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B.TECH
PEI3I103

3rd Semester Regular Examination 2016-17
ENERGY CONVERSION DEVICES
BRANCH(S): AEIE, EIE, IEE
Time: 3 Hours
Max Marks: 100
Q.CODE: Y694

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

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

a) The basic function of a transformer is to change _____ .(voltage level/ power level/ power factor/ frequency).

b) Power transferred inductively in an autotransformer is ____ times the input power to the autotransformer.

c) The resultant flux developed by stator of a three phase induction motor is ____ times the maximum value of flux due to one phase.

d) The number of slip ring(s) on a squirrel cage induction motor is ___.

e) The OCC of a dc generator is also called its ___ characteristics. (magnetic / internal / external / performance)

f) By putting controller resistance in series with the armature of a DC motor , the speed obtained is ___ the normal speed . (above / below / above as below / equal to)

g) A 10 kVA, 2000 / 100V transformer has R_1=1.5 ohm, R_2=0.005 ohm, X_1=2.5 ohm and X_2=0.08 ohm. The equivalent resistance referred to primary is _____.

h) A 4-pole three-phase induction motor has a synchronous speed of 25 rev/s. The frequency of the supply to the stator is _____

i) The field winding of an alternator is ____ excited. (ac / dc/ both ac and dc/not)

j) If copper losses are 400 W at a load current of 10 A , then the copper losses will be _____ at a load current of 5 A.

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

a) It is desired to have 5mWb maximum core flux in a transformer at 230 Vand 50Hz. Determine the required number of turns in the primary of transformer.

b) Write two differences between salient pole rotor and cylindrical pole rotor?

c) What do you mean by the hysteresis angle of advance? Write the significance of the two components of the no-load current in a single phase transformer.

d) Explain the function of damper winding in case of a synchronous motor.

e) What do you mean by critical resistance and critical speed of a dc shunt generator?

f) What will happen if the primary of a transformer is connected to a DC supply?

g) Which DC motor is used in elevators and why?

h) What will happen if a shunt motor running at no-load has its shunt winding open accidentally?

i) How does an induction motor differ from a transformer?

j) Calculate the voltage induced in armature winding of a 4 pole lap wound DC machine having 728 active conductors and running at 1800 rpm.The flux per pole is 30mWb.

Part – B (Answer any four questions)

Q3 a) A 240 V DC shunt motor runs at 800 rpm and takes armature current of 2 A. Find the resistance required in series with the shunt winding so that the motor may run at 950 rpm when taking an armature current of 28 A. Assume flux is proportional to field current. The shunt field resistance is 160 ohm and armature resistance is 0.4 ohm. **(10)**

Give two disadvantages of this method of speed control. What other methods can be used to control speed of a DC shunt motor? Explain briefly with diagram.

b) Explain why a starter is required for starting a dc motor. Describe a 3-point starter having no load and over load protections for starting a dc shunt motor. **(5)**

Q4 a) A shunt generator delivers 195 A at a terminal p.d. of 250 V. the armature resistance and shunt field resistance are 0.02 ohm and 50 ohm respectively. The iron and friction losses are 950 W. Find (i) e.m.f generated (ii) total copper losses (iii) mechanical, electrical and commercial efficiencies. **(10)**

Also derive the condition for maximum efficiency of a DC Generator.

b) Explain the process of "building up" of voltage in a shunt generator. Under what condition may it fail to build up the voltage? **(5)**

Q5 a) A 10kVA, 200/400 V, 50 Hz single phase transformer gave the following results: **(10)**

O.C. test: 200 V, 1.3 A , 120 W …… on L.V. side

S.C. test: 22 V, 30A, 200 W …….. on H.V. side

Calculate

(i) magnetizing current and the component corresponding to core loss at normal frequency

(ii) the magnetizing branch impedances

(iii) Draw the equivalent circuit diagram as referred to H.V. side.

Under what conditions the no-load test and the impedance test is conducted on a transformer? What are the advantages of these two transformer tests?

b) Explain the star delta starter for 3-phase induction motor with a neat circuit diagram. **(5)**

Q6 a) A three phase induction motor has a 4 pole star connected stator winding. The motor runs on a 50 Hz supply with 200 V between lines. The rotor resistance and standstill reactance per phase are 0.1 ohm and 0.9 ohm respectively. The rotor e.m.f per phase at standstill is 77.4 V. Calculate (i) torque at 4% slip (ii) slip at which maximum torque occurs (iii) value of maximum torque (iv) speed at maximum torque. **(10)**

Draw and explain the torque-slip characteristics of a three phase induction motor. What happens to the maximum torque and slip if the external resistance is added to the rotor circuit?

b) A 440/110 V transformer has a primary resistance of 0.03 ohm and secondary resistance of 0.02 ohm. Its iron loss at normal input is 150 W. Determine the secondary current at which maximum efficiency will occur and the value of this maximum efficiency at a unity p.f. load. **(5)**

Q7 **a)** Mention two advantages of a transformer bank of three single phase transformer over a single unit of three phase transformer. **(10)**

Draw a neat diagram of a star – delta connected three phase transformer indicating the primary side line current, phase current, line voltage, phase voltage and secondary side line current, phase current, line voltage, phase voltage.

The input current to a three phase step down transformer connected to an 11 kV supply system is 14 A. Draw (i) star – star connected transformer and (ii) delta-star connected transformer. Also calculate the secondary line voltage and current for (i) star – star connected transformer and (ii) delta-star connected transformer if the phase turn ratio is 44.

b) Give any two applications of: **(5)**

(i) Stepper Motor
(ii) Single Phase Induction Motor
(iii) DC shunt motor
(iv) DC compound motor
(v) Auto-transformer

Q8 **a)** What is the importance of DC motor characteristics? Compare the (N/I_a) characteristics, (T/I_a) characteristics and (N/I_a) characteristics of DC shunt motor with that of DC series motor . **(10)**

b) Explain briefly how a single phase induction motor is different from three phase induction motor? **(5)**

Q9 **a)** How does an alternator different from DC generator? Derive the e.m.f equation of an alternator. **(10)**

Find the number of armature conductors in series per phase required for the armature of a three phase, 50 Hz, 10 pole alternator. The winding is star connected to give a line voltage of 11000 V. The flux per pole is 0.16 Wb. Assume $K_p = 1$ and $K_d = 0.96$.

b) Explain the principle of operation of a synchronous motor? **(5)**