A   Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The rating of a motor for a given industrial load cycle should have   CO1- R

   (a) Sufficient thermal capacity   (b) Sufficient over load capacity

   (c) Sufficient starting torque   (d All of the above

2. When only one quadrant operation is required the converter   CO1- R
   normally preferred is_____

   (a) Fully controlled converter   (b) Fully controlled converter with FWD

   (c) Half controlled converter   (d) Sequence control of two series connected converters

3. In a discontinuous mode of conduction for converter fed dc drive   CO1- R
   which is true

   (a) Peak current increases   (b) Average current increases

   (c) Rms current decreases   (d) Average currents decreases

4. A freewheeling diode in a phase controlled rectifier_____   CO1- R

   (a) Enables the inverter operation

   (b) Smoothens the load current consequently the smoothing inductance required is small

   (c) Makes the converter draw additional reactive power

   (d) Improves the line power factor

5. Regardless of the open loop or closed loop operation of the phase controlled induction drives the efficiency of the motor drive is proportional to_____   CO2- R

   (a) Speed   (b) Rotor copper loss   (c) Stray losses   (d) Input power

6. Which of the following induction motor drive method is more efficient   CO2- R

   (a) Phase voltage control   (b) Rotor side chopper resistance control

   (c) Slip power recovery control   (d) Stator resistance control

7. Which of the following is true for scherbius drive   CO2- R
   (i) regenerative operation
   (ii) super synchronous speed control
   (iii) possible to have mechanical power greater than air gap power

   (a) i and ii   (b) i and iii   (c) ii and iii   (d) i, ii and iii

8. In a closed loop controller dc motor drive which is fastest loop?   CO3- R

   (a) Speed loop   (b) Current loop

   (c) Both speed and current loop   (d) Neither speed loop nor current loop

9. In dynamic simulation of speed controlled dc motor drive the transfer function approach becomes invalid because of   CO3- R

   (a) Non linear current loop   (b) Non-inclusion of stray losses

   (c) Thermal instability   (d) None of the above

10. As per the field weakening control method which of the following is not true?   CO3- R

   (a) The drive responds very slowly   (b) Fully controlled rectifier is usually preferred

   (c) Both a and b   (d) Field time constant is small

<div align="center">PART – B (5 x 2= 10Marks)</div>

11. What is the difference between first quadrant and third quadrant operation of   CO1- Ana
    a DC drive?
12. Give the various components of load torque.   CO1- U

13. Why the slip power recovery scheme is efficient?   CO2- U

14. Using phase shifting principle, find the number of inverters, their phase   CO2- Ana
    shifts to suppress harmonics lower than fifteenth in a frequency controlled
    induction motor drive.

15. How the ratings of the converter and its power switches are chosen?   CO3- R

<div align="center">PART – C (5 x 16= 80Marks)</div>

16. (a) Explain the stability of motor load system through the   CO1- Ana   (16)
       investigation of torque equilibrium point steady state stability
       analysis.

<div align="center">Or</div>

   (b) Explain the steady state operation of three phase fully controlled   CO1- Ana   (16)
       converter fed separately excited DC motor for first quadrant and
       second quadrant mode.

17. (a) What are the classes of duty can be identified for a drive motor   CO1- U   (16)
       and how the drive motor rating is chosen for any two classes of
       duty.

<div align="center">Or</div>

   (b) A separately excited dc motor rated at 10 kW, 240 V, 1000 rpm is   CO1- Ana   (16)
       supplied from a fully controlled two pulse bridge converter. The
       converter is supplied at 250 V, 50 Hz supply. An extra inductance
       is connected in the load circuit to make the   conduction
       continuous. Determine the speed, power factor and efficiency of
       operation for thyristor firing angles of 0 and 60° assuming the
       armature resistance of 0.40Ω and an efficiency of 87% at rated
       conditions. Assume constant torque load.

18. (a) Analyse the field weakening mode of operation in detail and   CO2-Ana   (16)
       arrive the maximum value for stator frequency.

<div align="center">Or</div>

   (b) (i) Explain the principle of constant air gap flux control strategy   CO2-U   (10)
          with neat block diagram.

       (ii) Derive stator current magnitude in terms of the induction   CO2-App   (6)
       motor parameters, slip speed, and magnetizing current to
       implement a constant air gap flux linkages drive system.

19. (a) Explain the different control principles of current fed inverter   CO4- U   (16)
       induction motor drive with suitable block diagram and sketch.

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(b) A 460V, 60Hz 6 pole, 1180 rpm, star connected squirrel –cage   CO4- App   (16)
induction motor has the following parameters per phase referred
to the stator: R_s=0.19Ω, R_r'=0.07Ω, X_s=0.75Ω, X_r'=0.67Ω and
X_m=20Ω. The motor is fed by a 6-step inverter which in turn is
fed by a 6-fully controlled rectifier.
1. If the rectifier is fed by an ac source of 460V and 60Hz , what
should the rectifier firing be to get the rated fundamental voltage
across the motor?
2. Calculate the percentage increase in copper loss of the machine
at 60Hz, compared to the value when fed by a sinusoidal supply.
Neglect skin effect and derating factor due to harmonics.

20. (a) How to simulate the single quadrant converter fed dc drive?   CO3- Ana   (16)
Explain the steps along with flowchart.

(b) Design a speed controlled dc motor drive maintaining the field flu CO3- Ana   (16)
constant. The motor parameters and ratings are as follows:
220V, 8.3A, 470 rpm, R_a=4Ω, J=0.0607kg-m^2, L_a=0.072l
B_t=0.0869N-m/rad/sec., K_b=1.26V/rad/sec. The converter is suppli
from 230V, 3 phase ac at60Hz. The converter is linear and i
maximum control input voltage is ±10V.the tacho generator has tl
transfer function G(S)=0.065/(1+0.002s). The speed referen
voltage has a maximum of   10V. The maximum current permitted
the motor is 20A.

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