j) The resultant flux density in the air gap of synchronous generator is lowest during:

a. Open circuit
b. Short circuit
c. Full load
d. Half Load

Q2 **Answer the following questions:** (2 x 10)

a) List the causes of delayed commutation in a dc generator.
b) In case of a 4 pole dc generator provided with a two layer lap winding with sixteen coils, What will be the pole pitch in terms of no. of slots?
c) A dc shunt generator has a full load voltage regulation of 10% at rated speed of 1000 rpm. If it is now driven at 1250 rpm, then what will be its voltage regulation at full load?
d) In which type of dc motor the speed increases with load torque and why?
e) A dc cumulatively compound motor delivers rated load torque at rated speed. If the series field is short circuited, then How the armature current and speed will change?
f) A synchronous generator operating in parallel with infinite bus, how it can be taken out of operation?
g) A salient pole machine delivers power without excitation where as a cylindrical rotor type machine not, Justify.
h) A 3MVA,6 poles alternator runs at 1000rpm in parallel with other machines on 3.3KV. calculate the synchronizing power per one mechanical degree of displacement and corresponding synchronizing torque at no load.
i) Define short circuit ratio of synchronous machine and show SCR=$\frac{1}{X_{pu}}$
j) What is the effect of triplet harmonics on a delta connected alternator?

Part – B (Answer any four questions)

Q3 a) A 6 pole lap wound generator has 240 coils of 2 turns each. Resistance of 1 turn is 0.03Ω the armature is 50 cm long and 40 cm diameter. Air gap flux density of 0.6T is uniform over pole shoe. Each pole subtends an angle of 40^0mechanical. For a speed of 1200rpm determine the torque developed and terminal voltage for a load current of 40 A. (10)

b) Explain the process of commutation in a dc machine. (5)

Q4 a) A 230 V dc shunt motor has armature resistance of 0.4 Ω and field resistance of 115 Ω. The motor drives a constant torque load at 800 rpm while drawing an armature current of 20A. If the motor speed is to be raised to 1000rpm, find the resistance that must be inserted in field circuit. (10)

b) Give a comparison study of speed ~ torque characteristics of various types of dc motors. (5)

Q5 a) A shunt generator has full load current of 195A at 250V. The rotational losses are 720W and the shunt field resistance is 50Ω. It has a full load efficiency of 90%. Find maximum efficiency and power output corresponds to. (10)

b) Explain external and internal characteristics of dc shunt generator. (5)

Q6 a) A 3-phase alternator is rated at 5-kVA, 110V, 50 Hz and 1000 rpm. The stator resistance between any two terminals as measured with Dc is 0.2 Ω. With no-load at rated speed, the stator line voltage is 160 V for a field current of 4 A. At rated speed, the short circuit current per terminal is 60A for the same field current. Compute voltage regulation at 0.8 pf lagging and leading at rated load. Also calculate the power factor at which the voltage regulation will be zero. (10)

b) Show that the difference in power input and output of a cylindrical rotor synchronous machine is equal to its ohmic loss $I_a^2 R_a$. (5)