SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR

Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code : PSD (16EE223)	**Course & Branch**: B.Tech - EEE
Year & Sem: III-B.Tech & II-Sem	**Regulation:** R16

UNIT –I
CONVERTER FED DC MOTORS

1. Draw and explain operation of 1-Ø semi controlled converter fed by SEDC motor.   [L2][12M]

2. A 1-Ø,230V,50HZ supply feeds a separately excited dc motor through two 1-Øsemi converters, one for the field and the other for the armature. The firing angle for the semi converter in field circuit is zero, the field resistance is 200Ω and the armature resistance Ra is 0.3Ω. the load torque is 50 N-m at 900 rpm, the voltage constant is 0.8V/A-rad/s and the torque constant is 0.8N-m/A^2.assume that the armature and field currents are continuous and constant, and neglect the losses. Find the following (a) the field current (b) the firing angle and (c) the power factor of semi-converters in the armature circuit.   [L3][12M]

3. Draw and explain operation of 1-Ø fully controlled converter fed by SEDC motor.   [L2][12M]

4. Draw and explain operation of 1-Ø semi controlled converter fed by dc series motor.   [L2][12M]

5. The speed of a 20HP,210V,1000rpm,series dc motor is contolled by a semi-converter , the combined field and armature circuit resistance is 0.25Ω , Kaf=0.03N-m/ A^2 and Kres=0.075 V-S/rad. The supply voltage is 230V.Assuming continuous and ripple –free motor current,determine the following for a firing angle α=30^0 and speed N=1000 rpm. I) the motor torque ii) the motor current iii)the supply power-factor.   [L3][12M]

6. Explain the operation of 3-Ø half controlled converter fed by DC series motor with necessary waveforms.   L2][12M]

7. A 100KW,440V,1000 rpm dc motor running at 800rpm and developing 75% rated torque is controlled by a 3-Ø,6-pulse thyristor.If the back emf at rated speed is 410V,determine the triggering angle of the converter .it is fed with a 3-Ø,415V, 50Hz ac supply.   [L3][12M]

8. Draw and explain operation of 3-Ø fully controlled converter fed by SEDC motor.   [L2][12M]

9. The speed of a 150HP, 650volts SEDC motor is operating at 1750rpm is controlled by 3-ϕ full converter Which is operating from 3-ϕ, 460volts, 50Hz Supply. The rated armature current of the motor is 170A.The motor parameters are R_a=0.099Ω,L_a=0.73mH,$K_{aϕ}$=0.33V/rpm. (a)Find the no load Speed at α=0^0,α=30^0.Assuming no load current is 10% of rated current. (b)Calculate the firing Angle at 1750rpm speed of rated motor current also computes the supply p.f. (c) the speed regulation   [L2][12M]

10. Explain the operation of single phase fully controlled converter fed DC series motor with neat Waveforms and derive the expressions for speed and torque.   [L2][12M]

UNIT –II

FOUR QUADRANT OPERATION OF DC DRIVES

1. Write short notes on a) Plugging b) Dynamic braking c) Regenerative braking [L2][12M]

2. With a neat diagram, explain the four quadrant operation of a DC drive in all four quadrants When fed by a Three phase non circulating dual converter. [L2][12M]

3. A 220V, 970rpm, 100A dc separately excited motor has an armature resistance of 0.05Ω.It is Braked by plugging from an initial speed of 1000rpm.Calculate a) Resistance to be placed in armature circuit to limit braking current to twice the full load value,

    b) Braking torque c) Torque when the speed has fallen to zero. [L3][12M]

4.a) Compare Ideal and practical dual converter based on various aspects. [L3][6M]

    b) Compare practical non circulating and circulating type dual converter. [L3][6M]

5. A 220V,750RPM,200A separately excited motor has an armature resistance of 0.05 Ω. Armature is fed from a 3-phase non –circulating current mode dual converter consists of fully controlled rectifiers A&B. Rectifier A provides motoring operation in the forward direction, rectifier B in reverse direction, line voltage of ac source is 400volts.Calculate firing angle of rectifier for the motoring operation at rated torque and 600rpm assuming continuous conduction. . [L3][12M]

6. a) Draw and explain operation of current limit control   b) Draw and explain operation of torque control by using closed loop control of DC Drives . [L2][12M]

7. A 400V,750 rpm,70A,dc shunt motor has an armature resistance of 0.3Ω, when running under rated condition ,the motor is to be braked by plugging with armature current limited to 90A .what external resistance should be connected in series with the motor ,calculate the initial braking torque and its value when the speed is increased to 300 rpm. [L3][12M]

8 . With a neat diagram, explain the four quadrant operation of a DC drive in all four quadrants When fed by a Three phase circulating current mode dual converter. [L2][12M].

9. a)A 230V ,870rpm,100A seperately excited DC motor has an armature resistance of 0.02Ω.It is coupled to an over halling with a torque of 400N-m.Determine the speed at which motor can Hold the Load by regenerative braking. [L3][6M]

    b)Explain the operation of closed loop speed control of dc drive [L2][6M]

10. A 220V ,1000 rpm,60A separately excited dc motor with an armature resistance of 0.6 Ω is fed from a circulating current dual converter with ac source voltage(line) of 165 volts.Determine converter firing angles for the following operating modes.

    i) Motoring operation at rated motor torque & 900 rpm.

    ii) Braking operation at rated motor torque & 900 rpm

iii) Motoring operation at rated motor torque & -900 rpm

iv) Braking operation at rated motor torque & -900 rpm

[L2][12M]

UNIT –III
CHOPPER FED DC MOTORS

1. Explain the operation of first quadrant chopper fed by separately excited DC motor with necessary waveforms   [L2][12M]

2. Explain the operation of second quadrant chopper fed by separately excited DC motor with necessary waveforms.   [L2][12M]

3.a)A separately excited dc motor with armature resistance of 0.01Ω with dc supply 220V,100A,1000rpm is fed with chopper control for its motoring and braking operations. Assuming continuous conduction calculate (i) the duty ratio of the chopper at rated torque with speed of 500 rpm for its motoring operation (ii) the duty ratio of the chopper at rated torque with speed of 500 rpm for its braking operation   [L3][6M]

b) A 230V,1200 rpm ,15A separately excited dc motor has an armature resistance of 1.2Ω motor and is operated under dynamic braking ,with chopper control braking resistance of 20Ω. (i)calculate the duty ratio of the chopper for motor speed of 1000 rpm and braking torque equal to 1.5 times rated motor torque (ii) what will be the motor speed for duty ratio of 0.5 and motor torque equal to rated torque?

[L3][6M]

2. Explain the operation of dynamic braking for series & seperately excited DC motor?   [L2][12M]

3. a) A separately excited dc motor is running at 1100rpm,210V,with an armature resistance of 0.08. the initial speed of the motor is 1200rpm when broken by plugging ,take I_a=140A.(i) to limit the braking current to twice the full load value,calculate the resistance to be placed in armature circuit.(ii) calculate the braking torque ,and when speed is redued to zero, calculate the torque.   [L3][6M]

b)A 230V,10A,1500rpm separately excited dc motor with armatur resistance of 1.5Ω motor in operator under dynamic braking with chopper control.braking resistance has a value of 15Ω.(i)calculate the duty ratio of chopper for motor speed of 1200rpm and braking torque equal to 2 times the rated motor torque. (ii)what will be the motor speed for duty ratio of 0.6 and motor torque equal to twice the rated torque?   [L3][6M]

4. Explain the operation of motoring & regenerative braking of series excited DC motor?   [L2][12M]

5. A dc series motor has its speed controlled by a chopper from a 600V dc source having armature and field resistance of 0.05Ω and 0.07Ω respectively. The armature current is assumed to be continuous and ripple-free, and the average armature current is 500A,the back emf constant of the motor is

Kt=15.27mv/A-rad/s,if the duty cycle of the converter is 60%.Determine the following (i)power generated from the input source (ii) equivalent output resistance of converter (iii) speed of motor and developed torque of motor. [L3][12M]

6. In regenerative braking of dc series motor,a dc-dc converter is used.The armature and field resistance are 0.06Ω and 40.08Ω respectively.the dc supply voltage is 500V.the armature current is assumed to be continuous and ripple-free,and the average armature current is maintained constant at I_a=300A.the back emf constant is Kt=15.27mv/A-rad/s.If the duty cycle of the converter is 65%,determine (i) the voltage across chopper (ii) the equivalent resistance of motor acting as a generator. (iii)the power generated to supply voltage (iv) the minimum and maximum permissible braking speed,and (v) the motor speed. [L3][12M]

7. Explain the operation of motoring & dynamic braking of series excited DC motor? [L2][12M]

8. In rheostatic braking of dc series motor,a dc-dc converter is used.the armature and field resistance are 0.05Ω and 0.08Ω respectively and the braking resistor is 8Ω.the armature current is assumed to be continuous and ripple-free,and the average armature current is maintained constant at I_a=300A.the back emf constant is Kt=14mv/A-rad/s.If the duty cycle of the converter is 50%,determine (i) the average voltage of dc-dc chopper (ii)the power dissipated in braking resistor (iii) the equivalent resistance of motor acting as a generator. (iv) the motor speed and peak voltage of dc-dc converter

[L3][12M]

UNIT –IV
CONTROL OF INDUCTION MOTOR

1. (a) Explain voltage control method of Induction motor drive? [L2][6M]

   (b) A 3-Ø star-connected 400V,50Hz,4-pole induction motor has the following per phase parameters referred to the stators: R_1=0.15Ω, X_1=0.45Ω,$R2^1$=0.12Ω, $X2^1$=28.5Ω compute the stator current and power factor when the motor is operated at rated voltage and frequency with S=0.04. [L3][6M]

2. Draw the characteristics of torque-speed and and explain them? [L2][12M]

3. (a) Explain stator- frequency control method? [L2][6M]

   (b)A 3-Ø, 400V,50Hz,6 pole star connected induction motor has the following parameters (reffered to stator):R1=R2=0.15Ω,X1=X2=0.8Ω,determine the initial braking torque if the motor is braked by plugging the full load the slip is 0.04. [L3][6M]

4. Explain briefly voltage source inverter control of induction motor? [L2][12M]

5. A 3-Ø,50KW,1475rpm,400V,50Hz,4pole star-connected induction motor has the following parameters : Rs= 0.42Ω, Rr= 0.23Ω, Xs =0.95Ω, Xr =0.85Ω, Xm =30Ω, all quantities being referred to the stator side. the motor is operated with frequency control. if the break down torque is 225 N-m

at the supply frequency, determine (a) the supply frequency (b) the slip at maximum torque (c) the speed at maximum torque.   [L3][12M]

6. What is meant by slip power and Explain using a power circuit the working of a static Kramer drive system   [L2][12M]

7. (a) comparison of VSI Drive with CSI Drive?   [L2][6M]

   (b) Explain speed –torque characteristics of current source inverter ?   [L2][6M]

8. Explain the operation of static rotor resistance control with wave form .   [L2][12M]

9. A 3-Ø ,400V,50Hz,100Kw,24-pole,240 rpm slip-ring induction motor has both its stator and rotor windings connected in star pattern. The ratio of stator to rotor turns is 1.4.the resistance per phase of rotor referred to stator is 0.03 Ω . the motor drives a fan which requires 100kw at full load speed of the motor .determine the value of the resistance to connect in series with each slip ring ,so that the fan runs at 180 rpm. Assume that torque for the fan varies proportionally to the squares of its speed. Neglect stator resistance ,leakage reactance and rotational losses.   [L3][12M]

10.   A 3-Ø, 4-pole, 50Hz induction motor has a chopper – controlled resistance in the rotor circuit for speed control load torque is ω^2.when the thyristor is on, the torque is 40-N-m at an average slip of 0.04. If Ton/Toff=1,compute the average torque and speed. the motor develops a torque of 75% when the thyristor is off. If the speed variation range is down to 1250 rpm from synchronous speed, determine the ratio Ton/Toff require to obtain an average torque of 35N-m.   [L3][12M]

UNIT –V
CONTROL OF SYNCHRONOUS MOTORS

1. Discuss using a block diagram the operation of a voltage source inverter fed synchronous motor in the true synchronous mode.   [L2][12M]
2. a) Explain the operation of self –control of synchronous motor?   [L2][6M]
    b) Explain the operation of separate–control of synchronous motor?   [L2][6M]
3. Discuss using a block diagram the operation of a current source inverter fed synchronous motor in the true synchronous mode.   [L2][12M]
4. Discuss using a block diagram the operation of a cycloconverter fed synchronous motor ? [L2][12M]
5. Explain load commutated current source inverter fed synchronous motor?   [L2][12M]
6. Explain the closed loop control scheme of adjustable speed synchronous motor drive and mention its need and advantages ?   [L2][12M]
7. A 7 MW 3 phase 12 KV star connected 6 pole 50 Hz 0.9 leading power factor synchronous motor has X_s=10Ω,R_s=0Ω. The rated field current is 40 A. The machine is controlled by variable frequency control at constant V/F ratio up to the base speed and at constant voltage above base speed. Determine
    i.   Torque
    ii. The field current for the rated armature current at 750 rpm and 0.8 leading power factor
                                                                         [L3][12M]

8. A 6MW 3 Phase 11 KV, star connected 6 pole 50 Hz 0.9 lagging power factor synchronous motor has synchronous reactance equal to 9Ω and armature resistance equal to 0Ω. The rated field current is 50 A. The machine is controlled by variable frequency control at constant V/F ratio up to the base speed and at constant voltage above base speed. Determine
    i. Torque and field current for the rated armature current, 750 RPM and 0.8 leading power factor
    ii. Armature current and power factor for half the rated motor torque, 1500 rpm and rated field current. [L3][12M]

9. A 3 phase 400 volt 50 Hz 6 pole star connected wound rotor synchronous motor has $Z_s=0+j2$ Ω. Load torque proportional to speed^2, is 340 NM at rated synchronous speed. The speed of the motor is lowered by keeping V/F constant maintain unity power factor by field control of the motor. For the motor operation at 600 rpm, calculate
    i. Supply voltage
    ii. Armature current
    iii. Excitation angle
    iv. Load angle [L3][12M]

10. What is meant by self controlled synchronous motor drive and write any four special features of self controlled synchronous machine? [L2][12M]