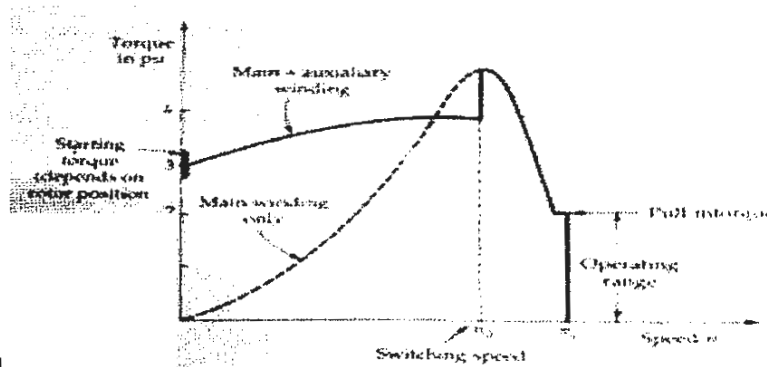


PART-I

Answer any Three questions. Two marks are for neatness. All symbols have their usual significance.

1. a) Show with a stator-conductors of the induction motor, how 2-poles are produced from 3-phase currents in a 3-phase Induction Motor.
b) Explain 3-phase linear induction motor structure and operation. What is the application and limitation of this motor?
8+8=16
2. a) Draw & describe the construction of stator and rotor of a single-phase reluctance motor.
b) Explain all the marked portion in speed-torque characteristics of single-phase reluctance motor as



shown in fig.1

8+8=16

3. Draw & describe the construction of stator and rotor and working method of a Hysteresis Motor deriving its speed-torque characteristic. State why it is a Silent Synchronous Machine.
16
4. Draw & describe the construction of stator and rotor and principle of operation of a Permanent Magnet DC Motor deriving its speed-torque characteristic. Also explain **Armature Reaction** and how it affects this Motor.
16
5. Write short notes on any two:
a) Hybrid Stepper Motors.
b) BLDC Motor
c) Permanent Magnet Synchronous motor.
8+8=16

[Turn over

PART-II.

Answer *all* questions from this part.

6.	a) Deduce the expression for torque developed in a three phase squirrel cage induction generator taking the stator parameters in to account and sketch its nature of variation with slip. (CO2)	10
	OR	
	b) Draw the circle diagram of a three phase induction generator and explain the same indicating all parameters. (CO1)	10
7.	a) Deduce the expression for reactive power in a three phase self excited induction generator having stator capacitors with the help of its steady state equivalent circuit. Sketch its nature with variation of speed. (CO3)	10
	OR	
	b) Draw the phasor diagram of a three phase doubly fed induction generator under super-synchronous operation and explain the nature of its power factor. (CO3)	10
8.	(a) Show the control scheme block diagram for variable speed grid connected squirrel cage induction generator coupled with wind turbine and explain the function of each block. (CO4)	10
	OR	
	(b) Explain the voltage build-up procedure in a self-excited induction generator. Also define critical capacitance and critical speed in this context. (CO4)	10
9	(a) A 415V, 50 Hz, 1440 rpm, 4-pole, 3-phase star connected squirrel cage induction machine is operating as generator. It develops rated voltage at rated speed and no load when three 80uF capacitors are connected in star with its stator terminals. Assuming linear magnetic circuit, find its voltage when it is supplying a load of 2A at 0.8 pf lag at same speed. The machine parameters at 50 Hz are: per phase $R_s=R_r=1.1$ ohm, $X_{ls}=X_{lr}=3.6$ ohm, $X_m=180$ ohm, core losses negligible. (CO4)	10
	OR	

	(a) Show how a slip ring induction machine can operate as generator under sub-synchronous speed operation. Deduce the necessary derivations if required.	
10	Write short notes on any One (CO2): i) Doubly fed induction generator (DFIG). iii) Voltage and current sensing techniques for induction generator controllers.	10