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Total Pages—6

(Set-Q_1)

M.Tech - 1st(EE-PSE)
PECD

Full Marks : 70

Time : 3 hours

Answer any **six** questions including **Q. No. 1**

The figures in the right-hand margin indicate marks

1. Give brief answers : 2×10

   (*i*) Where armature controlled dc drive is used and why ?

   (*ii*) Where field controlled dc drive is used and why ?

   (*iii*) In a dc drive, why current loop is inner and speed loop is outer loop ?

   (*iv*) Under which conditions, armature current of a dc drive can be discontinuous.

(*Turn Over*)

(*v*) What is the input power factor of a dc drive ?

(*vi*) What is current limit control ?

(*vii*) What are the advantages of VSI fed drives ?

(*viii*) What are the merits of static control of rotor resistance over conventional rheostatic control methods ?

(*ix*) What is vector control ?

(*x*) What is self controlled synchronous motor drive ?

2. (*a*) Discuss the factors affecting the choice of an adjustable speed drive. 5

(*b*) Explain all the parameters for performance evaluation of a dc drive. 5

3. (*a*) Explain the scheme of a dual converter fed dc drive. Compare the merits and limitations of this drive when operated with circulating current and without circulating current. Draw the waveforms of output voltage of

each converter, voltage across the dc link reactor and circulating current when one of the three phase dual converter is fired at 60°. 5

(*b*) The speed of a 125 hp, 600V 1800 r.p.m. separately excited dc motor is controlled by a 3-phase fully controlled converter. The converter is supplied from a 3-phase 480 V, 50 Hz source. Rated armature current is 165 A. Armature resistance is 0·0874 Ω. Back emf constant at rated fluxes $\frac{1}{3}$ V/rpm. No load armature current is 10 % rated armature current.

(*i*) Determine the no load speed at $\alpha = 30°$.

(*ii*) Calculate α to obtain rated speed of 1800 r.p.m. at rated current.

(*iii*) Compute input power factor and speed regulation for the value of α, obtained in part-(ii). 5

4. (*a*) Why V/f control is important ? Sketch the variation of stator voltage, current, torque,

speed, power and slip for the entire range of speed variation. Explain a closed loop V/f control scheme. 5

(*b*) A 2·8 kW, 400 V, 50 Hz, 1370 r.p.m. Y-connected induction motor has the following parameters referred to stator :

$R_s = 1{\cdot}9\ \Omega, R'_r = 4{\cdot}757\ \Omega, X_s = X'_r = 3\ \Omega.$

Load characteristics are matched with motor such that the motor runs at 1370 r.p.m. with full voltage across its terminals. The motor is controlled by terminal voltage control and load torque is proportional to speed. Calculate the motor terminal voltage and current at half the rated speed. 5

5. (*a*) Discuss the principles of direct vector control, a scheme of direct vector control and its merits for a 3-phase induction motor drive. 5

(*b*) Explain the indirect vector control scheme and its relative merits for three phase induction motor drive. 5

6. (*a*) Explain the static slip power control scheme for three phase induction motor. Draw its torque vrs. speed characteristics and discuss the merits. 5

(*b*) A 6-pole, 50 Hz slip ring induction motor is controlled by slip power recovery scheme. Stator and inverter are connected to 415 V, 3-phase, 50 Hz source. There is no transformer. Determine the firing angle of phase controlled inverter to give a speed of (*i*) 600 r.p.m., (*ii*) 800 r.p.m.. Open circuit voltage at standstill between slip-rings is 600 V. 5

7. (*a*) Explain the scheme for static control of rotor resistance in 3-phase induction motor drive. Draw the rotor voltage and current waveforms and obtain the total equivalent rotor resistance. Draw the variable speed vrs. torque characteristics. 5

(*b*) What are the different types of synchronous machines ? Obtain the expression for developed power for them. Draw the phasor diagram for

motoring operation with lagging and leading power factors for cylindrical rotor and salient pole machines. 5

8. Write short notes on any *two* : 5 × 2

(*i*) Air gap flux oriented control

(*ii*) One, two and four quadrant dc drives with different chopper circuits

(*iii*) Adjustable speed synchronous motor drive in true and self synchronous modes.
