TE(Elect), Sem-Ⅴ. Re-exam, control system-Ⅰ,

BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

MunshiNagar,Andheri(West),Mumbai 400 058

[An Autonomous Institution Affiliated to University of Mumbai]

Re-Examination

SEM/CLASS: V   TOTAL MARKS: 100

SUBJECT: Control System-I (TE (Elect), sem-Ⅴ)   DURATION: 3 HOUR

Note: 1. Attempt any FIVE question out of SEVEN questions.

2. Answers to all sub questions should be grouped together.

3. Figures to the right indicate full marks.   Master

4. Assume suitable data if necessary and justify the same.

Q1 a)   Reduce the block diagram shown in **Fig. 1** to a single block $T(s) = \dfrac{C(s)}{R(s)}$.   (10)
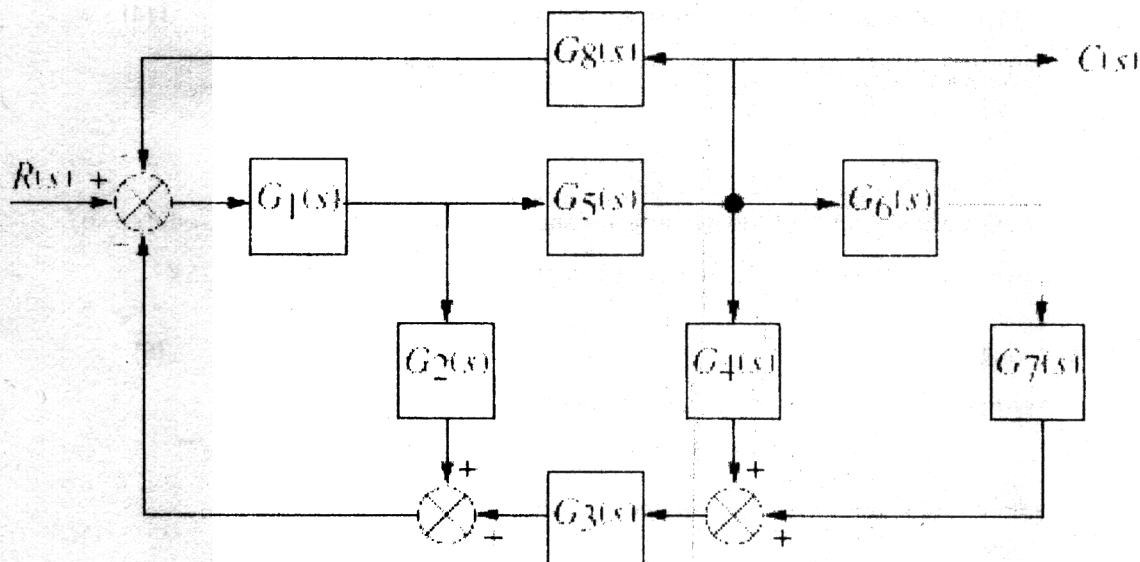

Fig. 1 Block diagram for Q1 a)

Page - ①

Q1 b) Find transfer functions Y/R for SFG shown in **Fig.2**.　　　　　　　　　**(10)**
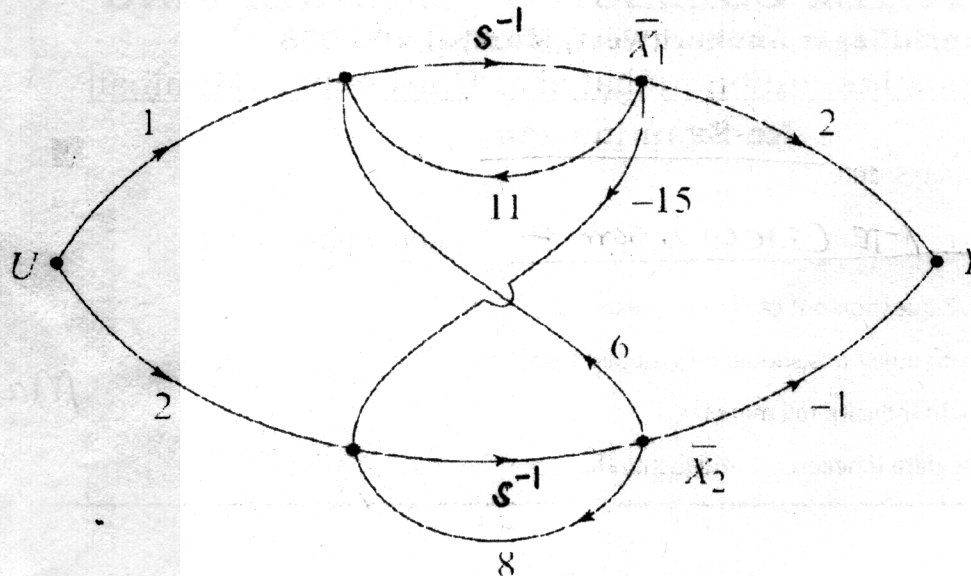

Fig.2 Signal Flow Graph (SFG) for Q1 b)

Q2 a) The open loop transfer function of a unity feedback system is given by　　　**(14)**

$$G(s) = \frac{K}{s(Ts+1)}$$

Where K and T are positive constants. By what factor should the value of gain "**K**" be reduced so that the peak overshoot of unit-step response of the system is reduced from 75% to 25%?

Q2 b) Define the following　　　　　　　　　　　　　　　　　　　　**(6)**

1. Asymptotic Stability　　　2. BIBO Stability　3. Relative Stability

Q3 a) A negative unity feedback system with forward path transfer function

$$G(s) = \frac{K(s+\alpha)}{(s+\beta)}$$ has to be designed such that

(i) the steady-state position error for a ramp input is 0.1 and

(ii) closed-loop poles will be located at $-1 + j$

Find K, α and β to meet the specifications.　　　　　　　　**(15)**

page ②

Q3 b) For the root locus plot shown in **Fig.3** Mention the value/range of the gain K for which

1. Closed loop system is stable.
2. Closed loop system is unstable.

Also approximately list of the following

1. Break-away and Break-in points.
2. Location of centroid.
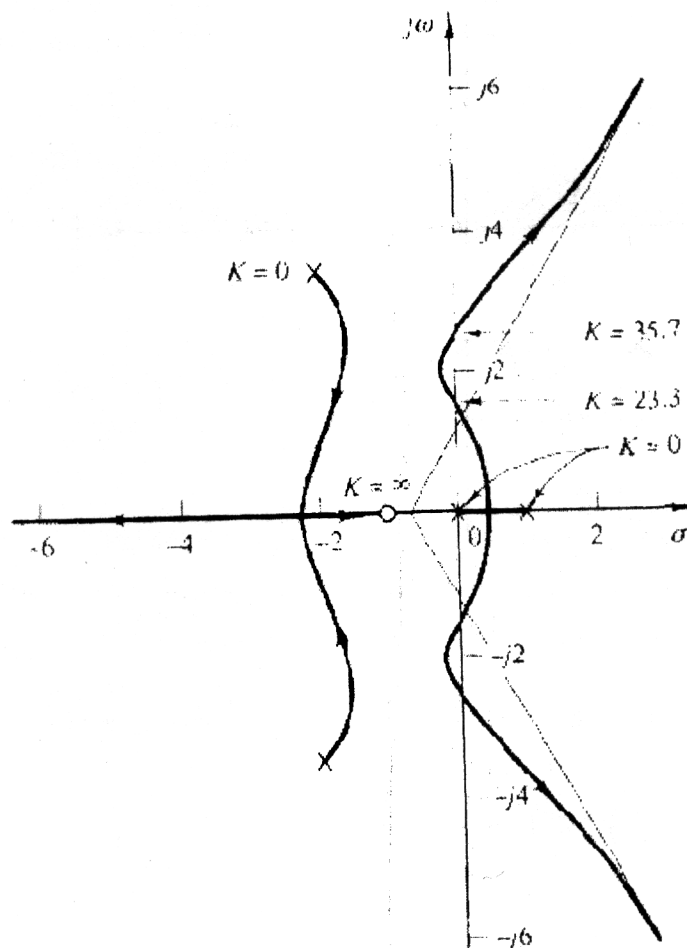3. Value of gain K for closed loop system to be critically damped.

(5)

Fig.3 Root Locus Plot for Q3 b).

page - ③

V

Q4a)(1) Using Routh criterion determine the relation between K and T so that unity feedback control system whose open loop transfer function given below is stable

$$G(s) = \frac{K}{s\left[s(s+10)+T\right]}$$

(6)

(2) Determine the modified relation between K and T if all the roots of characteristics equation as determined in (1) are to lie to the left of the line $s = -1$ in s-plane. (9)

Q4 b) Pole/Zero plot of five systems i.e. A,B,C,D and E are shown in Fig. 4. Comment on the stability of each system. (5)
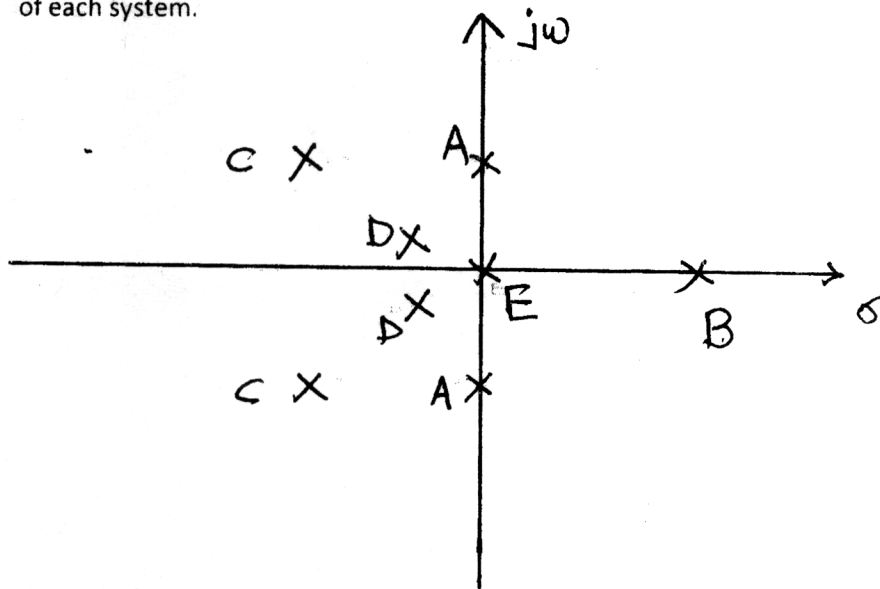
Q5a) (1) Describe inbrief the time domain interpretation of Proportional, Integral and Derivative control separately and not as a combine PI,PD or PID control. (6)

a) **(2)**Unit step response of the first order unity feedback system is given by

$$c(t) = 1 - e^{-t/100}$$

Determine its (4)

a.   Open loop transfer function.

b.   Closed loop transfer function.

c.   Steady state error for step input.

d.   Steady state error for ramp input.

Page - ③

Q5b) Prove the following statement

"The asymptotes cross the real axis at a point known as centroid, determined by the relationship:
(sum of real parts of pole – sum of real parts of zeros)/ (number of poles – number of zeros)".   **(10)**

Q6) A unity feedback system with forward transfer function

$$G(s) = \frac{K}{(s+15)\left[s^2 + 6s + 13\right]}$$

is operating with 30% overshoot.
  a. Find the transfer function of a cascade compensator, the system gain, and the dominant pole location that will cut the settling time in half if the compensator zero is at -7.
  b. Find other poles and zero's and discuss your second-order approximation.

                                                                        (15+5)

Q7) Consider the unity feedback system with   **(10+10)**

$$G(s) = \frac{K}{(s+3)(s+5)}$$

  a. Show that the system cannot operate with a settling time of **0.667 second** and a percentage overshoot of 1.5% with simple gain adjustment.
  b. Design a lead compensator so that the system meets the transient response characteristics of part **a.**

Page 5

BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

Munshi Nagar,Andheri(West),Mumbai 400 058

[An Autonomous Institution Affiliated to University of Mumbai]

END SEMESTER

SEM/CLASS **V** / TE (Elect)   TOTAL MARKS: 100

SUBJECT: Control System - I   T·E(Elect), Sem-V   DURATION : 3 HOUR

DATE : 30/10/2014

Master

Note: 1. Attempt any FIVE question out of SEVEN questions.

2. Answers to all sub questions should be grouped together.

3. Figures to the right indicate full marks.

4. Assume suitable data if necessary and justify the same.

Q1 a)   Consider the armature controlled d.c. motor shown in Fig.1 . In this system ,

|		
R_a	-	Resistance of Armature (ohm)
L_a	-	inductance of armature winding (H)
i_a	-	armature current (A)
i_f	-	field current (A)
e_a	-	applied armature voltage (V)
e_b	-	back emf(V)
T_M	-	torque developed by motor (Nm)
Θ	-	angular displacement of motor-shaft (rad)
J	-	equibvlaent moment of inertia of motor and load referred to motor shaft (kg-m^2)
fo	-	equivalent viscous friction coeffecient of motor and load referred to motor shaft.
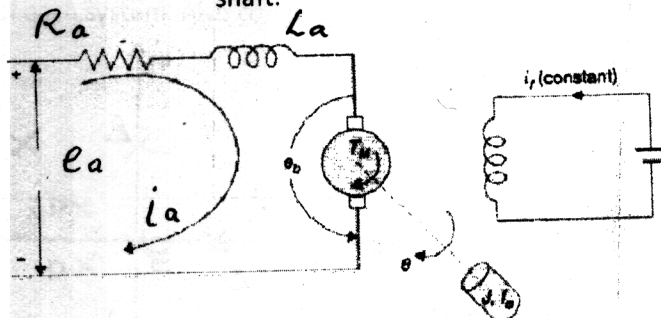
Fig. 1 Armature Controlled D.C. Motor

Derive the transfer function $G(s) = \theta(s)/E_a(s)$ and also draw the complete block diagram for the same.

(10)

Q1 b) Find transfer functions Y_1/R_1 and Y_2/R_2 for SFG shown in Fig. 2. (10)
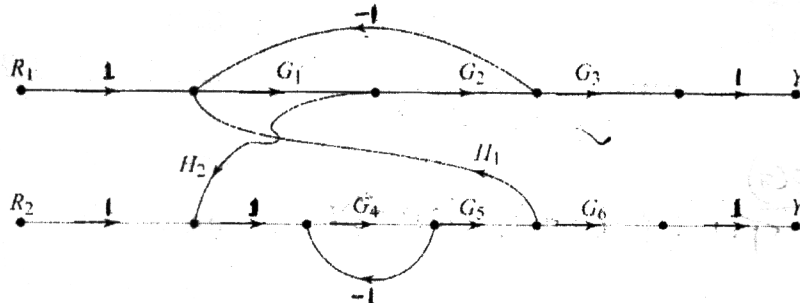

Fig.2 Signal Flow Graph (SFG)

Q2 a) Fig. 2 shows the step response for second order system. Tolerance band for the settling time is also shown in the figure. Determine following from the figure

1. Damping ratio and natural frequency of oscillation of the system.
2. Transfer function of the system.
3. Steady state error.

Fig.2 Step Response for Q2 a) (7)

Q2 b) Fig. 3 shows the step response for second order system. Determine following from the figure

1. Damping ratio and natural frequency of oscillation of the system.
2. Transfer function of the system.
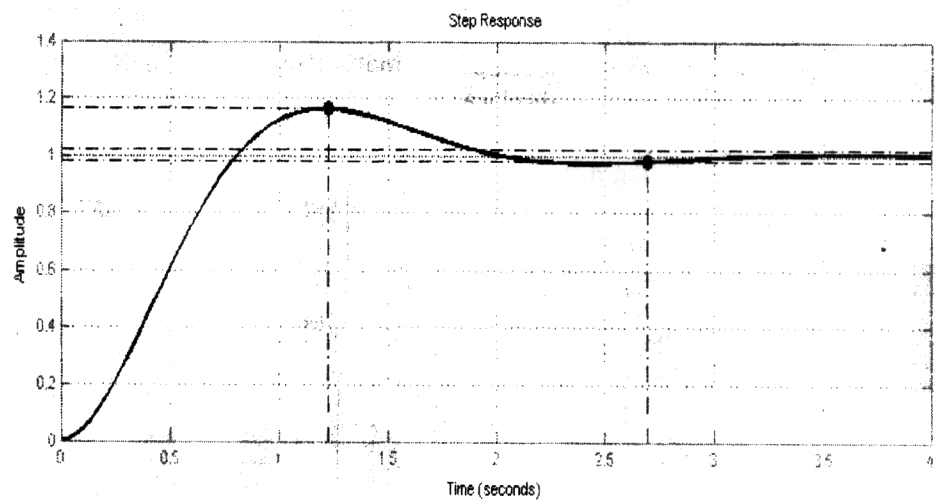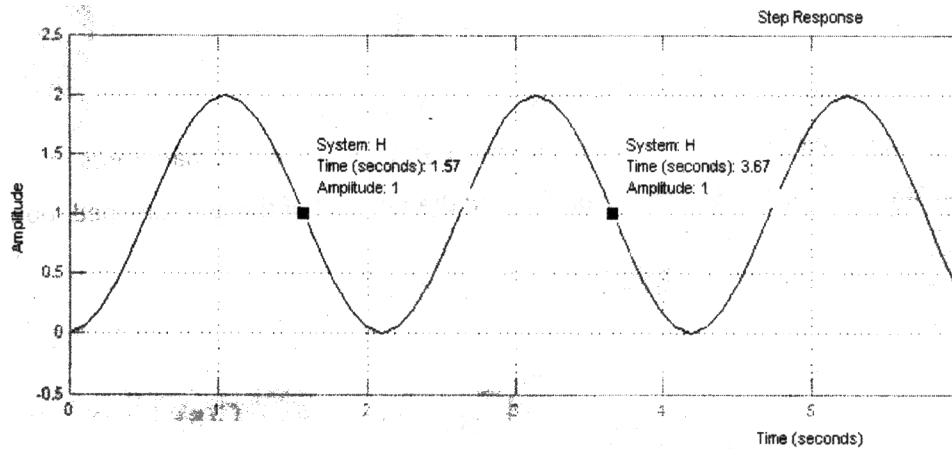3. Steady state error.

Fig.3 Step Response for Q2 b) (7)

Q2 c) Measurements conducted on a servomechanism shows the system response to be

$$c(t)= 1+ 0.2e^{-60t} - 1.2 e^{-10t}$$

when subjected to a unit step input.

a) Obtain the expression for the closed loop transfer function.

b) Determine the undamped natural frequency and damping ratio of the system.

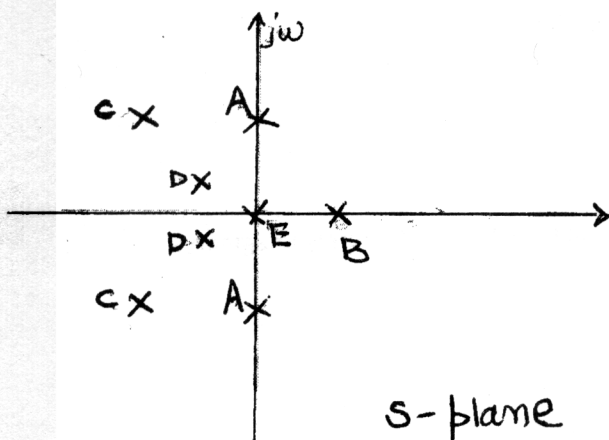c) Determine the steady state error.

(6)

Q3 a) Define the following (6)

       1. Asymptotic Stability   2. BIBO Stability 3. Relative Stability

Q3 b) Pole/Zero plot of five systems i.e. A, B, C, D and E are shown in **Fig. 4.** Comment on the stability of each system. Also comment on the comparison of relative stability between system C and D.

(6)

Fig.4 Pole/Zero plot for Q3 b)

Q3 c) For the feedback control system shown in Fig. 5

  a) Find the limiting values of 'K' for system to be stable

  b) For the value of K found in part **a)** find the magnitude of the imaginary roots.

  c) For the value of K=0.5 of that in part **a)** find the real part of the least damped root.

(8)

R(s) → (+) (−) → $\dfrac{K(s+25)}{s(s+5)}$ → C(s), feedback block $\dfrac{1}{s+15}$
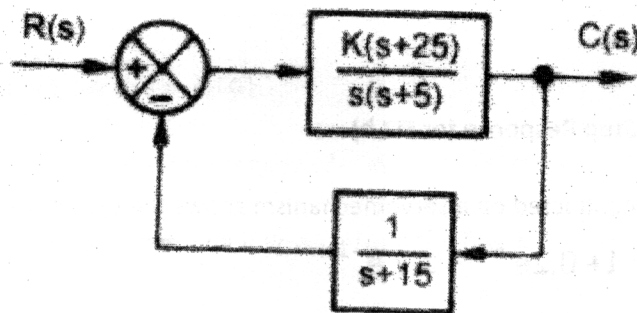
Fig.5 Figure for Q3 c)

Q4 a) Prove the following statement

"The asymptotes cross the real axis at a point known as centroid, determined by the relationship: (sum of real parts of pole – sum of real parts of zeros)/ (number of poles – number of zeros)".   **(10)**

Q4 b) Root locus for the system is shown in Fig. 6. Determine the following   **(10)**

  1. Open loop transfer function of the system i.e. G(s) H(s).
  2. Angle of asymptotes.
  3. The centroid.
  4. Breakaway points.
  5. Value of gain K for which close loop system will have two roots purely imaginary.

Page 4
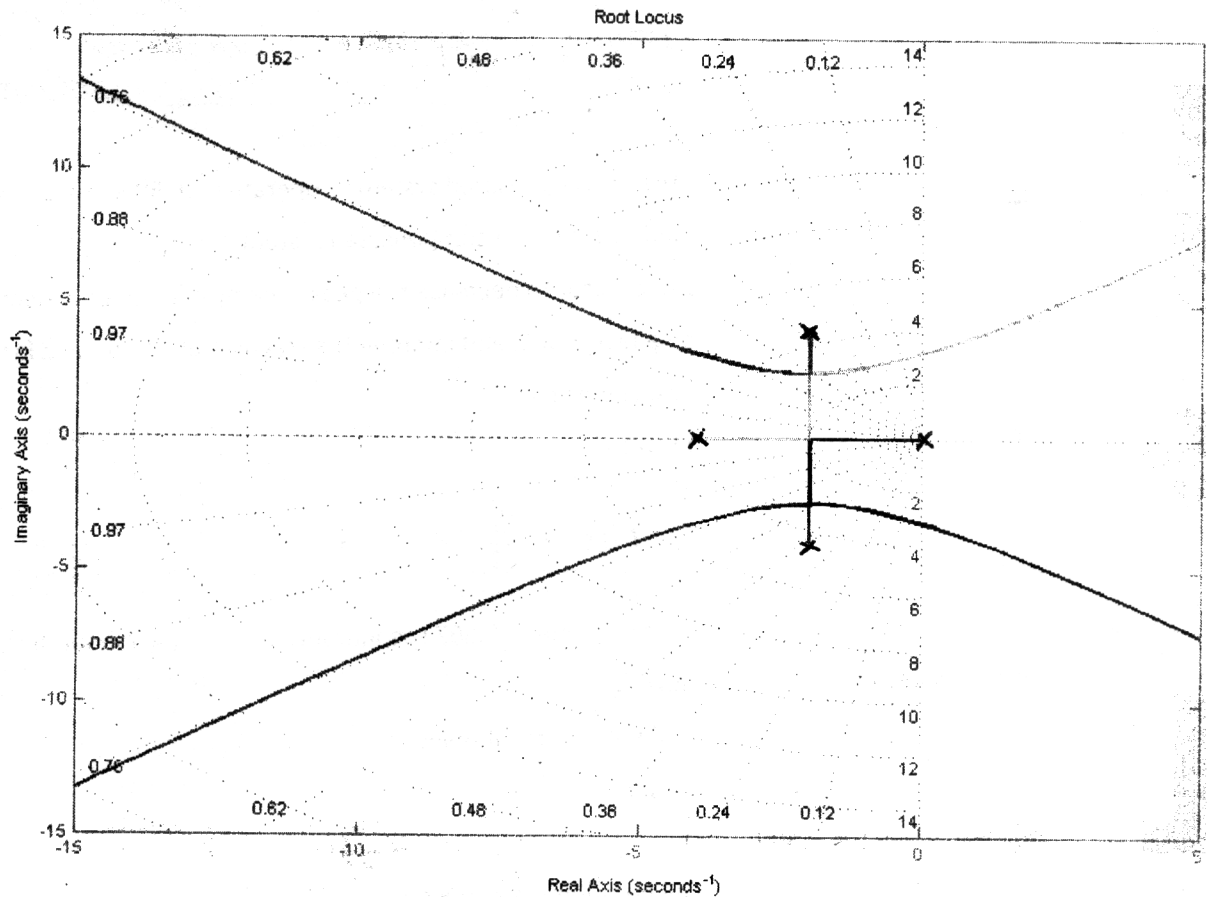
Fig.6 Root locus for Q4 b)

Q5) Consider the unity feedback system with   (20)

$$G(s) = \frac{K}{(s+4)^3}$$

a. Find the location of the dominant poles to yield a 1.6 second settling time and an overshoot of 25%.

b. If a compensator with a zero at -1 is used to achieve the conditions of Part a. what must the angular contribution of the compensator pole be?

c. Find the location of the compensator pole.

d. Find the gain required to meet the requirements stated in Part a.

f. Discuss the validity of your second-order approximation.

Q6) For the unity feedback system with   **(20)**

$$G(s) = \frac{K}{s(s+5)(s+11)}$$

do the following :

a. Find the gain, K, for the uncompensated system to operate with 30% overshoot.

b. Find the peak time and Kv for the uncompensated system.

c. Design a lag-lead compensator to decrease the peak time by a factor of 2, decrease the percent overshoot by a factor of 2, and improve the steady-state error by a factor of 30. Specify all poles, zeros, and gains.

Q7) The unity feedback system with   **(20)**

$$G(s) = \frac{K}{s^2}$$

is to be designed for a settling time of 1.667 seconds and a 16.3% overshoot. If the compensator zero is placed at --1, do the following:

a. Find the coordinates of the dominant poles.

b. Find the compensator pole.

c. Find the system gain.

d. Find the location of all non-dominant poles.

e. Estimate the accuracy of your second-order approximation.

f. Evaluate the steady-state error characteristics.

ub
9||2|14

BHARATIYA VIDYA BHAVAN'S
SARDAR PATEL COLLEGE OF ENGINEERING
[An Autonomous Institution Affiliated to University of Mumbai]
RE- EXAMINATION

SEM/CLASS: **V/TE ELECTRICAL.**
SUBJECT: **Digital System Design**

TOTAL MARKS: **100**.
DURATION: **3Hours**.
DATE: December,**2014**.

MASTER FILE.

Solve any Five Questions.

Q1: a> With a neat diagram explain set associative mapping. (08)
    b> What is cache coherency? Explain methods to maintain the same. (08)
    c> Explain write policy for cache management. (04)

Q2: a> List and explain addressing modes. (10)
    b> With examples explain different types of instructions. (10)

Q3: a> Explain different partitioning schemes in memory management system. (05)
    b> Explain (10)
        (i)   Virtual Memory
        (ii)   Demand paging.
    c> List and briefly define the major types of OS scheduling. (05)

Q4: a> Explain various steps taken by CPU in interrupt handling process. (08)
    b> Explain how does the data transfer take place between I/O devices and memory
       using DMA. (06)
    c> List and explain two types of I/O interfaces. (06)

Q5: a> What is meant by the term nesting of the procedure? List three possible places for
       storing return address for the procedure return. What is reentrant procedure? (06)
    b> List and explain different machine cycles involve in an execution of instruction. (06)
    c> List and explain different VHDL models. (08)

Q6: a> List and explain different data types in VHDL (05)
    b> Write VHDL code for (15)
        (i)   8 bit latch.
        (ii)   JK flip flop.
        (iii)   Hull Adder.

Q7: Compare (20)
    a> RISC and CISC Computers.
    b> SRAM and DRAM.
    c> Process and Program.
    d> Direct mapping and Associative mapping.

BHARATIYA VIDYA BHAVAN'S
SARDAR PATEL COLLEGE OF ENGINEERING
[An Autonomous Institution Affiliated to University of Mumbai]
END SEMESTER EXAMINATION
SEM/CLASS: **V/TE ELECTRICAL**.   TOTAL MARKS: **100**.
SUBJECT: **Digital System Design**   DURATION: **3Hours**.
                                                  DATE: November,2014.

T.E(E(elt)Sem V   *Master*

Solve any Five Questions.

Q1: a>What are the advantages and disadvantages of using variable length instruction
    format.   (05)
   b>An address field of an instruction contains decimal value 12. Where is the   (05)
    corresponding operand located for
    (i)   **Immediate Addressing**   (ii)   **Direct Addressing**
    (iii) **Indirect Addressing**   (iv)   **Register Addressing**
    (v)   **Register Indirect Addressing**
   c>List and briefly define two approaches to dealing with multiple interrupts.   (06)
   d>Draw timing diagram for the instruction MOV A, B. After the execution of this
    instruction the data of internal register B is copied into accumulator.   (04)

Q2: a>Why are the peripherals not connected directly to system bus?   (04)
   b>State advantages and disadvantages of memory mapped I/O.   (04)
   c>List and briefly define three techniques of performing I/O.   (06)
   d>With a neat block diagram explain the working of Direct Memory Access unit.   (06)

Q3: a>Explain different modeling styles in VHD using an example of 4:1 multiplexer. (12)
   b>Write VHDL code to implement 3 bit up down counter.   (08)

Q4: a>Explain the following statements in VHDL.   (04)
    (i)   **Loop**   (ii)   **Next**   (iii)   **Exit**   (iv)   **Wait**.
   b>Write VHDL code to implement RS flip flop with rising clock edge. Make use of
    'process'.   (06)
   c>Write VHDL code to implement N-bit adder.   (06)
   d>Explain difference between inertial and transport delay.   (04)

Q5: a>List and briefly define the major types of Operating System scheduling. (06)
   b>Why are the unequal fixed size and variable size partitions are inefficient? Explain
    paging system in detail.   (08)
   c>A computer has a cache, main memory and a disk used for virtual memory. If the
    referenced word is in cache, 15ns are required to access it. If it is in main memory
    and not in cache, 50ns are needed to load it into the cache and then the reference is
    started again. If the word is not in the main memory, 10ns are required to fetch the
    word from disk, followed by 50ns to copy it into cache and then the reference is
    started again. The cache hit ratio is 0.9 and memory hit ratio is 0.5. What is the
    average time in ns required to access a referenced word on this system?   (06)

Page -①

Q6: a>List and explain cache replacement algorithms. (06)

b>What are the differences among direct mapping, associative mapping and set (06)
associative mapping.

c>Consider a machine with a byte addressable main memory of 2^{16} bytes and a block
size of 8 bytes. Assume that direct mapped cache consisting of 32 lines is used with
the machine.

1. How the 16 bit memory address is is divided into tag, line number and byte
   number? (02)

2. Into what line would bytes of the following address be stored? (04)

   i>   0001 0001 0001 1011

   ii>   1101 0000 0001 1101

3. Suppose the byte with address 0001 1010 0001 1010 is stored in cache. What are the
   addresses of the other bytes stored along with it? (02)

Q7: Write short note on

  a> Memory hierarchy. (04)

  b> Instruction set. (06)

  c> Cache coherency. (06)

  d> Performance Equation (04)

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

T·E (Elect), Sem -V

Total Marks :100

TE (Elec) sem V (old)

Duration : 3 Hours

SUBJECT :Electrical Machine-II

master

- Attempt any Five question out of Seven questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks

Q.1	a)	Explain various starting methods of polyphase induction motors	12
	b)	Derive the equation for torque developed by the an induction motor and deduce condition for maximum torque .	8
Q2.	a)	Why is the waveshape of magnetizing current of the transformer non sinusoidal Discuss the phenomena of inrush magnetizing current .What factors contributes the magnitude of inrush current.	10
	b)	Explain need of starter for 3-ph induction motor and explain star-delta starter, compare its staring torque with torque of DOL starting	10
Q3.	a)	A 4.5 KW,400V,50Hz3-ph delta connected motor gave the following results on test(voltage and current are line values):	20

No-Load test	400V	4.2A	480W
Blocked –Rotor test	215V	15A	1,080W

Rotor resistance referred to stator is 1.2Ω per phase. Stator and rotor ohmic losses at standstill are assumed equal and stator to rotor turns ratio is 2:1.Calculate the external resistance that must be exerted in series with the rotor circuit in order to obtain
(i)The maximum torque at starting.
(ii)1.25 times the full load torque at starting.
(iii)For both (i) and (ii) ,find the corresponding stator current and power factor

Q4.	a)	Describe four possible ways of connection of 3-Φ transformer with relevant relation amongst voltage and current on both H.V. and L.V. side.	10
	b)	Explain working of shaded pole induction motor. Also give its application.	10

Page-①

Q5 a) A 3-ph ,star connected,400V,50Hz,4-pole induction motor has the following per 10
        phase constants in Ohms referred to stator: $r_1=0.15$, $x_1=0.45$,
        $r_2=0.12$,$x_2=0.45$,$x_m=28.5$. Fixed losses (core, friction and windage losses)
        =400W.Calculate:(i) stator current (ii)rotor speed(iii) output torque
        and(iv)efficiency when motor is operated at rated voltage and frequency at a slip
        4%.

    b) Explain the phenomenon of oscillating neutral in three phase transformer 10

Q6 a) Explain why single phase induction motor has no starting torque, but if the 12
        rotor is given spin, the rotor starts rotating

    b) Explain with the help of connection and phasor diagram, how Scott connection 8
        are use to obtain two to obtain two phases supply from three phase supply
        mains.

Q7   Write short notes on any two :-
        a) Crawling and cogging   20
        b)Induction generator operation
        c) Double cage induction motor

BHARARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

Munshi Nagar Andheri (West), Mumbai 400 058

(An Autonomous Institution Affiliated to University of Mumbai)

KT 2014

CLASS/SEM : **TE / V** (Elect),

Subject : **Electrical machines II**

Total Marks :100
Duration   : 3Hr
Date   17/12/2014

- Attempt any **FIVE** out of the **SEVEN** questions.
- Answer to all sub questions should be grouped together.
- Assume **suitable data** where required.
- Neat diagrams and phasors are expected which carry marks.

MASTER FILE

Q1a)	What is the two reactance concept of salient pole synchronous machines? Neatly explain with phasors and derive the power equations for salient pole alternator?	07
b)	Explain armature reaction in alternator with pharos and cross section view for leading and unity power factor load?	07
c)	A 4-pole , 3-phase, 50 Hz star connected alternator has 60 slots with 4 conductors per slot. Coils are short pitched by 3 slots. If the phase spread is 60 degrees find the line voltage induced for a flux per pole of 0.943 wb, distributed sinusoidally. All the turns per phase are in series.	06
Q2a)	Explain with neat cross sectional view and equivalent circuits working of a cylindrical or non salient pole type of alternator.	07
b)	What are the reasons of having an armature stationary in an alternator? Explain neatly elaborating with points?	07
c)	A 80 kVA, 230 V, 50 Hz, 1-phase alternator has effective resistance of 0.0178 Ω and an armature leakage reactance of 0.065 Ω. Find the voltage induced in the armature when the alternator is delivering rated current at a load p.f of i) unity ii) 0.8 lagging and iii) 0.8 leading.	06
Q3a)	Explain in detail with diagrams working of synchronous motor? What are the ways in which motor can be made self starting?	07
b)	Explain with neat phasors the effect of changing field excitation at constant load in a synchronous motor?	07
c)	A 210 V, star connected, 3-phase synchronous motor has a synchronous reactance of 3.55Ω/phase and negligible armature winding resistance. At a certain load, the motor takes 6.92 kW at 0.75 p.f lagging. If the power delivered by the motor remains the same while the same excitation voltage is increased by 40 % by raising the field excitation, determine (i) the new armature current and ii) the power factor.	06

Q4a)	What is voltage regulation in synchronous machines? Explain neatly any one method by which voltage regulation can be determined?	07
b)	What are the conditions necessary for paralleling alternator with infinite bus. Explain synchronization and any one method of synchronization.(with phasors)	07
c)	Two identical 3 phase alternators operating in parallel, share equally a load of 2500Kw at 6600V & 0.75 lagging pf. The field excitation of first machine is adjusted so that the armature current is 45 A at lagging pf. Determine i) armature current of the second alternator .	06
Q5a)	Explain in detail the working of single phase induction motor? Draw neat diagrams with equivalent circuits and explain?	07
b)	What is infinite bus? Write characteristics of infinite bus and obtain infinite bus?	07
c)	A 2-pole , 240 V , 50 Hz single phase IM has the following constants referred to the stator: $R_1 = 2.12$ ohms, $X_1 = 3.1$ ohms, $R'_2 = 3.7$ ohms, $X'_2 = 2.11$ ohm, $X_m = 78$ ohm. Find the stator current and the input power when the motor is operating at a full load speed of 2810 rpm.	06
Q6a)	Draw the phasor diagram of loaded cylindrical pole alternator for leading power factor. Also derive the equation for EMF generated.	07
b)	Derive the power equation and draw the power angle characteristics for synchronous motor and explain what are V-curves?	07
c)	A 1000 kVA, 3000 V, 50 Hz, 3ø star connected alternator has effective armature resistance of 0.2 Ω. A field current of 40 A produces short circuit current of 200 A & an open circuit emf of 1040 V (line value). Calculated the full load % regulation at a power factor of 0.8 lagging. How will the regulation be affected if the alternator delivers its full load output at p.f. of 0.8 leading	06
Q7	Write short notes : a) Permanent magnet Stepper motors b) Hunting in synchronous machines c) Shaded pole motor d) Cooling methods of alternator	20

BHARARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

Munshi Nagar Andheri (West), Mumbai 400 058

(An Autonomous Institution Affiliated to University of Mumbai)

END TERM 2014

CLASS/SEM : **TE / V** (Elect).

Subject : **Electrical machines II**

T.E (Elect), sem - V

Total Marks :100
Duration : 3Hr
Date 01/11/2014

master

- Attempt any **FIVE** out of the **SEVEN** questions.
- Answer to all sub questions should be grouped together.
- Assume **suitable data** where required.
- Neat diagrams and phasors are expected which carry marks.

Q1a)	Derive the power developed in salient pole synchronous generator with neat diagrams. How does saliency affect the power developed.	10
b)	A 60 kVA, 220 V, 50 Hz, 1-phase alternator has effective resistance of 0.016 Ω and an armature leakage reactance of 0.07 Ω. Find the voltage induced in the armature when the alternator is delivering rated current at a load p.f of i) unity ii) 0.7 lagging and iii) 0.7 leading.	10
Q2a)	Explain in detail with neat phasors and equivalent circuit of an alternator at lagging power factor load.	10
b)	A 12-pole, 3 phase, star connected alternator has 72 slots. The flux per pole is 0.0988 Wb. Calculate: i) the speed of rotation if the frequency of the generated e.m.f is 50 Hz. ii) the terminal e.m.f for full pitch coils and 8 conductors per slot. iii) the terminal e.m.f if the coil span is reduced to 2/3 rd of the pole pitch.	10
Q3a)	Explain neatly with phasors and equivalent circuit of synchronous motor the effect of changing field excitation at constant load.	10
b)	A 208 V, star connected, 3-phase synchronous motor has a synchronous reactance of 4 Ω/phase and negligible armature winding resistance. At a certain load, the motor takes 7.2 kW at 0.8 p.f lagging. If the power delivered by the motor remains the same while the same excitation voltage is increased by 50 % by raising the field excitation, determine (i) the new armature current and ii) the power factor.	10
Q4a)	Explain neatly the ZPF or Potier method to calculate the voltage regulation of an alternator.	10
b)	A 1200 kVA, 3300V, 50 Hz three phase star connected alternator has an armature resistance of 0.25 ohms per phase. A field current of 40 A produces a short circuit of 200 A and an open circuit emf of 1100 V line to line. Find the voltage regulation on i) full load 0.8 pf lag ii) full load 0.8 pf lead	10

Page - ①

Q5a)	What are the conditions necessary for paralleling alternator with infinite bus. Explain any one method of synchronization.(with phasors)	10
b)	Two identical 3 phase alternators operating in parallel, share equally a load of 1000Kw at 6600V & 0.8 lagging pf . The field excitation of first machine is adjusted so that the armature current is 50A at lagging pf. Determine i) armature current of the second alternator .	10
Q6a)	Discuss why single phase induction motors do not have starting torque. Explain working principle of split phase induction motor with the help of neat sketch. How can you reserve the direction of rotation of such motor? Give the industrial & domestic applications.	10
b)	A 2-pole , 240 V , 50 Hz single phase IM has the following constants referred to the stator: $R_1 = 2.2$ ohms, $X_1 = 3$ ohms, $R'_2 = 3.8$ ohms, $X'_2 = 2.1$ ohm, $X_m = 86$ ohm. Find the stator current and the input power when the motor is operating at a full load speed of 2820 rpm.	10
Q7	Write short notes on: a) Stepper motors b) Brushless DC motor c) Capacitor start capacitor run motor d) Cooling methods of alternator	20

Bhartiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An autonomous institute affiliated to the university of Mumbai)

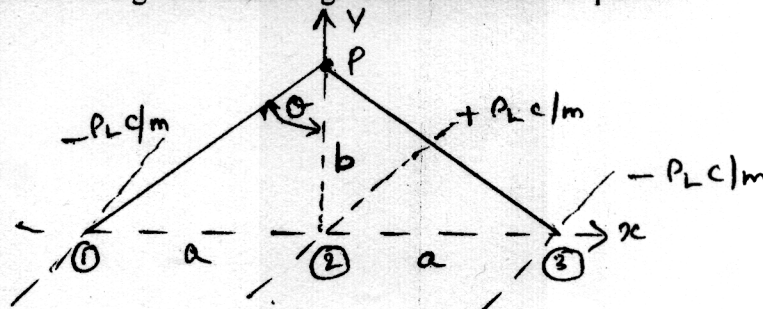Subject: **Electromagnetic fields & waves**   Marks : 100

Class: TE Electrical / Sem – V   Time : 3 hrs

Master

1. Attempt any **five** of the **seven** questions .

2. Neat vector representation is a must and limit time per question.

3. Any assumptions must be specified clearly.

1a   In the rectangular region -2<x<2, -3<x<3,z=0,the surface charge density is given by   10
$P_s=(x^2+y^2+z^2)^{3/2}$.If no other charge is present find $\vec{E}$ at pont P(0,0,1)

b.   Evaluate both sides of divergence theorem for the field $\vec{D} = 2xyz\,\hat{a}_x + 3y^2 z\,\hat{a}_y + x\hat{a}_z$ 10
C/sq.m for the region defined by $-1\le x \le 1, -1 \le y \le 1, -1 \le z \le 1$.

2a.   What is an electric dipole? Obtain an expression for the potential V at a distant point   10
P due to an electric dipole.

b   Derive the expression for the capacitance of a spherical capacitor .   5

c.   It is required to hold four equal point charges +Q coulomb each in equilibrium at the
corners of a square..calculate the point charge which will do this if placed at the   5
centre of the square.

3a   Three infinitely long charges run parallel to the z axis as shown in the figure. The   10
lines have uniform charge densities as given.Determine $\vec{E}$ at point P.

b.   In a spherical coordinate V = 0 for r = 0.1 m & V = 100 for r = 2 m. assuming free   10
space between   these concentric spherical shells find $\vec{E}$ and $\vec{D}$ using Laplace's
equation.

page ①

4a. Verify both sides of Stokes theorem for the field $\overline{G} = 10 \sin\theta\, \hat{a}_\phi$ and the surface r=3,   10
  $0 \leq \theta \leq 90$ and $0 \leq \Phi \leq 90°$. Let the surface have $\hat{a}_r$ direction .

b. A current filament carries a current of 10 A in the **az** direction on the z-axis. Find   10
the magnetic field intensity $\overline{H}$ at point P(1,2,3) due to this filament if it extends
from
 a) Z = - infinity to infinity b) z = 0 to 5m c) z = 5 to infinity

5a. State and explain the Poynting's theorem and explain its significance.   10

b Explain the concept of displacement current.   5

c.. State and explain Biot-Savart's law.   5

6a. State and explain in detail Maxwell's equations for time varying fields in point and   10
integral form.

b. A lossy dielectric has μ_r=1, ε_r=50 and σ=60 mho/m at 15.9MHZ. Find $\alpha, \beta, \lambda, v, \eta$. If   10
uniform plane wave is travelling through this medium.

7a Write short notes on any two: 20
 a) Method of images.
 b) Continuity Equation.
 c) Scalar and Vector magnetic potential.
 d) Gauss law and its applications.

page (2)

Bhartiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

T·E (Elect), Sem - V

(An autonomous institute affiliated to the university of Mumbai)

Subject: Electromagnetic fields & waves   Marks : 100

Class: TE Electrical / Sem – V (OLD)   Time : 3 hrs

Master

1. Question no.1 is compulsory.
2. Attempt any **four** of the **remaining six** questions .
3. Vector notation must be used wherever necessary.
4. Any assumptions must be specified clearly.

---

1   Attempt any four: (5x4=20)
   a) State and explain Gauss's law.
   b) Prove that $\bar{E} = -\nabla V$
   c) What is uniform plane wave? Explain its significance.
   d) Explain displacement current.
   e) State and explain Biot-Savart's law.

2.   a) State and explain in detail Maxwell's equations for time varying fields in point   10
   and   integral form.(Electric and magnetic fields)

   b) Evaluate both sides of divergence theorem for the field $\bar{D} = 2xyz\,\hat{a}_x + 3y^2 z\,\hat{a}_y + x\hat{a}_z$ C/sq.m for the region defined by $-1 \leq x \leq 1$, $-1 \leq y \leq 1$, $-1 \leq z \leq 1$.   10

3.   a) Derive the expression for Poynting's theorem and explain its significance.   10

   b) Four like charges are located on x and y axis at a distance $\pm$ 4m. Find out the   10
   electric force on 100µC charge located at (0,0,3) due to 4 like charges.

4   a) Using Biot Savart's law find magnetic field intensity due to a infinitely long   10
   straight conductor.

   b) In a spherical coordinate V = - 25V for r = 2c m & V = 150 for r = 35c m. The   10
   space between the conductor has dielectric of permittivity 3.12   find $\bar{E}$ and $\bar{D}$
   using Laplace's equation.

Page - ①.

5   a) What is an electric dipole? Obtain an expression for the potential V at a distant   10
    point P due to an electric dipole.

    b) Derive wave equations from Maxwell's equations.   10

6. a) Derive the expression for electric field intensity and electric flux density for a   10
    uniformly charged sphere.

    b) Verify both sides of Stoke's theorem for the surface defined by $0 \leq \theta \leq 0.25\pi$,   10
    r = 5m and $0 \leq \Phi \leq 0.3\ \pi$. Given $\overline{H} = 3\ r\ \cos\Phi\ a_r + 5\ r\ \sin\Phi\ a_\Phi$ A/m.

7   Write short notes on any two: 20
        a) Method of images.
        b) Poissons and Laplace Equations.
        c) Continuity Equation.
        d) Scalar and Vector magnetic potential

Bhartiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

T. E. (Elect), Sem - V

(An autonomous institute affiliated to the university of Mumbai)

Subject: **Electromagnetic fields & waves**   Marks : 100

Class: TE Electrical / Sem – V   Time : 3 hrs

Master

1. Attempt any **five of the seven questions** .

2. Neat vector **representation is a must** and limit time per question.

3. Any assumptions **must be specified clearly**.

Q1 a) Two-infinite sheets of uniform charge densities $\rho_s = 10^{-9}/6\pi$ C/m^2 are located at z= -5m and y= -5m. Determine the uniform line charge density ρ_L necessary to produce same value of **E** at (4,2,2) m if the line charge is at y=0,z=0.   (10)

b) Given that **D**=(10x^3/3) $\hat{a}_x$ C/m^2 evaluate both sides of the divergence theorem for the volume of the cube of 2m side centered at the origin and with edges parallel to the axes.   (10)

Q2 a) Derive the expression for the capacitance of a co-axial cable.   (10)
 b) If V=60 sinθ/r^2 volts in free space . Find V,**E** and ρ_v at P(3,60°,25°).   (10)

Q3 a) The region with z < 0 is characterized by ε_{r2} = 2 while the region z >0 is characterized by ε_{r1}= 5. If **D$_1$** = 2 $\hat{a}_x$ + 5 $\hat{a}_y$-3 $\hat{a}_z$ nC/m^2. Find **D$_{N2}$**, **D$_{tan2}$**, **D$_2$**, angle that **D$_2$** makes with the z axis.   (10)

b)Two parallel conducting discs are separated by a distance 5mm at z=0 and z=5mm. If V=0 at z=0 and V=100V at z=5mm, using Laplace's equation find the charge densities on the discs.   (10)

4a) State and derive the Poynting's theorem and explain its significance.(both point and integral form)   (10)
b) Prove that the **magnetic field intensity due to a finite length of current filament** is given   by

H = I [sin α2 – sin α1] /4 π r $\hat{a}_\phi$ A/m.   (10)

Q5 a) Evaluate both sides of Stoke's theorem for the field H=[y^2z/x] $\hat{a}_x$ +[0.5 y^2z^2/x^2] $\hat{a}_z$
and find current in the a_y direction crossing the square surface in the plane y=2,bounded
by x=z=1 and x=z=2. (10)

b) State and explain in detail Maxwell's equations for time varying fields in point and
integral form.(Electric and magnetic fields) (10)

Q6a) A 300 MHz plane wave propagates through fresh water ($\sigma = 0$, $\mu r = 1$, $\varepsilon_r = 78$) calculate α
β, λ, v, η. (10)

b) What is transverse electromagnetic waves ? Derive a general wave equation. (10)

Q7 Write short notes on any **two** (20)

a) Magnetic boundary conditions.

b) Scalar and vector magnetic potential.

c) Poisson's and Laplace Equations

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Total Marks: 100   T. E CEFcut) Sem $\overline{V}$ Duration: 3 Hours

CLASS/SEM: TE/V SEM (Elect).   SUBJECT: POWER ELECTRONICS

Master

- Attempt any FIVE question out of SEVEN questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks
- Assume suitable data if necessary and justify the same

Q1) A. What are the performance parameters of a rectifier? Explain the significance of each parameter.   10

B. With the help of neat diagrams and waveforms explain Boost regulator. (mathematical expression not expected)   10

Q2) A. Explain six step operation of inverter. Explain it with pole voltage and line voltage waveforms. (USE GRAPH PAPER)   12

B. Draw the voltage and current waveforms of single phase full wave controlled rectifier with pure inductive load so that current is just continuous .What is the value of alpha for the same condition?   8

Q3) A. Explain current source inverter. What are its advantages and disadvantages w.r.t. voltage source inverter.   10

B. The Buck regulator has an input voltage of V_s=12V .The required average output voltage is 5V at R=500Ω and peak to peak output ripple voltage is 20mV. The switching frequency is 25 KH$_z$. If peak to peak ripple current of inductor is limited to 0.8A .Determine duty cycle and critical values of L and C.   10

Q4) A. What are the performance parameters of inverters?   6

B. The single phase half bridge inverter has a resistive load of R=2.4Ω and the DC input voltage is V_s=48V. Determine
(a) r.m.s. output voltage (b) the output r.m.s. power P_0 6

C. Explain sinusoidal sine-triangular PWM.   8

Q5) A. Explain natural or line commutation.
With the help of neat sketch explain effect of source inductance on performance of converters.   10

Page -①

B. Explain two transistor model of Thyristors .Explain off state and on state condition of thyristors.   10

Q6) A. Explain principle of phase control. And explain single phase full wave controller with RL load.   10

B. Write short note on single phase dual converter with the help of circulating current mode.   10

Q7) A. A single phase full converter is supplied from 230V, 50H$_z$ source. The load consist of R=10Ω and a large inductance so as to render the load current constant. For a firing angle delay of 30˚, Determine average output voltage ,average output current and power factor.   9

B. With the help of neat circuit and waveforms, explain single phase full bridge voltage source inverter with RL and L load.   8

- Mark the conduction time of diodes and control switches on waveforms.   3

T·E·/V sem (Elect) - Re - exam.

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

RE-EXAMINATION:DEC2014

Total Marks: 100   Duration: 3 Hours

CLASS/SEM: TE/V SEM (Elect).   SUBJECT: POWER ELECTRONICS

- Attempt any FIVE question out of SEVEN questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks
- Assume suitable data if necessary and justify the same   MASTER FILE·

Q1) A. Draw output current and voltage waveform for the following load when it is fed   15
      by **controlled** FULL wave SINGLE PHASE rectifier.(assume $\alpha=90^0$)
      1. RL load
      2. RLE load
      3. Pure L load
   B. Derive output voltage of three phase controlled rectifier.   5

Q2) A. Explain the effect of variation in firing angle of rectifier on reactive power   10.
      consumption
   B. Write short note on single phase dual converter with the help of noncirculating   10
      current mode.

Q3) A. Derive expression for average DC voltage for three phase 6 pulse controlled   5
      converter.
   B. Draw output voltage waveform of 3 phase 6 pulse controlled converter when,   15
      (USE GRAPH PAPER)
      1.$\alpha = 0^0$
      2. $\alpha = 90^0$

Q4) A. Explain qualitatively (no mathematical approach), what will happen if a free-   8
      wheeling diode (cathode of the diode shorted with the cathode of the thyristor)
      is connected across the load in rectifier circuit.
   B. Explain space vector modulation techniques for inverter.   12

Q5) A. Explain the operation of single phase half bridge inverter with RL Load.   5
   B. A three phase full wave rectifier is operated from a three phase Y connected   15
      208V, 60Hz supply and the total load resistance is R=10ohm. If it required
      obtaining an average output voltage of 50% of the maximum possible output
      voltage, calculate the delay angle α, the RMS and average output currents the
      rectification efficiency, the TUF and input power factor.

Q6) **A.** With the help of neat diagrams and waveforms explain Buck regulator.   **10**
(mathematical expression not expected)

B. Explain performance parameters of full wave rectifier with center tap   **10**
transformer.

Q7)   Write notes   **20**
1. Bidirectional ac voltage control with RL load
2. Current source inverter

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to University of Mumbai)

Old Course
A.T.K.T. Examination

Total Marks: **100**

Duration : **3 Hours**

CLASS/SEM: **T.E. (Electrical) / Sem V**

SUBJECT : **POWER ELECTRONICS**

Master

- Attempt any **FIVE** question out of **SEVEN** questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks
- **Assume suitable data if necessary and justify the same.**

Q.1a) Explain the operation of single phase full bridge uncontrolled rectifier with pure inductive load. Draw the output voltage, source current and load current waveforms. Derive the expression for average output voltage. **(12)**

b) Discuss the operation of Power BJT. **(08)**

Q.2a) Explain the operation of single phase full bridge inverter with **RL** load. Draw the output voltage and load current waveforms. Enlist the advantages of full bridge inverter over half bridge inverter. **(04+06+02)**

b) What is an ac regulator? Derive the condition for firing angle alpha, when the ac regulator feeds **RL** load and there is complete control on the output voltage. **(08)**

Q.3a) A single phase fully controlled bridge rectifier is operated with a **RE** load with R = 10 Ω and E=100V. The input voltage to the bridge is **200V**. The firing angle is **60°**. Determine
(i) Average load voltage,
(ii) Average load current,
(iii)Average output power. **(12)**

b) "Rectifier consumes reactive power" justify. **(08)**

Q.4a) Explain 180° conduction mode of three phase VSI. Draw the pole voltages, line voltages, and one phase current waveform for delta connected **RL** load. **(12)**

b) Draw the output voltage and current waveform for uncontrolled half wave rectifier with pure L load. Derive the expression for instantaneous output voltage. **(04+04)**

TE(Elect), Sem-V, Power Electronics (old course. ATICT)

16/11/14   1

Q.5a) With the help of a neat circuit diagram and associated waveforms, discuss the operation of buck converter. Derive the expression for critical inductance for continuous current. **(14)**

b) A step-up chopper with a pulse width of 150µs is operating on 200 V d.c. supply. Compute the load voltage if the blocking time of the device is 40µs. **(06)**

Q.6a) Explain the triggering methods of SCR. **(08)**

b) The boost regulator has an input voltage of 6V. The average output voltage of 15 V and average load current is of 0.5A. The switching frequency is 20 kHz. If L = 250µH and C= 440µF, determine (i) the duty cycle (ii) the ripple current of inductor, ΔI (iii) the ripple voltage of filter capacitor, ΔV_c **(12)**

Q.7a) For three phase, half wave, uncontrolled rectifier (three phase rectifier with three diodes), draw the waveform of instantaneous output voltage and instantaneous voltage across any one diode. **(12)**

   Note: Use graph paper

b) Explain the sine triangle PWM schemes used to control the output voltage of an inverter. **(08)**

Page - ②

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Total Marks :100   Duration : 3 Hours

<u>CLASS/SEM :V /TE(Elect)</u>   <u>SUBJECT : PSA</u> (Power System Analysis).

- Attempt any Five question out of Seven questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks

Master

|		
Q1.a)	State and explain the Fortescue's theorem for analysis of unbalanced system	10
b)	Draw zero sequence network of the transformer with following configurations: (i)Star-Star (ii) Star –delta (iii)delta-delta(iv)star solidly grounded-star solidly grounded(v)star grounded through reactance-star grounded.	10
Q2.a)	A 25MVA,13.2KV alternator with solidly grounded neutral has a sub transient reactance of 0.25pu.The negative and zero sequence reactance are 0.35 and 0.1pu respectively. A single line to ground fault occur at the terminal of an unloaded alternator; determine the fault current and line-to-line voltages. Neglect resistance .	10
b)	Derive swing equation and also explain how can stability of the system can be determined using swing curves.	10
Q3.a)	A double circuit three phase feeder connects a single generator to a large network. The power corresponding to the limit of steady-state stability for each circuit is 100MW.The line is transmitting 80MW when one of the circuit is suddenly switched out. Determine with reference to appropriate diagram whether the generator is likely to remain in synchronism.	10
b)	Explain the computational procedure for load flow solution using Gauss -Seidel method when the system contains all types of buses.	10
Q4 a)	Three 6.6KV generators A,B and C ,each of 10% leakage reactance and MVA ratings 40,50and 25 respectively are interconnected electrically as shown in figure by a tie bar through current limiting reactors each of 12% reactance based upon the rating of the machine to which it is connected .A three phase feeder is supplied from the bus bar of the generator A at a line voltage of 6.6KV.The feeder has a resistance of 0.06Ω/phase and an inductive reactance of 0.12Ω/phase. Estimate the maximum MVA that can be fed into a symmetrical short circuit at the far end of the feeder.	10

page 1
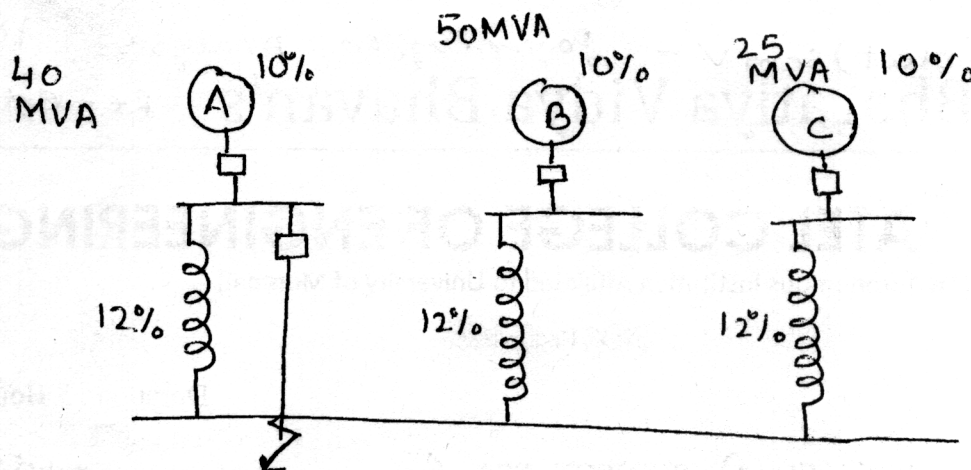
b) Draw a diagram showing interconnection of sequence network for a double line to 10
ground fault. Derive equations for sequence current.

Q5 A three bus power system is shown .The relevant per unit line admittances on 100MVA 20
base are indicated on the diagram and bus data are given below:

Bus No.	Type	Generation		Load		V_{pu}	δ
		P_G(MW)	Q_G(MW)	P_L(MW)	Q_L(MW)		
1	Slack	?	?	0	0	1.02	0
2	PQ	25	15	50	25	?	?
3	PQ	0	0	60	30	?	?

Form Y_{bus} and determine the voltage at bus 2 and 3 after second iteration using Gauss
Seidel Method .Take the acceleration factor α=1.6.
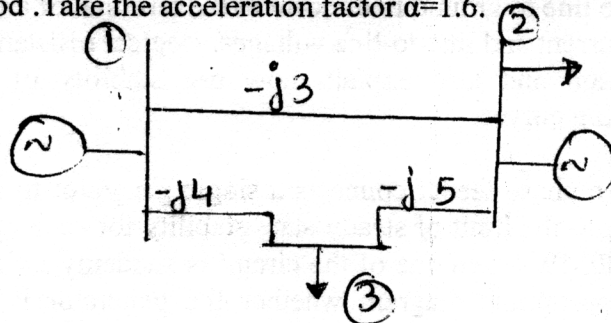
Q6.a) Figure shows the on line diagram of a simple four bus system .Table gives the line 10
impedances identified by the buses on which these terminate. The shunt admittances at
all the buses is assumed negligible.

(i) Find Y_{Bus} assuming that the lines shown dotted is not connected.
(ii) What modifications need to be carried out in Y_{Bus} if the line shown dotted is
connected.

page no. 2 .

Sem V – T.E. Electrical – PSA. (power system Analysis)
Re-exam.

Line Bus –to-Bus	R (pu)	X(pu)
1-2	0.05	0.15
1-3	0.10	0.30
2-3	0.15	0.45
2-4	0.10	0.30
3-4	0.05	0.15

b)

10
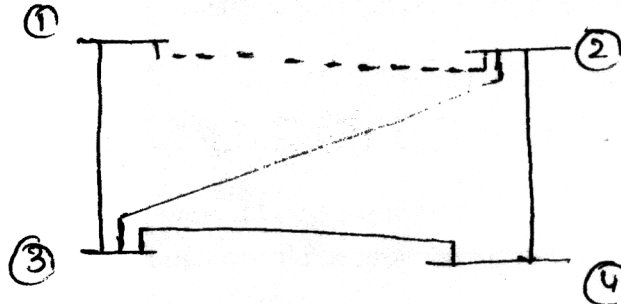
What is the significance of load flow analysis in a power system ?Give the classification of the various buses in a power system and justify the classification.

Q7. Write short note on *any two*:

20

i)Series Faults
ii)Gauss Elimination Method
iii)Equal Angle criteria

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

TE (Elect), sem - V

Total Marks :100   Duration : 3 Hours

CLASS/SEM V/TE (Elect)   SUBJECT : PSA (Power System Analysis)

master

- Attempt any Five question out of Seven questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks

---

Q1.a) Derive interconnection of sequence network for L-L fault.   10

b) Derive the swing equation for a machine system connected to infinite busbar.   10

Q2.a) A synchronous generator and a synchronous motor each rated 25MVA,11KV having   10
15% subtransient reactance are connected through transformer and a line as shown. The
transformer are rated 25MVA,11/66 KV and 66/11KV with leakage reactance of 10%
each. The line has a reactance of 10% on a base of 25 MVA,66KV.The motor is drawing
15MW at 0.8power factor leading and a terminal voltage of 10.6KV when a
symmetrical three phase fault occurs at the motor terminals. Find the subtransient current
in the generator ,motor and fault.
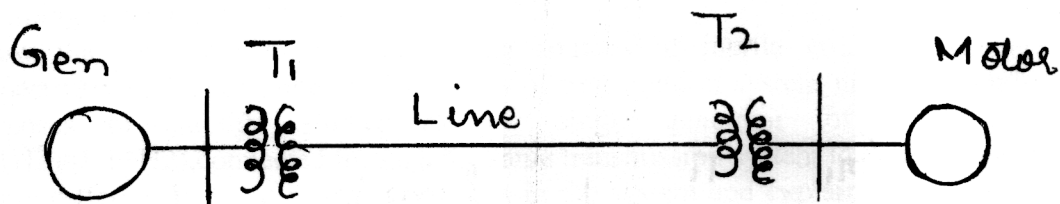
b) Explain the Decoupled method used for solving SLFE.Also mention the advantages of   10
using it over Newton Raphson method.

Page -①

Q3.a) Find the critical clearing angle for the system shown in figure below for a three –phase **12** fault at the point P. The generator is delivering 1.0pupower under prefault conditions.
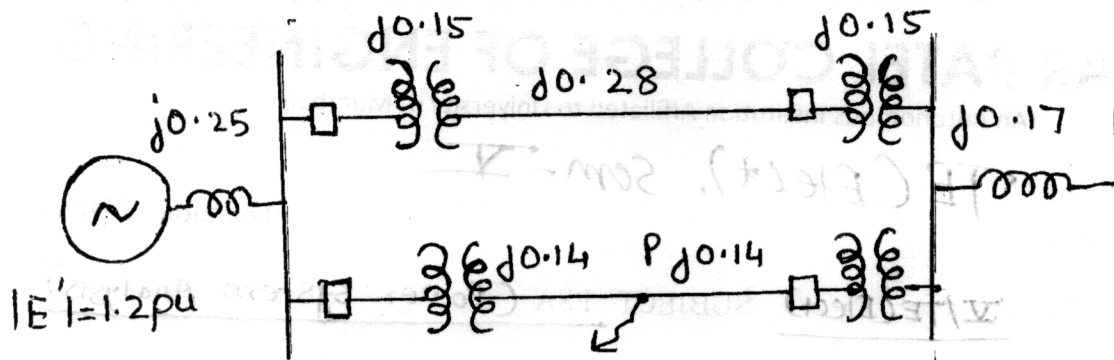

b) Explain with the help of a neat diagram how steady state stability of a system can be **8** determined and also mention the assumptions made?

Q4 a) Draw the sequence network for the system shown. determine the fault current when **10** (a)LLG (b)LL fault occurs at point F. The per unit reactances all referred to the same base are as follows:

Equipment	Xo(pu)	X1(pu)	X2(pu)
Generator G1	0.05	0.3	0.2
Generator G2	0.03	0.25	0.15
Line1	0.7	0.3	0.3
Line2	0.7	0.3	0.3
Transformer T1	0.12	0.12	0.12
Transformer T2	0.1	0.1	0.1

Both generators are generating 1 .0 pu voltage.
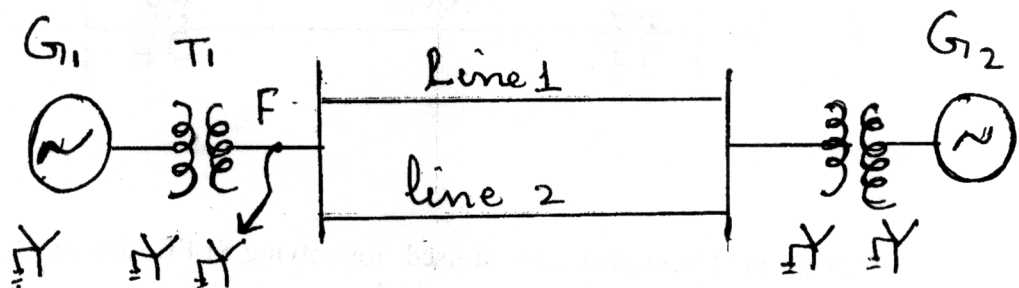
b) In a portion of a power system Network two branches 1-2 and 2-3 are mutually coupled through Zm=j0.2.Find the bus admittance matrix using singular transformation for the system shown   10
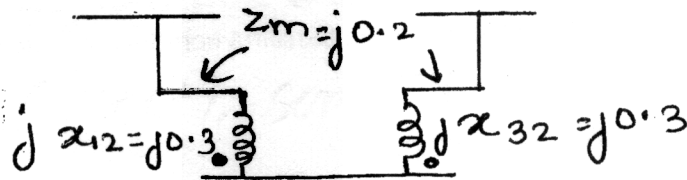
Q5 a) The following is the system data for a load flow solution.   12

The line admittances in pu:

Bus Code	Admittance
1-2	2-j8.0
1-3	1-j4.0
2-3	0.666-j2.664
2-4	1-j4.0
3-4	2-j2.0

The schedule of active and reactive powers in pu :

Bus code	P	Q	V	Remarks
1	-	-	1.06	Slack
2	0.5	0.2	1+j0.0	PQ
3	0.4	0.3	1+j0.0	PQ
4	0.3	0.1	1+j0.0	Pq

Determine the voltages at the end of the first iteration using Gauss Seidel method.Take α =1.6

b) In the above problem bus2 is taken as a generator bus with $|V2|$=1.04 and reactive power constraints is $0.1 \leq Q2 \leq 1.0$. Determine the voltage starting with a flat voltage profile and assuming accelerating factor 1.0.   8

Q6.a) Show that two synchronous generating sources of inertia constant H1 and H2 respectively and interconnected by means of transmission system may be regarded for purposes of stability studies as a single generator ,of inertia constant (H1H2)/(H1+H2),connected through the same transmission system to a infinite busbar.   10

b) Name different types of buses are present in the system and explain importance of the reference bus.   (4+6)

Q7. Write short note *any two* of the following: 2x10
i)LU decomposition method
ii)Methods of improving Transient stability
iii)Newton Raphson Method for solving SLFE

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Total Marks :100

TE (Elect), Sem-V

(OLD)

Duration : 3 Hours

SUBJECT :Power System Analysis

- Attempt any Five question out of Seven questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks

Q.1	a)	Discuss the principle of symmetrical components. Derive the necessary equation to convert phase quantity into symmetrical components.	10
	b)	Derive interconnection of sequence networks for LL-G fault	10
Q2.	a)	- Find the critical disruptive voltage and the critical voltages for local and general corona on a 3-ph overhead transmission line, consisting of three stranded copper conductors spaced 2.5m apart at the corners of an equilateral triangle. Air temperature and pressure are 21°C and 73.6 cm Hg respectively. The conductor diameter, irregularity factor and surface factors are 10.4mm,0.85,0.7 and 0.8 respectively.	10
	b)	What are causes of over voltages in power system.	10
Q3.	a)	Discuss the phenomena of corona and corona loss and indicate the circumstances under which they are likely to occur.	10
Q4.	a)	An over headline with surge impedance 0f 400Ω is 300Km long. One end is of the line short circuited while at the other end a source of three phase 11KV is suddenly switched in. Calculate at source end 0.05 s after the voltage is applied.	10
	b)	A synchronous generator is rated **25MVA,11 KV**. Its star-connected with the neutral point solidly grounded. The generator is operating at no-load at rated voltage. Its reactances are $X"=X_2=0.20$ and $X_0=0.08$ pu. Calculate the symmetrical subtransient line currents for (i)LG fault (ii)LL fault (iii) LLG fault. Compare all these currents and comment.	10
Q5	a)	In a three phase four- wire system the currents in the lines a,b,c under abnormal conditions of loading were as follows:$I_a=100/\underline{30°}$ A, $I_b= 50/\underline{300°}$ A, $I_c= 30/\underline{180°}$ A. Calculate the zero, positive and negative phase sequence currents in line a and the return current in the neutral.	10
	b)	Explain with the help of a neat diagram working of Zinc oxide arrester	10

Q6 a) Draw a general circuit which can be used to determine the zero sequence   10
        network of a two winding transformer. Using this circuit ,draw the zero
        sequence network of i)Y-Y ii) Y-Δ with star point solidly grounded iii)Y-Y
        with both the star points solidly grounded(iv) Y-Y with both stars points
        grounded(v) Δ-Δ.

    b) A 25MVA,11KV,three phase generator has a subtransient reactance of   10
        20%.The generator supplies two motors over transmission line with
        transformer at both the ends as shown in diagram. The motors have rated input
        of 15 and 7.7MVA,both rated 30MVA,10.8/121KV,connection Δ-Y with
        leakage reactance of 10% each .The series reactance of the line is 100Ω.draw
        the positive and negative sequence networks of the system with reactance
        marked in pu.
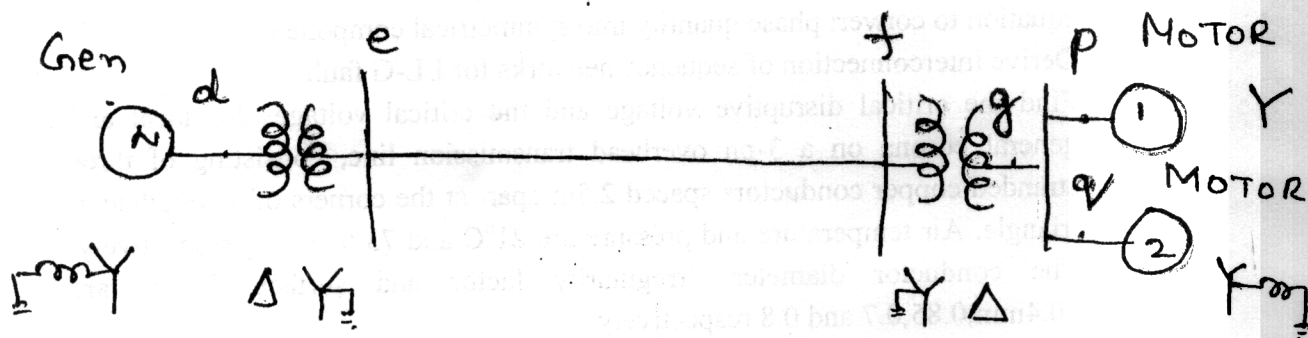
Q7   Write short note on any two: 2x10
            i)   Bewley lattice diagram
            ii) Methods of reducing corona losses
            iii) Current chopping

Page-②