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

Total Number of Pages : 02 **B.Tech**

PME5H001

5th Semester Regular / Back Examination 2019-20

ENERGY CONVERSION TECHNIQUES

BRANCH : MECH

Max Marks : 100

Time : 3 Hours

Q.CODE : HRB304

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Write down the important components of a DC generator and state the difference, if any, in the construction of DC generator and DC motor.

b) How does critical resistance affect the emf in case of a DC generator? Explain with example.

c) Derive the torque equation for a separately excited DC motor.

d) State and explain two important applications of any type of DC motor.

e) Determine the turns ratio relationship for a single phase transformer based on the emf equation.

f) Why do induction motors require supplementary starting device? Explain one such starting method.

g) Show the power angle curve for three phase synchronous generators, and justify its shape with help of power expression.

h) Compare the electrical power and mechanical power for a three phase synchronous motor.

i) Calculate the possible number of stator pole of a three phase induction motor if it runs at 1450 rpm while taking supply from a 5o Hz AC supply. Can you also calculate the slip for that condition.

j) How does the construction of a DC shunt motor differ from that of a DC series motor in terms of armature and field circuit parameters.

Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Analyze the importance of critical speed in case of a DC generator. Also, formulate a model for controlling the speed of a DC shunt motor through a DC generator.

b) Justify that no load characteristics, OCC, and magnetization characteristics are similar terms in respect of DC generator.

c) Illustrate the circuit diagram for speed control of a DC shunt motor and explain the procedure briefly.

d) Develop the relationship between speed and armature current of a separately excited DC motor. Explain why DC series motors are not started without load on the shaft.

e) Explain the procedure for conducting OC and SC tests on a single phase transformer with proper circuit diagram. Also indicate the precautions to be followed while performing the tests.

f) Calculate the total mechanical power developed, if the power input to a three phase 50 Hz induction motor is 50 kW and the total stator loss is 0.8 kW. It may be noted that corresponding rotor frequency is 90 cycles per minute.

g) State the similarities and the differences between three phase squirrel cage and slip ring type of induction motors.

h) A single phase 50 HZ transformer is to be designed for providing a voltage ratio of 6000/250 V. Calculate the number of turns for both LV and HV windings, provided that the limiting value for the flux in each winding is 0,05 Wb.

i) Explain the significance of synchronous speed. Justify, if a three phase induction motor can achieve this.

j) How does synchronous reactance affect the operation of an alternator. Justify your answer with the help of equivalent circuit.

k) Develop the relationship for torque expression for a synchronous motor.

l) Explain the necessity for running alternators in parallel in power system scenario. Hence, explain the procedure for synchronization of alternators.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Discuss the principle of operation of DC motors and DC generators describing the specific role of the commutator. Derive the emf equation for a DC generator and examine whether same terminology is applicable for the emf in case of DC motor. **(8)**

b) A shunt generator delivers 40 kW at 250 V and 500 rpm. If the armature resistance is 0.02 ohm and field resistance is 50 ohm, what would be the speed of the same machine while running as a DC motor taking 40 kW input power being connected to 250 V DC source. Assume that the voltage drop at brushes is 1 V per brush. **(8)**

Q4 A 4 KVA, 200/400 V, single phase transformer gives the following test results; **(16)**

OC Test: Wattmeter reading=70 W, Ammeter reading=0.8 A, Voltmeter reading=200 V (LV side)

SC Test: Wattmeter reading=60 W, Ammeter reading=10 A, Voltmeter reading=20 V (HV side)

Calculate the (i) efficiency, (ii) secondary terminal voltage, and (iii) primary input current

When supplying full load secondary current for two power factor conditions,

(a) unity pf, and (b) 0.8 pf lagging

Q5 A 4 pole three phase squirrel cage induction motor when delivering a load of 40 hp, is rotating at a speed of 1425 rpm being connected to a 500 V, 50 Hz supply. If the mechanical loss is 3 hp, stator losses are 2.5 kW and the power factor is 0.9 lag, calculate the followings for this loading condition. **(16)**

a) slip
b) rotor copper loss
c) total power input
d) efficiency and
e) line current

Q6 **Write short notes on all of the followings :** **(4 × 4)**

a) Procedure for drawing the Equivalent circuit of an alternator

b) Significance of phasor diagram of synchronous motor

c) Speed control and starting method for 3-phase induction motor

d) Operation of three single phase transformers as a bank of a three phase star-delta transformer, along with connection diagram