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

Total Number of Pages : 03 **B.Tech.**

PEL4I101

4th Semester Regular / Back Examination 2018-19

ELECTRICAL MACHINES - II

BRANCH : EEE

Time : 3 Hours

Max Marks : 100

Q.CODE : C1011

Answer Part-A which is compulsory and any four from Part-B.

The figures in the right hand margin indicate marks.

Answer all parts of a question at a place.

Part – A (Answer all the questions)

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

a) If the current drawn by a DC series motor increased from 10A to 12A, what is the change in torque expressed as a percentage of initial torque?

a. 21% b. 25%
c. 41% d. 44%

b) The brush axis of a dc shunt generator is rotated by an angle 'α' from the GNA. The torque developed will be proportional to

a. sin α b. cos α
c. tan α d. cos2α

c) Two dc machines are mechanically coupled. One is operating as motor and the other as generator. The iron and frictional losses of the machines will be identical when:

a. Their speeds are identical
b. Their speeds and excitation are identical.
c. Their speeds and armature current are equal.
d. Their armature sizes are equal.

d) In a dc generator the critical resistance can be increased by

a. Increasing its field resistance b. Increasing its speed
c. Decreasing its field resistance d. Decreasing its speed

e) Armature coil is short circuited by brushes when it lies

a. Along neutral axis b. Along field axis
c. Along GNA d. Along d-Axis

f) An over excited alternator operates at_____p.f. by _____reactive power.

a. Lagging, delivering b. Leading, delivering
c. Lagging, consuming d. Leading, consuming

g) Active power of an alternator can be varied by

a. Changing field excitation b. Changing prime mover speed
c. Changing the power factor d. Any one of the above

h) An electromechanical energy conversion device has cylindrical stator but salient pole rotor. If δ is the angle between stator field and rotor field, the average torque developed is proportional to (A and B are constants)_____

a. Asinδ b. Asin2δ
c. Asinδ+Bsin2δ d. δ

i) In a salient pole synchronous motor, the developed reluctance torque attains the maximum value when the load angle in electrical degrees is

a. 0 b. 45
c. 60 d. 90

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)**

Q7 **a)** A 230 V, 4 pole, 50Hz star connected synchronous motor has armature resistance and synchronous reactance of 0.6Ω and 3Ω per phase respectively. Its field current is so adjusted that motor draws 10A at upf. Now keeping the excitation constant, the load on motor is increased till it draws 40A from supply. Find the new pf, load angle and efficiency if the rotational losses are 1020 W. **(10)**

b) Explain how the reactance of a salient pole synchronous machine can be determined. **(5)**

Q8 **a)** Two alternators are rated at 25MW each. They are running in parallel.The speed load characteristics of the driving turbines are such that the frequency of alternator 1 drops uniformly from 50Hz on no-load to 48Hz on full load, and that of alternator 2 from 50Hz to 47.5Hz.How will the two machines share a load of 40MW? Also calculate maximum load that can be delivered by both without overloading either of them. **(10)**

b) A 5 MVA, 6-pole, 50Hz, 4000V star connected alternator has $R_a = 1\Omega, X_d = 10\Omega, X_q = 6\Omega$ per phase. Determine the excitation voltage at full load and 0.8 power factor lagging. **(5)**

Q9 **Write short notes on any THREE :** **(5 x 3)**

a) Voltage buildup process in a dc shunt generator.

b) 3-point starter

c) Hunting

d) Universal motor