**5<sup>th</sup> Semester Regular / Back Examination 2016-17**
**ELECTRICAL MACHINE - II**
**BRANCH(S): EEE,EE**
**Time: 3 Hours**
**Max Marks: 70**
**Q.CODE: Y460**

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

**Q1**   **Answer the following questions:**                                                    **(2 x 10)**

**a)** A 50 Hz and 60 Hz alternator are mechanically coupled together. At what maximum speed it should rotate so as to induce voltage at their rated frequency?

**b)** An alternator is operating at a pf 0.8 lagging, now keeping the armature current constant its pf changes to 0.5 lagging. What will be the impact on armature reaction?

**c)** A 3-phase salient pole type synchronous motor is connected to infinite bus. If the field winding is open circuited, is the motor continues to run? Justify your answer.

**d)** An alternator has the same voltage, frequency and phase sequence as that of the infinite bus. Is it sufficient to put ON the synchronization switch now? Give reasons for your answer?

**e)** What is the effect of 3rd harmonics on a star and delta connected alternator?

**f)** State and explain the conditions required to connect two 3-phase transformers in parallel.

**g)** In slip test why a positive sequence reduced voltage is applied?
During the experiment weather the machine is operated as motor or generator?

**h)** Three single phase transformers are connected in Δ- Δ, and operating at full load. If one of the transformer is taken out of operation with the same load, find the % overloading of each transformer?

**i)** How the reactive power, armature current and power factor of a synchronous motor will be affected, with increase in load at a constant excitation,

**j)** Draw the torque slip characteristics of a single phase induction motor.

**Q2 a)** Explain static excitation system with its advantages and disadvantages.        **(5)**

**b)** A 3-phase, 6 pole, 1000 rpm star connected alternator has diameter of 28 cm, length=23 cm, and double layer winding. The winding is accommodated in 4 slots/pole/phase with 4 turns/coil. The coils are short pitched by 1 slot. The air gap flux density is B=0.87sinωt + 0.23sin3ωt. Determine line and Phase voltage.        **(5)**

**Q3**  **a)**  A 10kVA, 440V, 50Hz, 3-phase alternator has occ given below:  **(5)**

| Field Current | 1.5 | 3 | 5 | 8 | 11 | 15 |
|---|---|---|---|---|---|---|
| No load voltage | 150 | 300 | 440 | 550 | 600 | 635 |

With full load zero power factor applied an excitation of 13A produces 440V. On short circuit 4A excitation was required to give full load current. Determine the % voltage regulation at full load and 0.8 pf lagging.

**b)**  A 5MVA, 10 KV, 1500 rpm, 50Hz alternator runs in parallel with other machine. The synchronizing reactance is 20%. Find synchronizing power and torque for per unit mechanical angle of phase displacement for (i) No-load (ii) Full-load at pf 0.8 lagging.  **(5)**

**Q4**  **a)**  Explain the effect of variation in excitation of a synchronous motor at various load condition.  **(5)**

**b)**  A 6600 V, star connected synchronous motor has synchronous impedance of $1.5+j12\Omega$. When the input power is 1000kW, the power factor is 0.8 leading. With the excitation kept constant the input power is increased to 1500kW, find new operating power factor?  **(5)**

**Q5**  **a)**  What is synchronization? Explain the process of synchronization by one dark-two bright lamp method.  **(5)**

**b)**  A 5kVA, 220V, star connected, 3-phase salient pole alternator with direct and quadrature axes reactance of $12\Omega$ and $7\Omega$ respectively. Calculate the excitation voltage and load angle when the generator delivers rated kVA at a power factor of (i) 0.8 lagging and (ii) 0.8 leading. Consider the armature resistance to be $1\Omega$.  **(5)**

**Q6**  **a)**  Show the connection and phasor diagram of $Yz_1$ and $Dy_{11}$.  **(5)**

**b)**  Two exactly similar turbo-alternators are rated at 800MW each. They are running in parallel. The speed-load characteristics of the turbines are such that the frequency of alternator 1 drops uniformly from 50Hz.on no-load to 48.5Hz on full load, and that of alternator 2 from 50.5Hz to 48Hz. Determine (i) how a total load of 1200MW is shared between two and the operating frequency, (ii) maximum load that can be delivered by both without overloading either of them.  **(5)**

**Q7**  **a)**  Two single phase furnaces are supplied at 250V from a 6.6kV , 3 phase system through a pair of Scott connected transformers. If the load on the main transformer is 85kW at 0.9p.f (lag) and on the teaser transformer is 69kW at 0.8 p.f (lag) Find the turn ratio of each transformer and values of line current on the three phase side?  **(5)**

**b)**  Explain how the parameter of a single phase induction motor can be calculated with suitable tests.  **(5)**

**Q8**  **Answer Any Two:**  **(5 x 2)**

**a)**  Armature reaction in synchronous machine.
**b)**  Staring of three phase synchronous motor.
**c)**  Open delta connection.
**d)**  Stepper motor.