Registration No. : | | | | | | | | | | |

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B. Tech

PCEL 4302

Fifth Semester Examination – 2013

ELECTRICAL MACHINE – II

BRANCH : EEE, ELECTRICAL

QUESTION CODE : C-348

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) Calculate the distribution factor for a 6 pole, 72 slots, single layer three-phase alternator stator winding.

   (b) Define short-circuit ratio of an alternator.

   (c) What is the basic difference between the salient pole and cylindrical rotor synchronous machine ?

   (d) What will happen if the transformers working in parallel are not connected with regard to polarity ?

   (e) How the third harmonic problem of Y-Y connected three-phase transformer can be solved ?

   (f) What do you understand by phasing out of 3-phase transformer ?

   (g) What is a Universal motor and why is it called so ?

   (h) Mention two practical applications of stepper motor.

   (i) Mention two application of stepper motors.

   (j) Explain why an auxiliary winding is used in a single-phase induction motor?

2. (a) The per phase direct axis and quadrature axis synchronous reactances of a three-phase salient pole synchronous generator are 0.9 p.u and 0.6 p.u respectively. The per phase effective stator resistance of the machine is 0.15 p.u. The generator is synchronized with the grid and is supplying full-load rated current at 0.9 p.f (lag). Under this loading condition of the

machine, compute its load angle 'delta' and per unit no-load induced emf per phase. (The excitation of the machine is kept constant throughout the operation.) 5

(b) Explain with the help of phasor diagram, the effect of varying excitation on armature current and power factor in a synchronous motor. 5

3. (a) A 11 kV,1000 kVA three-phase star connected alternator has a resistance of 2 ohm per phase. The open-circuit curve and characteristic with rated full-load current at zero power factor are given in the following table. Determine the voltage regulation of the alternator for full load current at 0.8 p.f (lag). 5

Field Current (A)	40	50	110	140	180
Line Volts	5800	7000	12500	13750	15000
Line volts zero pf	0	1500	8500	10550	12500

(b) Derive the expression for synchronous power for cylindrical pole machine and explain different terms. 5

4. (a) Explain Blondel's two reaction theory and also draw the phasor diagram of salient pole synchronous alternator. 5

(b) A 3-phase 20 kVA, 440 V, 50 Hz, star connected alternator supply a rated load at 0.8 p.f (lag). The armature resistance 0.5 Ω and synchronous reactance is 10 Ω. Find the power angle and % voltage regulation. 5

5. (a) A 50 kW, 3-phase star connected, 50 Hz, 440 V cylindrical rotor synchronous motor operates at rated condition with 0.8 p.f (lead). Neglect field and stator losses, the efficiency of machine is 95% and $X_s = 2.5\,\Omega$. Calculate : 5

(i) Mechanical power developed

(ii) Power Angle.

(b) What is the necessity of parallel operation of three-phase transformers ? Also mention the conditions for paralleling. 5

6. (a) A Scott connected transformer set supplies two single-phase furnaces A and B each at 120 V from a 3-phase 4.4 kV, 50 Hz balanced supply system. The voltage of furnace A is leading If the furnace connected to teaser transformer takes 200 kW at unity power factor and the other one connected to

main transformer takes 450 kW at 0.8 power factor lagging .Determine the line currents taken from the three-phase mains. (Neglect losses) 5

(b) Explain phasor group yZ11, Yd11 with reference to three-phase transformer showing suitable clock diagram. 5

7. (a) The following test results were obtained in case of 230 V, single-phase, 4 pole, 50 Hz induction motor :

No-Load Test : 230 V, 0.5 A, p.f 0.2 (lag)

Locked rotor Test : 58 V, 1.48 A, p.f 0.58 (lag)

Determine the approximate equivalent circuit. Assume stator and rotor I^2R losses at stand still are equal and rotor leakage reactance referred to the stator and stator leakage reactance are equal. 5

(b) Explain, in brief, the frequency and real power characteristic of a three-phase synchronous generator. 5

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

(a) ZPF Characteristic of synchronous Generator

(b) Transformers connected in open Delta (V)

(c) Reluctance Motors.