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Total Number of Pages: 03

B.Tech.  
PEE31103

3<sup>rd</sup> Semester Regular/Back Examination 2017-18

ELECTRICAL MACHINES-I

BRANCH: ELECTRICAL

Time: 3 Hours

Max Marks: 100

Q.CODE: B1170

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: *multiple type or dash fill up type* (2 x 10)

- a) The starting winding of a single-phase induction motor has poles that of main winding is  
a) More b) Less c) Same d) None of option
- b) The approximate efficiency of 3-phase, 50 Hz, 4-pole induction motor running at 1350 r.p.m. is  
a) 90% b) 40% c) 65% d) None of the option
- c) Calculate the core-area required for a 1600 kVA, 6600/440 V, 50Hz, single-phase core-type power transformer. Assume a maximum flux density of 1.2 Wb/m<sup>2</sup> and induced voltage per turn of 30 V.  
a) 975 cm<sup>2</sup> b) 1100 cm<sup>2</sup> c) 1125 cm<sup>2</sup> d) 1224 cm<sup>2</sup>
- d) When a 3-phase induction motor is at no load, the slip is  
a) 1 b) 0.5 c) 0.3 d) None of these
- e) A transformer has 200 W at iron loss at full-load. The iron loss at half full-load will be.  
a) 50 W b) 100 W c) 400 W d) 200 W
- f) As compared to 3-phase induction motor, the efficiency of a single-phase induction motor for same rating is  
a) More b) Less c) Same d) None of the option
- g) The no-load input power to a transformer is practically equal to which loss in the transformer.  
a) Iron b) Copper c) Eddy current d) Hysteresis
- h) The magnetic flux in the core of a single-phase transformer is  
a) Purely alternating one b) purely rotating one  
c) partially alternating and partially rotating d) none of the option
- i) What is the speed of the rotor of a 3-phase induction motor having synchronous speed of 1500 r.p.m.  
a) 1320 r.p.m. b) 1440 r.p.m. c) 1420 r.p.m. d) None of the option
- j) A 230/2300 V transformer takes no-load current of 5 A at 0.25 power factor lagging. The core loss is  
a) 300.2 W b) 192.5 W c) 287.5 W d) 212.6 W

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

- a) What do you mean by cogging and crawling in an induction motor?
- b) Why a transformer is rated in kVA?
- c) What are the conditions for the parallel operation of a single phase transformer?

- d) When will rotor resistance dominate rotor reactance and vice-versa in a 3-phase induction motor?
- e) Why bucholz relay is used in transformer ?
- f) What is the function of a centrifugal starting switch in a single phase induction motor?
- g) Why does the rotor of a 3- phase induction motor rotate in the same direction as the rotating field?
- h) Write down the applications of open-delta connection.
- i) Why the starting torque of a capacitor start induction is motor is high?
- j) What is single phasing in a 3-phase induction motor and what are its effects on the machine?
- Q3 a)** i) In a 6-pole, 50Hz, single phase induction motor, the gross power absorbed by the forward and backward fields are 160 W and 20W respectively at a motor speed of 950 r.p.m. If the no-load frictional losses are 75 W, find the shaft torque. **(10)**  
 ii) Explain about the different speed control technique of a single-phase induction motor.
- b)** Classify the different types of losses associated with a transformer? Explain with suitable mathematical expressions. **(5)**
- Q4 a)** i) Develop the equation for the starting torque of a 3-phase induction motor. **(10)**  
 ii) Draw and explain about the torque-slip characteristics of a 3-phase induction motor.
- b)** Explain about the double field revolving theory with neat sketch. **(5)**
- Q5 a)** i) Draw the phasor diagram of a single phase transformer for an inductive load. **(10)**  
 ii) The voltage on the secondary side of a single phase transformer is 200 Volt when supplying a load of 8 kW at a p.f. of 0.8 lagging. The secondary resistance is  $0.04\ \Omega$  and secondary leakage reactance is  $0.8\ \Omega$ . Calculate the induced e.m.f. in the secondary.
- b)** What are the advantages and disadvantages of an auto transformer? **(5)**
- Q6 a)** i) Draw and explain about the Scott (T- connection) of transformers. **(10)**  
 ii) Two transformers are required for a Scott connection operating from 440 volt, 3- phase supply for supplying two single-phase furnaces at 200 V on the two-phase side. If total output is 150 kVA, calculate the secondary to primary turns ratio and the winding currents of each transformers.
- b)** Explain about the different types of connection of three phase transformer with suitable diagram. **(5)**
- Q7 a)** i) Explain how a rotating magnetic field is produced from a 2- phase supply in case of a single-phase induction motor with neat sketch. **(10)**  
 ii) Draw and explain the equivalent circuit of a single-phase induction motor and also find the different parameters of the machine at stand still and running condition.

- b) Draw and explain about the open delta connection (V- Connection) of two single phase transformer. (5)

- Q8 a)** A 400 V, 4-pole, 50 Hz, 3-phase, star-connected induction motor has the following per phase parameters referred to stator (10)

$$R_1 = 0.6\Omega, X_1 = 1.1\Omega, R_2' = 0.3\Omega, X_2' = 0.5\Omega, X_m = 25\Omega$$

The mechanical losses are 1000 W and stator core losses are 500 W. The slip is 3%. Using approximate equivalent circuit, find i) speed ii) stator current iii) stator power factor iv) power input to rotor v) gross torque vi) shaft torque vii) efficiency viii) rotor copper loss/ phase. Neglect  $R_c$

- b) Explain about the star delta starting of a 3-phase induction motor with neat sketch. (5)

- Q9 a)** The equivalent circuit impedances of a 20-kVA, 8000/240 V, 60-Hz transformer are to be determined. The open-circuit test and the short-circuit test were performed on the primary side of the transformer, and the following data were taken: (10)

Open-circuit test (on primary)	Short-circuit test (on primary)
$V_{oc} = 8000V$ $I_{oc} = 0.214A$ $P_{oc} = 400W$	$V_{sc} = 489V$ $I_{sc} = 2.5 A$ $P_{sc} = 240W$

Find the impedances of the approximate equivalent circuit referred to the primary side, and sketch that circuit. Also find the % voltage regulation when supplying a full-load at 0.8 p.f. lagging.

- b) Explain about the shaded pole starting of a single-phase induction motor with neat sketch. (5)