

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), November 2016

B. Tech in Electrical Engineering, Semester VII

Roll No.....

EE701: Electrical Drive and Control

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	In electrical drives the component which is used to modulate power from source to motor. (a) Control unit (b) Power modulator (c) Sensing unit (d) Control command	
ii.	A three phase Induction motor is started by means of a star/delta switch. The starting current is (a) three time the current with DOL (b) 1/3 times the current with DOL (c) $\sqrt{3}$ time the current with DOL (d) $1/\sqrt{3}$ time the current with DOL	
iii.	A variable speed three phase induction motor drive obtained with varying the applied voltage is suitable for (a) driving constant load torque (b) driving fan type load where $T \propto N^2$ (c) driving load where $T \propto 1/N^2$ (d) driving all type of load	
iv.	When only one quadrant operation is required for converter normally preferred (a) fully controlled converter (b) fully controlled converter with FWD (c) half controlled converter (d) sequence control of two series connected converter	
v.	Ward Leonard method of speed control achieves speed change by (a) varying field flux (b) varying armature voltage (c) varying armature resistance (d) all of the above	
vi.	The snubber circuit is used in thyristor circuits for (a) Triggering (b) dv/dt protection (c) di/dt protection (d) phase shifting	
vii.	In dual converter, the circulating current (a) Allows smooth reversal of load current, but increase the response time (b) Allows smooth reversal of load current with improved speed of response (c) Does not allow smooth reversal of load current, but reduces the response time	

	(d) Flows if there is no interconnecting inductor	
viii	In chopper fed drive the speed is controlled by changing (a) the duty cycle (b) the firing angle (c) either (a) or (b) at a time (d) all of these.	
ix	The load torques which usually retain their sign when the direction of the drive motion (rotation) is changed are (a) passive load torques (b) active load torques (c) both active and passive load torques (d) none	
x	The rotor frequency for a 3 phase 1000 RPM 6 pole induction motor with a slip of 0.04 is _____ Hz (a) 8 (b) 4 (c) 6 (d) 2	

Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i	Analyze the armature and speed of separately excited motor will be affected when halving the armature and field current with load current remaining constant.	
ii	When plugging is employed for stopping an induction motor, Why is it necessary to disconnect it from supply when speed reach to zero?	
iii	Recommended the necessity of starter for a dc motor.	
iv	Name the type of starters suitable for three phase squirrel cage induction motor.	

Q.3A	Define the electrical drives. Point the factors influencing the choice of electrical drives.	05
Q.3B	Describe the operation of a conventional ward Leonard speed control system for dc separately excited motor.	05
Q.4A	Derive the Speed, Torque Equations of a fully controlled converter connected to separately excited D.C motor with continuous current operation with necessary waveforms	05
Q.4B	Explain the modification of speed torque characteristic of dc motor of the following i. With increase in armature resistance. ii. By field weakening.	05

Q.5A	Describe the relative merits and demerits of the following types of braking for dc motors: mechanical braking, dynamic braking and regenerative braking with neat diagram	05
Q.5B	A 220 volt, 875 rpm, 150 amp separately excited dc motor has an armature resistance of 0.1 ohm. It is fed from a single phase fully controlled rectifier with an AC source voltage of 200 V, 50 Hz. Calculate i. Firing angle for rated motor torque and 400 rpm. ii. Firing angle for rated motor torque and (-500) rpm.	05
Q.6	Describe the slip power recovery control of slip ring induction motor.	10
OR		
Q.6	The maximum torque of a 3-phase squirrel cage induction motor is 2.5 times the full load torque, and starting torque is 1.2 times the full load torque. For negligible stator resistance, compute the i. Slip at maximum torque ii. Full load slip iii. Starting current in term of full load value.	10
Q.7A	With the diagram, Examine the operation of multi quadrant fed dc drive.	05
Q.7B	A 400 volt, 50 Hz, 3-phase, 6-pole. Y-connected, squirrel cage induction motor has following parameters: $R_s = 0.05 \text{ ohm}$, $R_r' = 0.2 \text{ ohm}$, $X_s = X_r' = 0.6 \text{ ohm}$, The combined inertia of motor and load is 40 Kg-m ² . i. Calculate the time taken by the motor during starting. ii. Calculated time taken by the motor when it is stopped by plugging.	05
OR		
Q.7B	Explain the advantages and disadvantages of ac voltage controller fed 3-phase IM drive when compared to inverter fed drives.	05
Q.8A	Derive the fundamental load torque equation. Explain the types of load used in the industries.	10

Q.9A	A 3 phase 440 volt, 50 Hz, 4-pole, y-connected induction motor has following parameter referred for the stator: $R_s=0.4$ ohm, $R_r'=0.8$ ohm, $X_s = X_r' = 1$ ohm stator to rotor turn ratio is 2.5. If motor used for regenerative braking, determine: - Maximum overhauling torque it can be hold and the range of the speed in which it can safely operate. - The speed at which it will hold a load with a load torque of 160 n-m.	10
Q.9B	What are requirement of transient analysis of drives? Do the transient analysis of separately excited dc motor with armature control and calculate acceleration & retardation time and also total energy loss.	10
OR		
Q.9B	A 200 volt, 500 rpm, 800 amp separately excited dc motor has an armature resistance and field resistance of 0.05 ohm and 10 ohm respectively. The load torque is given by the expression $T_L=2000-2N$, N-m, where N is the speed in rpm. Speed below the rated are obtained by armature voltage control and speed above the rated are obtained by field control. - Calculate motor terminal voltage and armature current when the speed is 500 rpm. - Calculate field winding voltage and armature current when the speed is 1000 rpm	10