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

Total Number of Pages : 03 **B.Tech**
PEI3I103

3rd Semester Regular/Back Examination 2017-18
ENERGY CONVERSION DEVICES
BRANCH : AEIE, EIE, IEE
Time : 3 Hours
Max Marks : 100
Q.CODE : B1173

Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

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

a) The effect of the magnetic field set up by the armature current in DC machines on the distribution of the flux due to main poles is called _____.

b) Saturation curve (magnetization curve) for a DC generator does not ordinarily start from zero due to _____.

c) The emf induced in the armature conductors of DC generator is alternating in nature. (True / False)

d) Under the condition of maximum starting torque of a three phase Induction motor, the value of rotor power factor is _____.

e) _____ type of alternator is used in hydro- electric plant.

f) A synchronous motor can run at any speed above and below synchronous speed. (True/ False)

g) The starting torque of a three phase induction motor varies as the _____ of the supply voltage. (1.5 times / square)

h) Applied voltage and primary e.m.f in a transformer are in _____ . (phase / phase opposition)

i) Copper losses in a transformer _____. (remains constant irrespective of load / varies with variation in load)

j) _____ type of three phase transformer is commonly used for stepping up to a high voltage. (star-star / star-delta / delta –delta / delta –star)

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

a) A 4 pole, 1250 rpm generator with lap wound armature has 72 slots and 12 conductors per slot. The flux per pole is 0.02 Wb. Calculate the emf induced in the armature.

b) The rotor resistance per phase and standstill rotor reactance per phase of a 3-phase IM is 0.2 ohm and 1 ohm respectively. What should be the value of external resistance per phase to be inserted in the rotor circuit to give maximum torque at starting?

c) What are the advantages of having stationary armature with rotating field system over a rotating armature with stationary field system?

d) What do you mean by synchronous speed?

e) Give any two applications of servomotor.

f) Primary current and secondary current in a transformer are inversely proportional to their respective turns. Justify.

g) What are the advantages of no-load test and impedance test of a transformer?

h) The input power to an ideal auto-transformer is 1000 W and its voltage transformation ratio is 0.25. What is the power transferred inductively and conductively to the secondary?

i) A 50 Hz, 4 pole , 3 phase induction motor has a rotor current of frequency 2 Hz. Determine (i) the slip and (ii) speed of the motor

j) Why is a DC series motor used to start heavy loads?

Q3 **a)** A compound generator delivers a load current of 50 A at 500 V and has armature resistance, series field resistance and shunt field resistance of 0.05 ohm, 0.03 ohm and 250 ohm respectively. Calculate the armature current and the generated emf when the machine is connected in (i) long shunt (ii) short shunt. Take drop per brush as 1 V. **(10)**

b) Of what materials are the following parts of a DC machine made and why **(5)**
(i) Brushes
(ii) Commutator

Q4 **a)** A short-shunt compound generator delivers 100 A at 220 V. The armature resistance, series field resistance and shunt field resistance are 0.05 ohm,0.025 ohm and 50 ohm respectively. The iron and friction losses amount to 1 kW. Find (i) e.m.f generated (ii) total copper losses (iii) commercial efficiency. **(10)**

b) A 200 V DC series motor runs at 800 rpm when taking a line current of 15A. the armature resistance and series field resistance are 0.6 ohm and 0.4 ohm respectively. Find the speed at which it will run when connected in series with a 5 ohm resistance and taking the same current at the same voltage. **(5)**

Q5 **a)** A 1-phase, 250/500V, 50 Hz transformer gave the following results: **(10)**
O.C. test: 250 V, 1 A, 80W…… on L.V. side
S.C. test: 20 V, 12 A, 100 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) the circuit constants from short circuit test
(iv) Draw the equivalent circuit diagram as referred to H.V. side.

b) The iron loss in a certain transformer is 80 W at 25 Hz and 204 W at 60 Hz, the maximum flux density being the same. Calculate the total iron losses at 100 Hz at the same maximum flux density. **(5)**

Q6 **a)** A three phase induction motor having a 6 pole, star-connected stator winding runs on 240V, 50 Hz supply. The rotor resistance and standstill reactance are 0.12 ohm and 0.85 ohm per phase. The ratio of stator to rotor turns is 1:8 and full load slip is 4%. Calculate : **(10)**
(i) synchronous speed (ii) full load speed (iii) the developed torque at full-load (iv) value of rotor resistance per phase for maximum starting torque (v) value of maximum starting torque (vi) slip for maximum running torque (vii) value of maximum running torque (viii) speed at maximum torque.

b) 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? **(5)**

Q7 **a)** Compare DC shunt motor, DC series motor and DC cumulative compound motor on the basis of Speed ~Armature Current characteristic, Torque ~Armature Current characteristic, Speed ~Torque Characteristic and their applications. **(10)**

b) A 230/2300 V single phase transformer takes no load current of 5 A at 0.25 power factor lagging. Find (i) the core loss (ii) magnetizing current and (iii) iron loss current. **(5)**
Also draw the phasor diagram of a practical transformer with no load.

Q8 **a)** **Differentiate between :** **(10)**

(i) Three Phase Induction Motor and Transformer
(ii) Synchronous Motor and Three Phase Induction Motor
(iii) Salient Pole Rotor and Non-Salient Pole Rotor
(iv) Squirrel Cage Rotor and Wound Rotor
(v) Autotransformer and Two Winding Transformer

b) In what respect does a single phase induction motor differ from a three phase induction motor? **(5)**

Q9 **a)** **Write Short notes on any TWO :** **(10)**

(i) Speed control of three phase induction motor by varying supply frequency and by pole changing method
(ii) Starting of Synchronous Motor
(iii) Process and condition of voltage build-up in a DC shunt generator

b) What is the necessity of DC motor starter? What are the protective devices used in DC motor starters and why? Draw a neat schematic diagram of a three-point starter. **(5)**