B.E. ELECTRICAL ENGINEERING THIRD YEAR SECOND SEMESTER (Old) - 2018

(3^{rd} Year, 2^{nd} Semester)

ELECTRICAL MACHINES – III

Time : Three Hours | Full Marks : 100

(50 marks for each part)
Use a separate Answer Script for each part

PART – I

Answer any three questions.
Two marks are for well organized answers.

1.(a)	Derive an expression for torque produced in a three phase induction motor. Establish the condition for maximum developed torque and discuss how it is affected with the change in rotor resistance.	8
(b)	What is the effect of change in supply voltage on the operating performance of an induction motor?	4
(c)	Compare the performance of SQIM and SRIM. Explain how the operating characteristics are affected with the change of air gap length.	4
2.(a)	Develop equivalent circuit of a polyphase induction motor also develop its approximate equivalent circuit for the ease of calculation.	8
(b)	The maximum torque of a 3-phase induction motor occurs at a slip of 12%. The motor has an equivalent secondary resistance of 0.08 ohm/phase. Calculate the equivalent load resistance R_L, the equivalent load voltage V_L and the current at this slip, if the gross power output is 9,000 watts.	8
3.(a)	Why starters are necessary for starting an induction motor? What are the various types of starters used for starting of squirrel cage induction motor? Describe with circuit diagram the working of any one type of starter for starting squirrel cage induction motor and hence derive an expression for starting torque in terms of full-load torque.	10
(b)	Describe briefly the phenomenon of cogging and crawling? What measures can eliminate these effects?	6
4.(a)	Describe the construction of a double cage rotor induction motor and explain how high starting torque is developed in double cage rotor induction motor. Draw the equivalent circuit of double cage rotor induction motor.	10
(b)	At standstill, the equivalent impedance of inner and outer cages of a double cage rotor are 0.4 + j 2) ohm and (2 +j 0.4) ohm respectively. Calculate the ratio of torques produced by the two cages (i) at standstill and (ii) at 5% slip.	6
5.(a)	Using double revolving field theory explain the working of a single phase induction motor.	8
(b)	What are the various methods of starting of single phase induction motor?	4
(c)	Describe the construction and working of a shaded pole motor.	4

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SUBJECT: - ELECTRICAL MACHINES-III

Time: ~~Two hours~~/Three hours/ ~~Four hours/ Six hours~~

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

PART II

Answer any three Questions
Two marks are for neat and systematic answers

Q6. Answer any four: 4x4

a) Why field winding of a synchronous machine is placed on the rotor?

b) Show that : the armature reaction in a synchronous machine is equivalent to a reactive voltage drop.

c) The open circuit test of a synchronous machine must be performed at synchronous speed, but the short circuit test may be performed at a speed slightly different from synchronous speed.- why?

d) Steady torque is produced in a synchronous machine only at synchronous speed- why?

e) Why slip test is performed at a reduced voltage.

f) Why CR synchronous machines have long rotor compared to SP synchronous machine of same rating.

Q7. a)What is z.p.f.c ? Describe test methods to determine z.p.f.c. Why z.p.f.c curve looks similar to o.c.c ? 2+4+4

b) What is synchronous reactance? How it is determined in the laboratory? 2+4

Q8. a) What is cylindrical rotor theory? 6
b) Why cylindrical rotor theory is not applicable to salient pole machine? 2
c) What is two reaction theory? 8

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Q9. a) What is power angle characteristics? Develop power angle characteristics of a hydro generator. 8

b) Describe operating chart of a CR synchronous machine. 8

Q10. a) A 150 kVA, 440V, 3 phase, star connected, alternator has the following data:
F&W Loss= 360W, Open circuit Core Loss=500W, Field winding resistance at 75^0C=200 ohm, Ra=0.02 ohm/phase
The voltage applied to field winding is 220V. Calculate alternator efficiency at 0.8 pf, at half load 8

b) A 20 MVA, 3 phase, star connected, 11kV, 12 pole 50 Hz, salient pole synchronous motor has the following parameters.
X_d= 5 ohm, X_q= 3 ohm
At full load unity power factor and rated voltage, compute (a) the excitation voltage (b) Total Power output 8
