$G(s)H(s) = \frac{10}{s(0.5s+1)(s^2+s+4)}$. Draw the Bode plot. Determine gain margin and phase margin and find stability of closed -loop system (Use semi-log graph paper).

8. a) Draw the typical response curve of a second order underdamped system for a unit step input. [5+5]
Define rise time, maximum-overshoot and settling time indicating them on the response curve.
b) Consider the closed-loop transfer function of a system $G(s) = \frac{25}{(s^2+4s+25)}$. Determine rise-time and settling-time of the system when system is excited by unit step input.

9. a) Draw the op-amp realization circuit of PI controller and determine its transfer function. [5+5]
b) Consider a system with $G(s) = \frac{25}{s(s+4)}$ and H(s) =1. Design a feed-forward PD controller so that the damping ratio of the closed loop system becomes 1 and natural frequency of oscillation becomes 4 rad/sec.

10. Write short notes on any **two** of the following. [5+5]
a) Lead compensator
b) Tacho generator
c) Synchro pair

Aliah University

Department of Electrical Engineering

End Term Examination Question Paper, Autumn - 2020-21

B. Tech.(EE) 3rd Year 5Th Semester

Subject Code: EE-305 Subject Name: Power System-I

Full Marks: 80 Time: 3 Hrs. + Half Hr. for uploading

Faculty Name: MKB (GF)

You should clearly mention the Question No. in the left margin of your answer sheet
Write your answer neatly as practicable as possible
The figure drawn in the answer sheet should be clear
All part of a question should be answered at one place
Answer paper file name should be as (Your roll no. like EEN123456)_EE305

Answer any five out of eight **[16X5=80]**

1) A. Name three types of conductor along with number of strands and their material used in high voltage transmission lines like 132KV and above. **[6]**

B. Why bundle conductor is used in H.V. lines? Explain clearly with diagram two types of bundle conductor. **[5+5]**

2) A. A 3 phase 50c/s transmission line of length 1,00,000 meter delivering a power of 110 KV, 20,000 KW at lagging p.f. of 0.85. The per phase per KM resistance and reactance of the line are 0.4 Ω and 0.6 Ω respectively, while the capacitance admittance is 0.0000025 siemen/KM/phase. Using nominal T method calculate: (i) the current at sending end, (ii) voltage at sending end and efficiency of transmission. **[6+6+4]**

3) A. A 3-phase transmission line of length 200 KM delivering a load of 20 MW with a constant voltage of 110 KV at 0.85 p.f. lagging. The resistance/ph/KM is 0.15 Ω, reactance/ph/KM is 0.26 Ω and shunt admittance/ph/KM is 0.0000016 S. Using rigorous method calculate the sending end voltage. **[16]**

4) A. A single-core cable has a conductor diameter of 2 cm and insulation thickness of 0.5cm. If the specific resistance is $6x10^{14}$ Ω-cm, calculate the insulation resistance for 5 km length of cable. **[5]**

B. A 33 KV single core cable has a conductor diameter of 2 cm and a sheath of inside diameter 5 cm. Find the maximum and minimum stress in the insulation. **[4+4]**

C. Find the most economical value of diameter of a single-core cable to be used on 66 KV, single phase system. The maximum permissible stress in the dielectric is not to exceed 50kV/cm. **[3]**

5) A. The capacitance per kilometer of a 3-phase belted cable is $0.35\mu F$ between the two cores with the third core connected to the lead sheath. Calculate the charging current taken by 5 kilometers of this cable when connected to a 3-phase, 50 Hz, 11kV supply. **[5]**

B. The capacitances of a 3-phase belted cable are $12.5\mu F$ between the three cores bunched together and the lead sheath and $7.5\ \mu F$ between one core and the other two connected to sheath. Find the charging current drawn by the cable when connected to 66kV, 50 Hz supply. **[6]**

C. The capacitance per kilometer of a 3-phase belted cable is $0.17\mu F$ between the two cores with the third core connected to the lead sheath. Calculate the kVA taken by 20 kilometer long cable when connected to 3-phase, 50 Hz, 3300 V supply. **[5]**

6) A. In a 33 kV overhead line, there are three units in the string of insulators. If the capacitance between each insulator pin and earth is 12% of self-capacitance of each insulator, find (i) the distribution of voltage over 3 insulators and (ii) string efficiency. **[8]**

B. What are the kV and kilo-newton rating of a disk insulator. **[2]**

C. How much maximum load can be used in horizontal string insulator having 11 disk and 15 disk in the string. **[1+1]**

D. How the corona effect can be reduced in string insulator? describe with diagram. **[4]**

7) A. A transmission line a span of 270 meters between level supports. The conductor has a diameter of 20 mm, weighs 0.9 kgf/m and has an ultimate breaking strength of 8000kgf. Each conductor has a radial covering of ice 9 mm thick and is subjected to a horizontal wind pressure of 50 kgf/sq.m of the ice covered projected area. If the factor of safety is 2, calculate the deflecting sag and vertical component of the sag. One cubic meter of ice weighs 913.5 kgf. **[8+8]**

8) A. What is the function of Distributor? Name four type of distributor. Describe and explain the advantages and disadvantages of any two types with their drawings. **[2+2+6+6]**

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Aliah University
Department of Electrical Engineering
B. Tech. VI semester Examination August -2021

Sub: Switchgear & Protection **Code- EE 306**
Full Marks: 80 Duration: 3 hrs

Instructions:
1. Please write all the parts of a question at one place.
2. Write from your own understanding in your own words; don't simply copy from website/notes/books etc.
3. 'Less accurate but original' answers may fetch better marks than the 'more accurate copied' ones.
4. Apart from writing the answers in one's own handwriting, the diagrams/figures/waveforms etc. must also be drawn by the candidate himself/herself. Any drawing, found to be otherwise, may attract penalty marks deduction.

Answer any four (4 X 20 = 80 marks)

1. **(a)** Describe the operation of any one type of SF_6 circuit breaker. Also mention the advantages-disadvantages of SF_6 and vacuum circuit breakers. **[8]**

(b) Explain how the energy from arc itself is utilized to extinguish the arc in circuit breakers like Air Break and Minimum Oil types. **[7]**

(c) The no load magnetizing current of a 50 MVA, 220/66 kV transformer was found to be 4% of the rated current. Find the maximum voltage that may occur across the circuit breaker contacts when the magnetizing current is interrupted at 50% of its peak value. Take system capacitance as 5000 pF. **[5]**

2. **(a)** With the help of a neat waveform, explain the various voltages and currents that appear in the circuit breaker during arc interruption process. Also derive the expression for restriking voltage. **[15]**

(b) What is current chopping phenomenon with respect to the circuit breaker? **[5]**

3. **(a)** What are the differences between a normal power transformer and a current transformer (CT)? Also discuss the differences between metering CTs and protective CTs. **[7]**

(b) What are PSM and TMS with reference to the protective relays? Discuss some of the relay (time-current) characteristics. **[10]**

(c) Discuss the incorrect and correct methods of CT selection for the differential protection of busbars. **[3]**

4. **(a)** What are the issues with simple differential protection scheme? How they can be overcome using biased differential protection? **[10]**

(b) Discuss the various abnormal conditions in large rated alternators, their possible effects and their remedies. **[10]**

5. **(a)** With the help of equations, explain the issue of magnetic current inrush in a transformer with respect to its protection? How it can be dealt with? **[10]**

(b) What are the possible electrical faults in 3-phase induction motors and their corresponding protection measures? **[10]**

6. **(a)** Describe the circuit, waveform and operation of few of the basic elements used in static and numerical relays. **[12]**

(b) Discuss the advantages of and issues with the numerical relays. **[8]**

Aliah University
Department of Electrical Engineering
B. Tech. V sem Examination March -2021

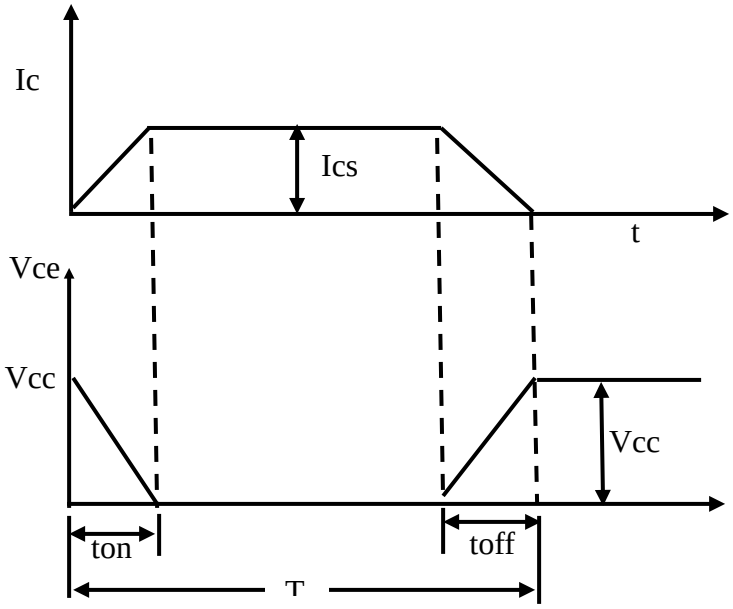
Sub: Power Electronics **Code- EE301**
Full Marks: 80 Duration: 3 hrs

Instruction: 1. Write from your own understanding in your own words; don't simply copy from website/notes/books etc.
2. Avoid mixing-up the answers of different groups.

Group-A
(Answer any Four: 4X10=40)

1. Explain the forward bias and reverse bias on the depletion layer in a p-n junction.
For a power diode, the reverse recovery time is 3.9μsec and the rate of diode-current decay is 50A/μs. For a softness factor of 0.3, calculate the peak inverse current and the storage charge.

2. Why α is less than 1 and β is more than 1 in BJT?



For the typical switching loss shown in above waveform of a power transistor find the instantaneous power loss during the t_{on} and t_{off} interval. I_{CS}= 80A, V_{CC}=220V, t_{on}=1.5μs and t_{off} = 4μs.

3. Compare the output characteristics and derive average output voltages of a single phase halfwave rectifier supplying a R-L load with freewheeling diode and without freewheeling diode.

4. For a three-phase full converter draw the input/ output voltage waveform for triggering angle 60^0 and 150^0.

5. Why a series of pulse or continuous gate pulse is required for an ac voltage controller when driving a R-L load. Explain with proper diagram.
For an integral cycle control ac voltage controller derive the output voltage if x1 is the number of cycles load is energized from the supply and x2 is the number of cycle load is disconnected from the source.

6. Draw the circuit diagram and input output voltage and current waveform of a bridge type cycloconverter to convert *f* frequency input supply to *f*/3 frequency output voltage. Consider the load current is continuous.

Group-B
Section-I: (Answer any Five: 5 X 7 = 35 Marks)

7. What are the safe and unsafe ways of triggering a thyristor? Explain the latching mechanism of thyristor with the help of two-transistor model.

8. With the help of multiple waveform examples, explain clearly the various control strategies for dc choppers. Discuss their merits and demerits.

9. Derive the Fourier series expression for the output voltage from any one type of voltage source inverter.

10. For a three-phase 180^0 mode bridge inverter feeding a star connected resistive load, sketch line to line voltage waveform for any one line (graph paper not compulsory but can be used if desired). From this waveform, calculate the rms value of line voltage. Take source voltage as 'V'.

11. A star connected load of 20 Ω per phase is fed from 500 V dc source through a three-phase bridge inverter. For both (a) 180^0 mode and (b) 120^0 mode, calculate
(i) RMS value of load current and (ii) power delivered to the load

12. Discuss the need for SMPS. Describe any one configuration of SMPS.

Group-B
Section-II: (Answer any One: 1 X 5 = 05 Marks)

13. A 120 V battery supplies RL load through a step-down chopper. A freewheeling diode is connected across the load having R = 6 Ω & L = 60 mH. Load current varies between 8 A & 12 A. Calculate time ratio T_{on}/T_{off} for this chopper.

14. A dc battery is to be charged from a constant dc source of 200 V via a step-down chopper. The battery is to be charged from its internal emf of 94 V to 134 V. The battery has internal resistance of 0.5 Ω. For a constant charging current of 12 A, compute the range of duty cycle.

Name of the Subject: **Power Electronics**
Subject Code: **EE 301**
Contact Hours: 3L + 1T Credit: 4

Module No.	Topics	Allotted Hours
1	**Introduction:** Concept of Power Electronic System, Scope & Applications, Classification of Power Processors & Converters	2
2	**Power Semiconductor Devices:** **Power Diodes:** Structure, I-V and Reverse Recovery Characteristics, Diode Equation, Types of Power Diode. **Power Transistors & Power MOSFETs:** Structure, Steady State and Switching Characteristics. **IGBTs:** Basic Structure, Equivalent Circuit, Output, Transfer & Switching Characteristics, Latch-ups in IGBTs. **Thyristors:** Construction & Operation, I-V Characteristic & Operating Modes, Two-Transistor Model, Turn-On Methods, Thyristor Turn-Off. Introduction to GTO, UJT, DIAC & TRIAC	8
3	**AC – DC Converters (Rectifiers):** **Diode Rectifiers:** Introduction, Single-phase Half Wave Rectifier with R & R-L Loads, Effect of Freewheeling Diode, Single-phase Full Wave Rectifier with R & R-L Loads, Performance Parameters. **Controlled Rectifiers:** Single-phase Half Wave & Full Wave Controlled Rectifiers with R & R-L Loads, Freewheeling Diode, Single-phase Semi Converter, Single-phase Dual Converter, Effect of Source Impedance. **Three-phase Rectifiers:** Three-phase uncontrolled and controlled rectifiers.	14
4	**DC – DC Converters (Choppers):** Introduction, Basic Chopper Classification, Principle of Chopper Operation (Step-Down Chopper), Step-Up Chopper, Step-Up/Down Chopper, Control Strategies.	6
5	**DC – AC Converters (Inverters):** Introduction & Classification, Single-phase Half Bridge and Full Bridge Inverters with R & R-L Loads, Shoot-Through Fault, Performance Parameters. 120^0 and 180^0 Three-phase Inverters. Voltage Control of Single-phase Inverters, External Control, Internal Control (PWM), Single-Pulse Modulation, Multiple-Pulse Modulation, Sinusoidal Pulse Modulation (SPWM). Introduction to Current Source Inverter (CSI) and Thyristor Inverters.	12
6	**AC – AC Converters:** **AC Voltage Controllers:** Introduction, Principle of Phase Control, Principle of Integral Cycle Control, Single-phase Voltage Controllers with R & R-L Loads, Introduction to Cycloconverter.	4
7	**Applications:** SMPS and UPS overview	2

Text Books:

1. M. H. Rashid, "Power Electronics: Devices, Circuits, and Applications", Pearson Education
2. P. S. Bimbhra, "Power electronics", Khanna Publishers

Reference Books:

1. Ned Mohan, Tore M. Undeland & William P. Robbins, "Power Electronics: Converters, Applications and Design", John Wiley & Sons
2. M. D. Singh & K. B. Khanchandani, "Power electronics", Tata McGraw-Hill
3. Bimal K. Bose, "Modern Power Electronics & Ac Drives", Prentice-Hall of India

Aliah University

Electrical Engineering Department

End Term Examination 2018

Subject: Signal & Network (EE 201)

Time: 3 hrs **Full Marks: 80**

Answer any four questions from group A and four questions from group B. Symbols have its usual meaning. Use separate script for each group

Group A

1. **a. Describe about ideal voltage source with the graph V(t) vs t plot .** **2**

   b. Find the Laplace transform of **4**

   c. Find the Laplace transform of h(t) in Fig.1 **4**

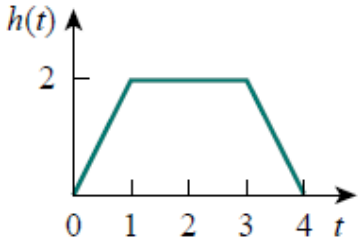


Fig. 1.

2. **State Thevenin's theorem. Obtain the Thevenin's equivalent at the terminal a-b in Fig. 2.** **3+7=10**

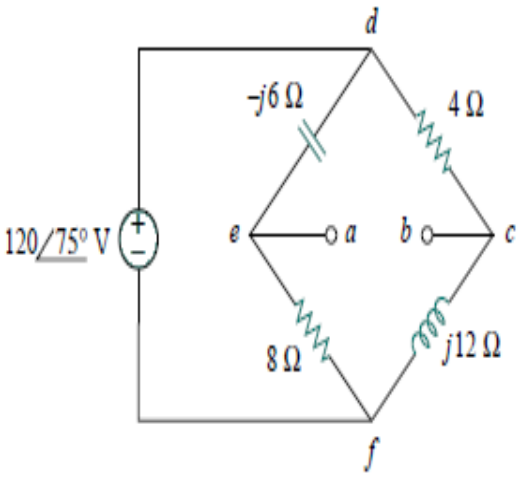


Fig. 2.

3. **Find I_0 in Fig. 3 using superposition theorem**

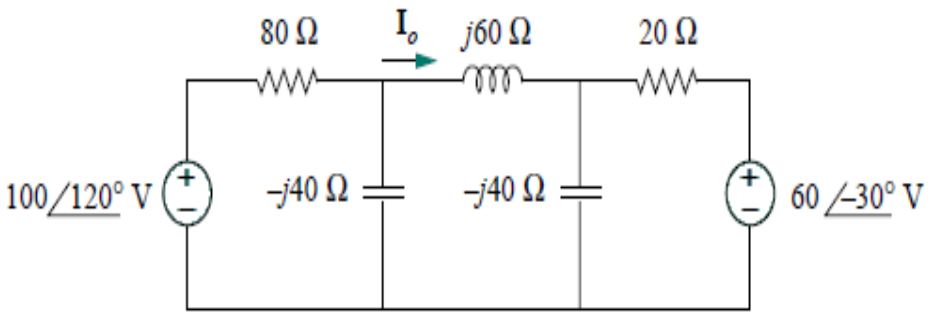


Fig. 3.

4. **What do you mean by super node and super mesh? Find out node voltages in the circuit shown in Fig. 4. using nodal analysis method: 3+7=10**

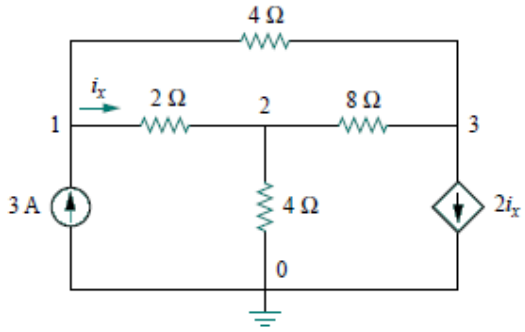


Fig. 4.

5. **Find $V_0(t)$ in Fig. 5. assume zero initial condition. [Use Laplace and inverse Laplace transform method] 10**

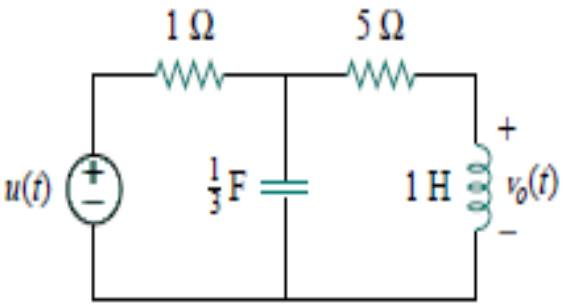
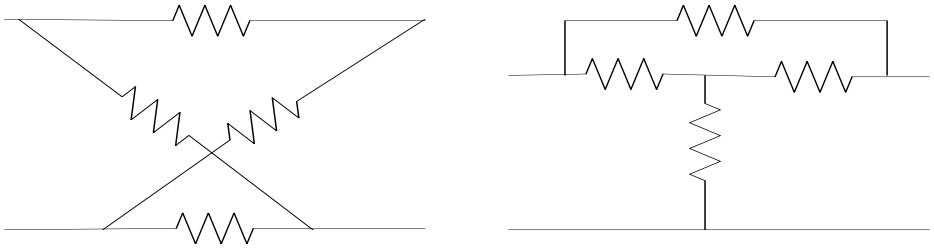


Fig. 5.

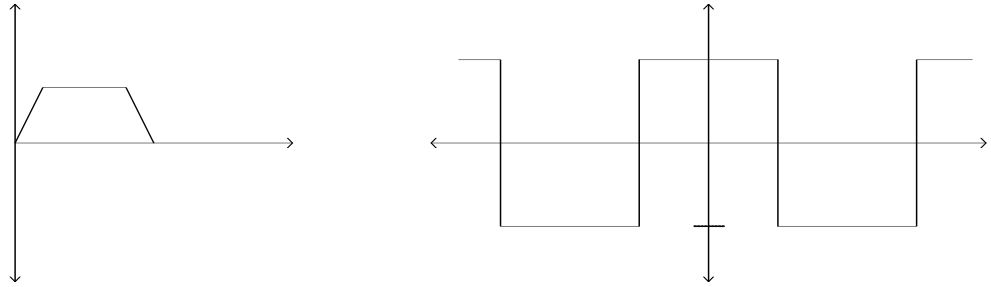
Group B

6. **(a) Obtain '*Z*'-parameter of the lattice network shown in Fig 6(a).**



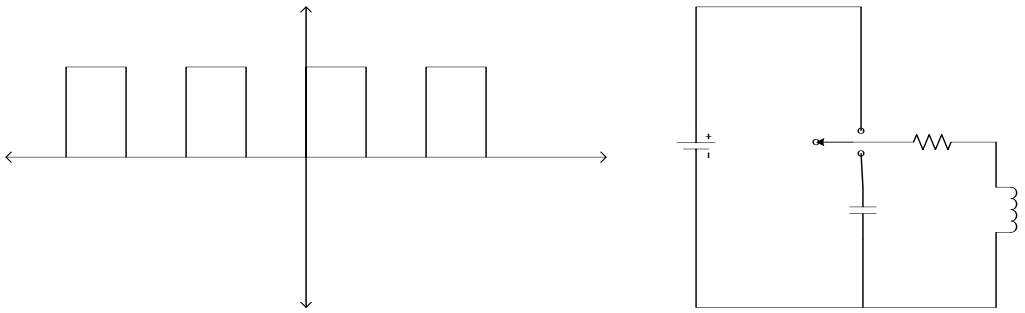
(b) Obtain '*Y*'-parameter of the network shown in Fig 6(b). **5 + 5**

7. **(a) A partial waveform is shown in Fig 7(a). Sketch the complete waveform if it has (i) odd order sine terms, (ii) even order sine terms, (iii) odd order cosine terms and (iv) dc and even order cosine terms in its Fourier series expansion.**



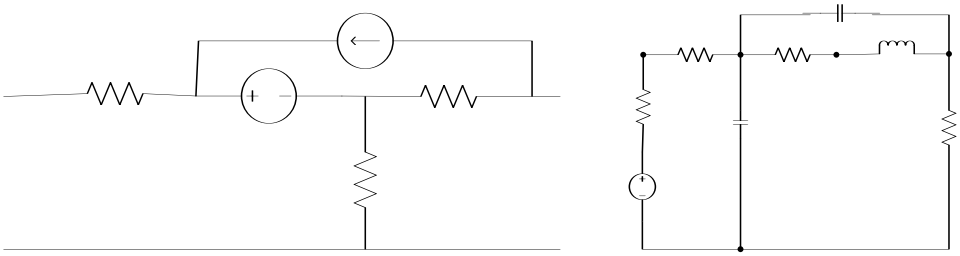
(b) Obtain Fourier series expansion of the waveform shown in Fig 7(b). **4 + 6**

8. **(a) Extract odd and even function of the waveform shown in Fig 8(a).**



(b) In the circuit shown in Fig 8(b), switch S is changed from position '*1*' to '*2*' at *t=0*. Find values of *i, di/dt,* d^2i/dt^2 at $t=0^+$. **5 + 5**

9. **(a) Determine the '*h*'-parameter of the network shown in Fig 9. Hence determine '*Z*'-parameter of the same network.**



(b) A 2-port network is defined by the following pair of equations: $I_1 = 2V_1 + V_2$, $I_2 = V_1 + V_2$. Find '*T*' parameters. **7 + 3**

10. (a) Define tree, twig and link of an oriented graph.

(b) Draw an oriented graph of the network shown in Fig 10. Hence draw a tree from that graph.

(c) Obtain incidence matrix from the tree you have obtain. **3 + 4 + 3**

---------X---------