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

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

PEI3I103

3rd Semester Regular / Back Examination 2018-19

ENERGY CONVERSION DEVICES

BRANCH : AEIE, EIE, IEE

Time : 3 Hours

Max Marks : 100

Q.CODE : E934

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

a) Which type of dc motor would be suitable for high starting torques drives but fairly constant speed?

b) What is a leakage flux? How can the leakage flux be minimized? Is it possible to have no leakage flux?

c) What are the reasons the dc generator fails to start?

d) Why a three phase alternator is called a synchronous machine?

e) The rotor speed of a 440-V, 50-Hz, 8-pole, three-phase induction motor is 720 rpm. Determine (a) the synchronous speed, (b) the slip, and (c) the rotor frequency.

f) How the direction of single phase induction motor can be reversed?

g) A6-pole, three-phase alternator has 72 slots. Determine its pitch factor, its distribution factor, and the winding factor.

h) The relative motion between rotor speed and rotating stator field is always asynchronous of an induction motor, Why?

i) Is it always possible to start an induction motor by applying the rated voltage?

j) What are the different methods of speed control of three phase induction motor?

Part- II

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

a) Explain in neat constructional details about the DC machines with its principle operation of generation of emf of DC generator.

b) Distinguish between the excitation current, the core-loss current, and themagnetizing current of a transformer. Draw the phasor diagram showing all the components at no load and with load at lagging power factor.

c) Cite the differences between a cylindrical and a salient-pole rotor. Enumerate the advantages and drawbacks of each rotor type.

d) What do you mean by an ideal commutation? Give briefly about practical commutation phenomenon in DC machine.

e) Define the residual emf in dc generator. Explain the various operating characteristic of separately excited dc generator.

f) Explain the following terms: pitch factor, phase belt, distribution factor, and fractional and full pitch winding, winding factor of an alternator.

g) Explain the principle of operation of an induction motor. Find the torque equation.

h) Describe the different methods for speed control of DC motor with suitable diagram. List out the advantages and disadvantages of each methods.

i) A 120-Vshunt motor takes 4 A when it operates at its no-load speed of 1200rpm. Its armature winding resistance is $0.8\Omega$and the shunt-field resistance is 60Ω. Determine the efficiency and the speed of the motor when it delivers its rated load of 2.4 kW.

j) Derive the e.m.f. equation of a synchronous generator.

k) Describe the principle of operation of synchronous motor and its applications.

l) An 8 pole dc shunt generator with 778 wave-connected armature conductors and running at 500 r.p.m. supplies a load of 12.5 ohm resistance at terminal voltage of 50 V. The armature resistance is 0.24 ohm and the field resistance is 250 ohm. Find the armature current, the induced e.m.f. and the flux per pole.

Part-III

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

Q3 Discuss the types of DC machines in regards to excitations. Derive the emf equation of DC generator. **(16)**

The wave-wound armature of a 8 pole dc generator has 95 coils. Each coil has five turns. The flux per pole is 0.5 Wb. The armature speed is 600 rpm. The current per conductor is 20 A. Determine (a) the power developed and (b) the torque developed.

Q4 Explain the basic principle of starting single phase induction motor. Classify the single phase AC motors. **(16)**

A 115-V, 60-Hz**,** 4-pole, single-phase induction motor is rotating in the clockwisedirection at a speed of 1710 rpm. Determine its per-unit slip (a) in the direction ofrotation and (b) in the opposite direction. If the rotor resistance at standstill is $12.5\,\Omega$, determine the effective rotor resistance in each branch.

Q5 Discuss the construction and principle of operation of single phase transformer. **(16)**

The parameters of a 12-kVA, 120/480-V, 60-Hz, two-winding, step-up transformer are $R_H = 0.6\Omega$, $X_H = 1.2\Omega$, $R_H = 0.6\Omega$, $R_L = 0.1\Omega$, $X_L = 0.3\Omega$, $R_{cH} = 3.2k\Omega$, $X_{mH} = 1.2k\Omega$ .The transformer is operating at 80% of its load at rated terminal voltage and 0.866 pf lagging. Determine the copper losses, the core loss, and the efficiency of the transformer.

Q6 Why parallel operation of alternators is required? Give the necessary conditions for parallel operation of alternators. **(16)**

In a 50-KVA, star-connected,440V,3-phase,50-Hz alternator has armature resistance of 0.25 ohm per phase and synchronous reactance is 3.2 ohm per phase. Determine at rated load and unity power factor (i) no-load e.m.f. E_0 (ii) line voltage (iii) percentage voltage regulation on full-load