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QUESTION BANK (DESCRIPTIVE)

Subject with Code: Electrical Machines-III (16EE220)   **Course & Branch**: B. Tech. - EEE

Year & Sem: III-B.Tech. & I-Sem.   **Regulation:** R16

UNIT –I
SYNCHRONOUS GENERATORS

1. A) Explain the principle of operation of Synchronous Generator.   5M
   B) Compare between DC Generator and AC Generator.   5M
2. Explain the constructional details of salient pole and Round rotor synchronous machines.   10M
3. Explain the different types of Armature windings.   10M
4. Write short notes on a) Pitch factor   5M
                          b) Distribution factor   5M
5. Derive the EMF equation of an Alternator   10M
6. Define harmonics and how the harmonics are generated in EMF wave form? How they are suppressed?   10M
7. Define Armature reaction? Discuss the armature reaction at UPF, lagging PF and leading PF with necessary wave forms.   10M
8. Calculate the RMS value of induced voltage per phase and line of a 10pole, 3Ø, 50HZ, alternator with 2 slots per pole per phase and 4conductors per slot. If the coil span is 150° electrically. If the flux per pole has a fundamental component of 0.12wb and 20% of 3rd harmonic component   10M
9. Find the number of armature conductors are connected in series per phase required for the armature has 3-phase, 10 pole alternator with 90 slots, the winding is to be star connected with a given line voltage of 11KV. Assume flux/pole is 0.16wb.   10M

10. Define   a) Armature resistance   2M
             b) Leakage reactance   2M
             c) Armature reactance   2M
             d) Synchronous reactance   2M
             e) Synchronous impedance   2M

UNIT –II

REGULATION OF SYNCHRONOUS GENERATORS

1. How do you calculate Synchronous reactance experimentally with suitable tests   10M
2. Explain the procedure for calculation voltage regulation by synchronous impedance method
   with Phasor diagram   10M
3. A 3-phase star connected alternator is rated at 1600 kVA and synchronous reactance are 1.5 Ω
   and 30 Ω, respectively. Calculate the voltage regulation by EMF method for a load of 1280KW at
   a) 0.8PF lagging   b) UPF   c) 0.8PF leading   10M
4. The following test results are obtained on a 3-Phase, 6600V, 50Hz star connected alternator as follows

I_f (A)	16	25	37.5	50	70
V_{oc} (V)	3100	4900	6600	7500	8300

   A field current of 20A is necessary to circulate the full load current on short circuit of the alternator.
   Determine voltage regulation by MMF method at
   a) 0.8PF lagging   b) 0.8PF leading   c) UPF   10M
5. a) Explain the procedure for construction of potier triangle by ZPF method.   5M
   b) How do you calculate the no load voltage and voltage regulation by ZPF method with phasor
      diagram?   5M
6. A 11kV, 1000 KVA, 3-phase star connected alternator has a resistance of 2 Ω/phase. The O.C and FL
   ZPFC are given below. Find the voltage regulation of an alternator for FL current at 0.8PF Lagging
   by potier method   10M

I_f (A)	40	50	110	140	180
V_{oc} (V)	5800	7000	12,500	13,750	15,000
V_{zpf} (V)	0	1500	8500	10,500	12,500

7. By using the above data calculate the voltage regulation by ASA method. Compare the results and
   comment them.   10M
8. Explain the procedure for calculation of voltage regulation of salient pole Alternator and draw the
   suitable phasor diagram and assumptions.   10M
9. A 3-phase star connected synchronous generator supplies a current of 10A having phase angle of 20°
   Lagging at 400 V. Find the load angle and components of armature current. If X_d =10Ω, X_q=6.5Ω.
   Assume R_a is neglected. Find the no load EMF and voltage regulation.   10M
10. a) Define synchronous impedance as per O.C and S.C tests   2M
    b) What is the meaning of potier reactance   2M
    c) Enumerate the lost of methods to find voltage regulation in synchronous machines   2M
    d) Express the formulae for direct and quadrature reactance.   2M
    e) Define load angle and phase angle.   2M

UNIT-III

PARALLEL OPERATION OF SYNCHRONOUS GENERATORS

1. a) Define infinite bus bar? Explain synchronization of alternator with infinite bus bar.   5M
   b) Necessity of parallel operation of alternators.   5M
2. Derive the expression for power developed of an alternator connected to infinite bus bar with Power angle characteristics.   10M
3. Derive the expression for synchronizing current, power and torque   10M
4. A 5MVA, 10kV, 1500 rpm, 50HZ alternator runs in parallel with other machines. Its reactance drop is 20%. Find the synchronizing power per unit mechanical degree of displacement and the corresponding torque at
   a) No load   b) Full load at 0.8PF lagging   10M
5. What is meant by synchronization of alternators? Discuss any two methods of synchronization of alternator.   10M
6. Derive the expression for circulating current for dissimilar alternators connected by a common load   10M
7. Two 1-phase alternators are operate in parallel and sharing a load impedance of $(3+j4)\Omega$ if the impedances of each machine is $(0.2+j2)\ \Omega$ and emf's are $(200+j0)$ V and $(220+j0)$ V respectively. Determine   10M
   a) Terminal voltage   b) Current   c) Power factor   d) Output power of each machine
8. Explain in detail about 'V'curve and 'Λ'curve of a synchronous motor   10M
9. Two 3-phase alternators are working in parallel with the following particulars:

   Alternator 1: $Z_1 = (0.2+j2)$ ohms/phase; E1 = $(2000+j0)$ V/phase

   Alternator 2: $Z_2 = (0.2+j2)$ ohms/phase; E2 = $(2200+j100)$ V/phase

   Load: $Z_L = (3+j4)$ ohms/phase.

Determine the kW output and power factor of each alternator.   10M

10. a) List out the conditions for parallel operation of alternators   2M
    b) What are the methods used for synchronization of alternators   2M
    c) Write the formulae for power developed per phase of an alternator connected to an infinite bus bar   2M
    d) Draw the power angle characteristics of synchronous machine   2M
    e) Mention the importance of synchronizing current   2M

UNIT-IV

SYNCHRONOUS MOTOR

1. a) Explain the theory of operation of synchronous motor   5M
   b) Compare between synchronous motor and 3-phase induction motor   5M
2. Draw and explain the phasor diagram of synchronous motor and derive the back EMF.   10M
3. Derive the expression for power developed by the synchronous motor.   10M
4. Explain the variation of current and power factor with excitation with suitable curves.   10M
5. Write short notes on
   a) Synchronous condenser   5M
   b) Hunting and elimination of hunting   5M
6. Briefly discuss about the starting methods of synchronous motor with suitable diagrams   10M
7. a) A sub-station operating at full load of 1200 kVA supplies a load at 0.7 p.f. lagging. Calculate the rating of synchronous condenser to raise the substation power factor to 0.9 lagging.   5M
   b) Explain the working operation of synchronous induction motor   5M
8. A 3-phase, 6600V, 50Hz star connected synchronous motor takes 50A current from mains. The Resistance and synchronous reactance are 1Ω and 20Ω, respectively.
   i) Power supplied to the motor
   ii) Induced emf /phase at 0.8PF lagging and 0.8PF leading
   iii) Rotor retardation angle   10M
9. A 3phase, 330V, star connected synchronous motor has synchronous reactance of 5Ω/phase. The input to the motor is 1000KW at a normal voltage and a line induced emf of 4000V. Calculate the operating power factor and line current.   10M
10. a) What is meant by synchronous condenser?   2M
    b) Why the synchronous motor is a non self starting?   2M
    c) Write the formulae for back EMF of synchronous motor at leading p.f. and lag p.f.   2M
    d) What is the purpose of damper winding used in synchronous motor?   2M
    e) List out the application of synchronous motor.   2M

UNIT-V

SINGLE PHASE AND SPECIAL MOTORS

1. Explain the constructional details of single phase induction motor with neat diagram   10M

2. Explain Double field revolving theory.   10M

3. Explain the working of split phase induction motor? List out the advantages, disadvantages and applications.   10M

4. Explain the working operation of capacitor start and capacitor run induction motor. List

 out the advantages, disadvantages and applications.   10M

5. Briefly discuss about the shaded pole IM with circuit diagram mention their applications.   10M

6. Discuss the working operation of A.C Series motor? What are the drawbacks?   10M

7. Explain the working operation of Universal motor and list out the applications   10M

8. Write short notes on

        a) Reluctance motor   5M

        b) Hysteresis motor   5M

9. Explain the working operation of stepper motor? How do you calculate stepping angle and list out the applications.   10M

10. a) State double field revolving theory.   2M

    b) Drawbacks of split phase induction motor   2M

    c) Compare permanent capacitor motor and two value capacitor motor   2M

    d) Write the current flow direction of shaded pole induction motor   2M

    e) Define stepping angle and number of steps for revolution   2M