TE (Elect), Sem-V, A.T.K.T, 25/6/15.
Power System Analysis.

HD
25/06/15

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Power System Analysis

TOTAL MARKS : **100**

DURATION : **3 Hours**

CLASS/SEM : **T.E.** Electrical Sem-V

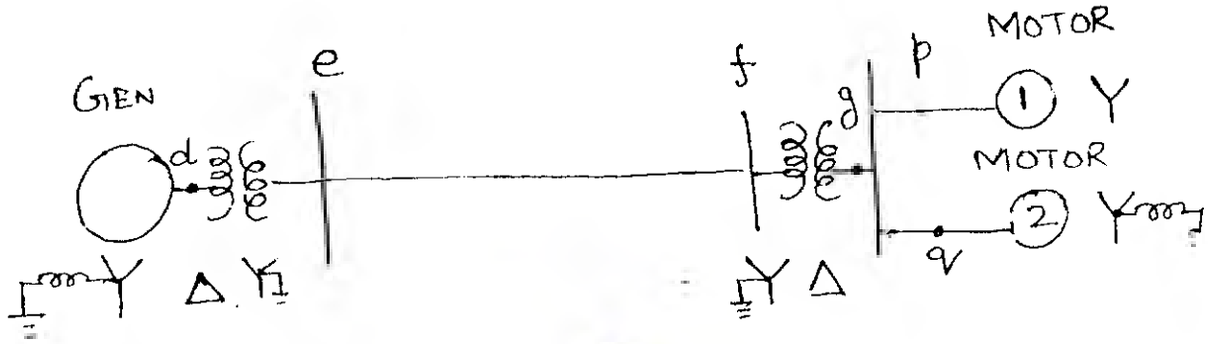
SUBJECT :**PSA (OLD)**

Attempt any ***FIVE*** questions out of ***SEVEN*** questions.

- Figures to the right indicate full marks.
- . Answers to all sub questions should be grouped together

Master.

Q1	a)	State and explain the Fortescue Theorem for analysis of unbalanced system.	10
	b)	Derive the interconnection of LLG fault.	10
Q2	a)	Draw the Zero sequence network for the following transformer connection:- (i) Star/Star with both neutral grounded (ii) Star neutral /Delta (iii) Delta/Star isolated neutral (iv) Delta/Delta	8
	b)	An 11KV,25 MVA synchronous generator has positive ,negative and zero sequence reactance of 0.12,0.12 and 0.08 pu respectively. The generator neutral is grounded through a reactance of 0.03pu.A single line –to –ground fault occurs at the generator terminals. Determine the fault current and line-to-line voltages. Assume that the generator was unloaded before the fault.,	12
Q3	a)	Draw and explain typical waveform of voltage and current over a transmission line terminating through an open circuit.	10
	b)	Explain the phenomenon of corona. State advantages and disadvantages.	10
Q4	a)	A 25 MVA ,11KV ,three phase generator has a subtransient reactance of 20%.The generator supplies two motors over a transmission line with transformers at both the ends as shown in the one-line diagram. The motors have rated inputs of 15 and 7.5MVA,both 10KV with 25% subtransient reactance .The three –phase transformer are both rated10MVA,10.8/121KV,connected Δ-Y with leakage reactance of 10% each. The series reactance of the line is 100Ω.Draw positive and negative sequence network reactance marked in pu.Assume that the negative reactance of each machine is equal to its subtransient reactance.Omit resistances. Select generator rating as base in the generator circuit.	10



BTE(Elect), Sem-IV, A.T.K.T, 05/6/15.
Power System Analysis.

	b)	With respect to the surge discuss the following: i)ground wire ii)protection angle iii)tower footing resistance iv)structure of tower footing conductor	10
Q5	a)	Explain different causes of overvoltage in power system	10
	b)	A cable with a surge impedance of 100Ω is terminated in two parallel-connected open-wire line having surge impedances of 600Ω and 1000Ω respectively. If a steep-fronted voltage wave of 1000 V travels along the cable , find from the first principles the voltages and current in the cable and the open-wire lines immediately after the travelling wave has reached the transition point. The line may be assumed to be of finite length	10
Q6	a)	Explain the principle of lighting arrestor. Explain any two in brief.	10
	b)	A three-phase ,132 KV,50Hz,150Km long transmission line consists of three stranded aluminum conductors spaced triangularly at 3.8 m between centers. Each conductor has a diameter of 19.53 mm. The surrounding air is at a temperature of 30°C and at the barometric pressure of 750mm of mercury. If the breakdown strength of air is21.1KV (rms) per cm and the surface factor is 0.85, determine the disruptive critical voltage .Also, determine the visual critical voltage for local and general corona if the surface factors are 0.72 and 0.82 for visual corona(local) and visual corona (general) respectively.	10
Q7		Write short note on any two of the following :	2*10
	a)	Bewley Lattice Diagram.	
	b)	Insulation coordination	
	c)	Arcing Ground	

TE (Elect), Sem-V, A.T.K.T, 25/6/15 — Power System Analysis

25/06/15

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Power System Analysis

TOTAL MARKS : **100**

DURATION : **3 Hours**

CLASS/SEM : **T.E.** Electrical Sem-**V**

SUBJECT :**PSA (KT)**

Attempt any ***FIVE*** questions out of ***SEVEN*** questions.

- Figures to the right indicate full marks.
- . Answers to all sub questions should be grouped together

Master

Q1 a) Discuss the principle of symmetrical components. Derive the necessary equation to convert phase quantity into symmetrical components. 10

b) In a three phase four wire system the currents in the lines a,b,c under abnormal conditions of the loading were as follows: $I_a = /\underline{30^\circ}$, $I_b = 50/\underline{300^\circ}$, $I_c = 30/\underline{180^\circ}$ A. Calculate the zero ,positive and negative phase sequence currents in line and the return current in the neutral. 10

Q2 a) Derive the interconnection of sequence network for line-to-line fault. 10

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

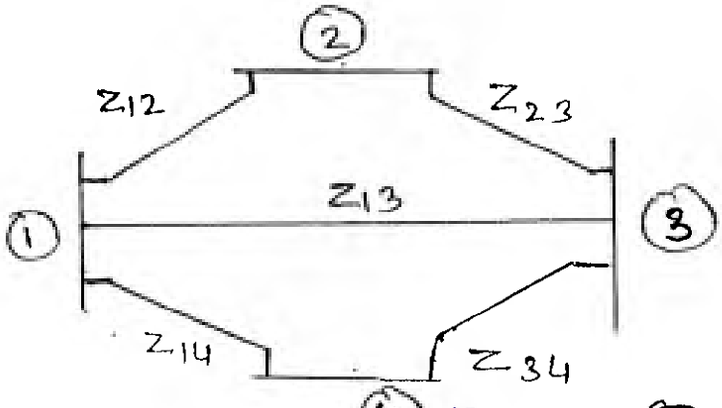
Q3 a) A star point of a 3KV, 3MVA, three phase synchronous generator is solidly grounded. Its positive, negative and zero sequence reactances are 2.4,0.45 and 0. 3Ω respectively. The generator operating at no- load sustains a resistive fault between phase *a* and ground. The fault resistance is 1.2Ω.Calculate the fault current and the voltages to ground of the phase *a* 10

b) Explain with the help of a neat diagram how steady state stability of a system can be determined and also mention the assumptions made? 10

Q4 a) Determine Y_{Bus} for the 4-bus system shown .The line series impedances are as follows: 10

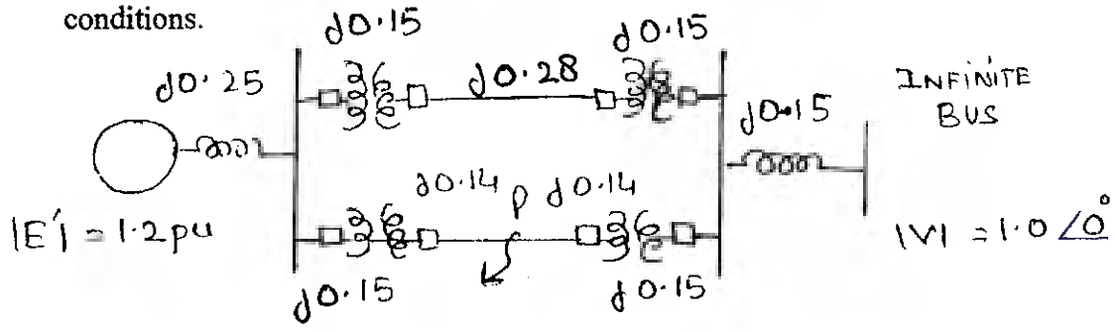
Line(bus-to bus)	Impedance(pu)
1-2	0.25+j1.0
1-3	0.2+j0.8
1-4	0.3+j1.2
2-3	0.2+j0.8
3-4	0.15+j0.6

Neglect the shunt capacitance of the line.



b) Write a short note on a symmetrical fault on a synchronous generator under no-load condition. 10

Q5 a) Find the critical clearing angle for the system shown in fig a three phase fault at the point P.the generator is delivering 1.0pu power under prefault conditions. 10

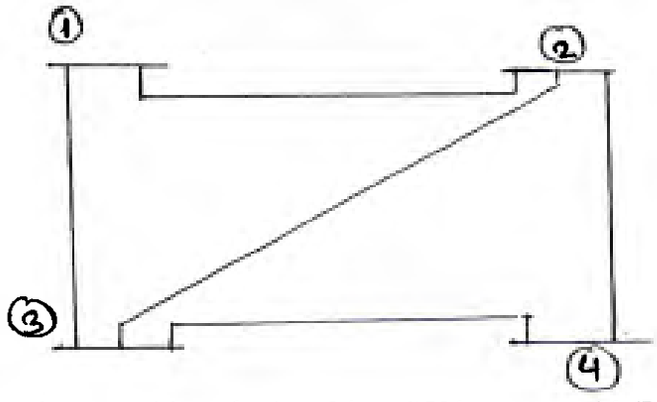


b) What is significance of load flow analysis in a power system .Give the classification of the buses and justify the need of having a reference bus 10

Q6 a) .For the system given the generators are connected at all the four buses, while loads are at buses 2 and 3.Values of real and reactive powers are listed in a table .All buses other than the slack bus are PQ bus type. Assuming a flat voltage start, find the voltage and bus angles at the three buses at the end of the first Gauss Siedel iteration. 12

Bus	**P_i,pu**	**Q_i,pu**	**V_i,pu**	**remark**
1	-	-	1.04/0	Salck bus
2	0.5	-0.2	-	PQ bus
3	-1.0	0.5	-	PQ bus
4	0.3	-0.1	-	PQ bus

Line(bus to bus)	**R ,pu**	**X, pu**
1-2	0.05	0.15
1-3	0.1	0.3
2-3	0.15	0.45
2-4	0.1	0.3
3-4	0.05	0.15



b) For the above problem ,let bus 2 be a PV bus now with $|V_2|$=1.04pu.Once again assuming the flat voltage start, find Q_2,δ_2,V_3,V_4 ,at the end of the first Gauss Siedel iteration .Given $0.2 \leq Q_2 \leq 1$. 8

Q7 Write short note on any two: 2*10

a) Kron's mehod
b) Fast decoupled method
c) LU decomposition
d) Newton Raphson Method.

TE (Elect), Sem-V, A.T.K.T. Lib 26/06/15

Power Electronics

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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Old Course

A.T.K.T. Examination

Total Marks: **100**

Duration : **3 Hours**

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

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.

Q.1a) Explain the triggering methods of SCR. **(10)**

b) Discuss the operation of MOSFET and compare with IGBT. **(10)**

Q.2a) Explain the operation of single phase half bridge inverter with **pure L** load. Draw the output voltage and load current waveforms. **(10)**

b) For a single-phase a.c voltage regulator feeding a **RL** load, draw the waveforms of source voltage load current and load voltage **(10)**

Q.3a) A single phase fully controlled bridge rectifier is operated with a resistive load $R = 20\ \Omega$, 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) Explain the reasons for lagging power factor operation of rectifier. **(08)**

Q.4a) Explain 180° conduction mode of three phase VSI with relevant waveforms. **(12)**

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

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

b) A step-down chopper with a pulse width of 150μs is operating on 220 V d.c. supply. Compute the load voltage if the blocking time of the device is 40μs. **(06)**

TE (Elect), Sem-V, A.T.K.T, 26/06/15.
Power Electronics

Q.6a) Explain the advantage of use of power electronics in control of electrical machines. **(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 a three phase bridge controlled rectifier, draw the waveform of instantaneous output voltage and instantaneous voltage across any one thyristor, for firing angle alpha is sixty degrees. Assume load current is continuous and constant. **(12)**
Note: Use graph paper

b) Explain various performance parameters to evaluate the performance of an inverter. **(08)**

TE (Elect), sem- II, A.T.K.T, 24/6/15.
Control Systems- I

2/6
24/06/15

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A.T.K.T.-Examination

SEM/CLASS: II TOTAL MARKS: 100 TE (Elect).

SUBJECT: Control System - I 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.

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

Master

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

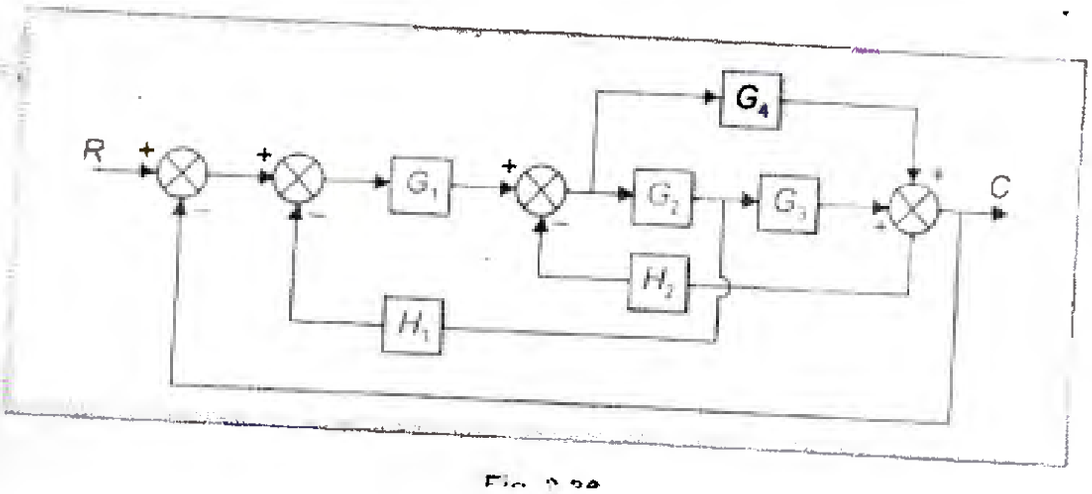

Fig. 1 Block diagram for Q1 a)

TE (Elect), Sem. V, M.T.K.T, 24/6/16.
Control System - I

Q.1.b) Find transfer functions Y/R for SFG shown in **Fig.2.** **(10)**

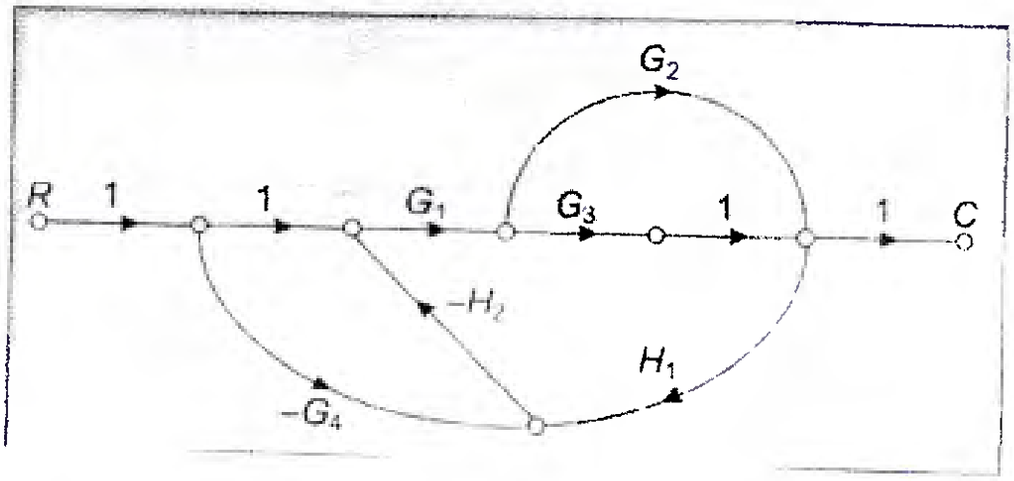

Fig.2 Signal Flow Graph (SFG) for Q1 b)

Q.2.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%?

Q.2.b) Define the following **(6)**

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

Q.3.a) Derive the relationship for Peak Time, Settling Time and Peak overshoot for typical prototype second order system. **(15)**

Q.3.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)**

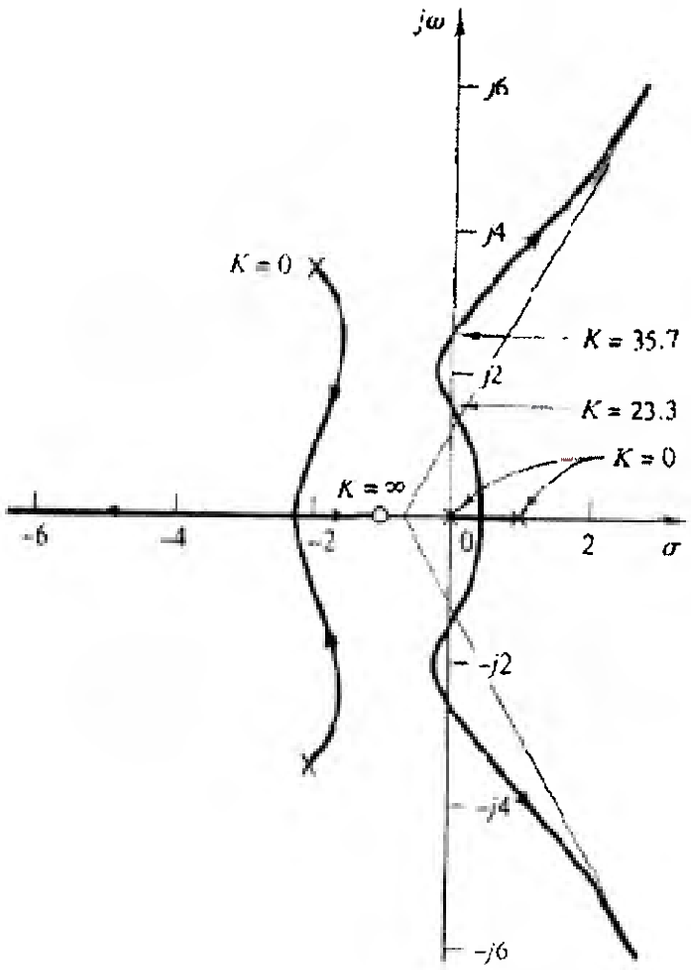

Fig.3 Root Locus Plot for Q3 b).

Q. 4.a) Find the following,

a) Damping ratio
b) Natural and damped frequency of oscillations
c) Settling, Peak and Rise time
d) Percentage Overshoot
e) Steady state error for unit step, unit ramp and unit parabolic input

for the second order system shown below.

$$T(s)=\frac{1.05\times10^{7}}{s^{2}+1.6\times10^{3}s+1.05\times10^{7}}$$

(10)

TE(Elect), Sem-V, A.T.K.T, 24/6/15.
Control System-I

Q. 4.b) a. Determine the stability of the following transfer function by using Rouths criterion. **(10)**

$$T(s)=\frac{84}{s^8+5s^7+12s^6+25s^5+45s^4+50s^3+82s^2+60s+84}$$

Q. 5) A unity feedback system with forward transfer function

$$G(s)=\frac{K}{(s+2)(s+3)(s+7)}$$

is operating with 10% overshoot.

a. What is the value of the appropriate static error constant?

b. Find the transfer function of a lag network so that the appropriate static error constant equals 4 without appreciably changing the dominant poles of the uncompensated system

(20)

Q.6) For the unity feedback system with

$$G(s)=\frac{K}{(s+1)(s+4)}$$

Design a PID controller that will yield a peak time of 1.047 seconds and a damping ratio of 0.8, with zero error for step input. **(20)**

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.

TE (Elect) Sem-II, A.T.K.T, dt 16/11/15,
Electromagnetic fields & waves

Lib
22/06/15

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Subject: **Electromagnetic fields & waves** **KT-2015** Marks : 100

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

- Attempt any **five** of the **seven** questions .
- Neat vector representation is a must and limit time per question.
- Any assumptions must be specified clearly.

Master

Vidya Bh

1 Answer any four:

a. Explain the concept of displacement current. 5
b. Prove that electric field intensity **E** = - grad V. 5
c. Calculate the field intensity at a point (3,4,5) due to a charge of 5nC placed at (1,2,3) 5
d. State and explain Continuity Equation of current in point and integral form. 5
e. State and explain Gauss Law. 5

2a. Obtain an expression for the electric field due to infinite line charge ρ_L C/m . 10

b. Given that $\mathbf{D}=(10x^3/3)\,\hat{a}_x$ 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

3a Verify stokes theorem for the field $\mathbf{H} = 6xy\hat{a}_x - 3y^2\,\hat{a}_y$ A/m and the rectangular path around the region , $2 \le x \le 5$, and $-1 \le y \le 1$. z=0.Let the positive direction of **ds** be $\hat{\mathbf{a}}_z$. 10

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

TE (Elect), Sem. V, A. T. K. T, 02/16/15.
Electromagnetic Fields & waves

4a.	Derive wave equation from Maxwell's equation for free space.	10
b.	Derive the expression for the capacitance of parallel plate capacitor.	10
5a.	Explain Biot Savarts Law and Ampere's Circuital Law.	10
b..	A dipole having moment of $\mathbf{p} = 3\,\hat{a}_x - 5\,\hat{a}y + 10\hat{a}_z$ nCm is located at Q(1,2,-4) in free space.Find V at P(2,3,4)	10
6a.	A charge of 1C is at (2,0,0).What charge must be placed at (-2,0,0) which will make y component of total **E** zero at the point (1,2,2).	10
b.	State and explain in detail Maxwell's equations for in point and integral form.	10
7a	Write short notes on any two: a) Scalar and vector magntic potential b) Method of images. c) Poisson's and Laplace's equations	20

TE(Elect), Sem - V, A.T.K.T, 22/6/15. (old)
Electromagetic fields & waves.

lib
22/06/15

Bhartiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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Subject: **Electromagnetic fields & waves** **kt-2015(old)**

Marks : 100

Class: TE Electrical / Sem – V

Time : 3 hrs

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.

Master.

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1 Attempt any four: (5x4=20)

a) State and explain Gauss's law.

b) Explain Electric field is conservative whereas magnetic field is non-conservative.

c) Calculate the field intensity at a point on a sphere of radius 3m,if a positive charge of 2μC is placed at the origin of the sphere.

d) Obtain the point form of the Continuity Equation.

e) State and explain Amperes circuital law.

2. a) Derive the expression for Poynting's theorem and explain its significance . 12

b) Determine the net flux of the vector field $\bar{F}(x,y,z)= 2x^2 y\, \hat{a}_x + z\, \hat{a}_y + y\hat{a}_z$ emerging from the unit cube $0 \leq x, y, z \leq 1$. 8

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

b) Verify both sides of Stoke's theorem for the surface defined by $0 \leq \theta \leq 0.1\pi$, $r = 4m$ and $0 \leq \Phi \leq 0.3\,\pi$. Given $\bar{H} = 6\, r \sin\Phi\, \mathbf{a}_r + 18 r \sin\theta\cos\Phi\, \mathbf{a}_\Phi$ A/m. 10

4 a) Derive the magnetic field intensity due to an infinitely long straight conductor carrying current in $\hat{a}_z$ direction using Biot Savart's law. 10

TE (Elect), Sem - V, A.T.K.T, 02/6/15.
Electromagnetic Fields & Waves.

b) Derive the boundary conditions for $\overline{E}$ and $\overline{D}$ at the interface between two dielectrics. 10

5 a) What is an electric dipole? Obtain an expression for the potential V at a distant point P due to an electric dipole. 12

b) A lossy dielectric has $\mu_r=1$, $\varepsilon_r=50$ and $\sigma=20$ mho/m at 15.9MHz electromagnetic wave propagating through this medium. Find attenuation constant, phase constant, velocity of propagation and intrinsic impedance of the medium. 8

6. a) A charge $Q_1 = -20\ \mu C$ is located at P(-6,4,6) and a charge $Q_2=50\ \mu C$ is located at R(5,8,-2) in a free space. Find the force exerted on Q_2 by Q_1 in vector form. (distance are in metres). 10

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

7 Write short notes on any two: 20

a) Method of images.
b) Scalar and Vector magnetic potential.
c) Poissons and Laplace Equations

TE(Elect), Sem-V, A.T.K.T, (Old),
Electrical machines - II

lib
24/06/15

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Kt old 2015

A.T.K.T. (Old).

CLASS/SEM : **TE / V** (Elect)
Subject : **Electrical machines II**

Total Marks :20
Duration : 1Hr
Date 24/06/2015

- Attempt any **five** out of the **seven** questions.
- Answer to all sub questions should be grouped together.
- Assume **suitable data** where required.

Master

Q1	Explain in detail cross sectional view and construction of 3-phase transformer and explain the switching in transient phenomena.	20
Q2	Give in detail the explanation of three phase Induction Motor speed control methods.	20
Q3	Explain the double field revolving theory with phasors and neat diagrams.	20
Q4	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. What is cogging and crawling?	20
Q5	Explain in detail the parallel operation of three phase transformer for load sharing purpose.	20
Q6	Explain in detail construction of circle diagram in three phase Induction motors.	20
Q7	Write short notes : a) Stepper motors b) Brushless DC motor c) Capacitor start capacitor run motor d) Cooling methods of alternator e) No load and blocked rotor test of three phase IM	20

TE (Elect), Sem-V, A.T.K.T, 24/06/2015. LD 24/06/15

Electrical machines - II

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SARDAR PATEL COLLEGE OF ENGINEERING

Munshi Nagar Andheri (West), Mumbai 400 058

(An Autonomous Institution Affiliated to University of Mumbai)

KT 2015

CLASS/SEM : TE / V (Elect)
Subject : **Electrical machines II**

Total Marks : 100
Duration : 3Hr

- 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

Q1a)	Derive the power developed in salient pole synchronous generator with neat diagrams. How does saliency affect the power developed.	10
	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

TE(Elect), Sem-V, A.T. K.T, 23/06/15.
Electrical Machines- II

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 : a) Stepper motors b) Brushless DC motor c) Capacitor start capacitor run motor d) Cooling methods of alternator	20