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B.Tech. Degree V Semester Examination November 2014

EE 1502 ELECTRICAL MACHINES II (2012 Scheme)

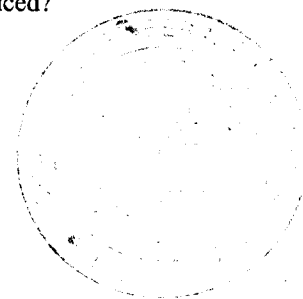
Time : 3 Hours

Maximum Marks : 100

PART A (Answer *ALL* questions)

(8 × 5 = 40)

- I. (a) Derive the relation between the number of poles, the frequency and speed of the alternator.
- (b) What are the causes of harmonics in an alternator and how these can be reduced?
- (c) Explain the effects of armature reaction in alternators for all power factors.
- (d) What is synchronization? Explain the necessity of synchronization.
- (e) Explain V-curves and inverted V-curves.
- (f) What is synchronous condenser?
- (g) Explain hunting in synchronous motors.
- (h) Define transient and subtransient reactance.



PART B

(4 × 15 = 60)

- II. (a) State the advantage of using a stationary armature and rotating field system in alternator. (7)
- (b) What are the different types of armature windings commonly employed in alternators? (8)
- OR**
- III. Calculate the rms value of the induced e.m.f. per phase of a 10 pole, 3-phase, 50Hz alternator with 2 slots per pole per phase and 4 conductors per slot in two layers. The coil span is 150°. The flux per pole has fundamental component of 0.12 Wb and a 20% third component. (15)
- IV. (a) Explain synchronous impedance of an alternator. (5)
- (b) A 1200kVa, 3300V, 50 Hz, 3 phase, star connected alternator has armature resistance of 0.25 Ω per phase. A field current of 40A produces a short circuit current of 200A and an open circuit emf of 1100V line-to-line. Find the voltage regulation on (i) full load 0.8pf lagging (ii) full load 0.8 pf leading. (10)

OR

- V. (a) Explain the slip test on alternator. (7)
- (b) Find the voltage regulation by zero power factor method of 15,000kVa, 11,000V, 3-phase, 50 Hz, star connected alternator at full load, 0.8 pf lagging having the following test data: (8)

Field AT in 10 ³	10	18	24	30	40	45	50
O.C. line voltage (KV)	4.9	8.4	10.1	11.5	12.8	13.3	13.65
Line volts, zero p.f (KV)	--	0	--	--	--	10.2	--

(P.T.O.)

- VI. (a) Explain the starting methods of a synchronous motor. (7)
(b) The synchronous reactance per phase of a 3-phase, star-connected, 6600V, synchronous motor is $10\ \Omega$. For a certain load, the input is 900Kw and the induced emf is 8900V (line value). Find the line current and power factor. Neglect resistance. (8)
- OR**
- VII. (a) Explain the operation of a synchronous motor under constant excitation and varying load. (7)
(b) Derive the expression for maximum power developed in a synchronous machine connected to infinite busbar. (8)
- VIII. (a) Explain in detail the power angle curve of a salient pole synchronous machine. (10)
(b) Explain the functions of damper windings in a synchronous motor. (5)
- OR**
- IX. (a) Obtain an expression for the natural frequency of undamped oscillation of the rotor of a synchronous motor. (8)
(b) A 10,000kVa, 4 pole, 6600V, 50Hz, 3 phase, star connected alternator has a synchronous reactance of 25% and operates on constant voltage, constant frequency bus-bars. If the natural period of oscillation while operating at full load and unity p.f is to be limited to 1.5 seconds, calculate the moment of inertia of the rotating system. (7)
