Total Number of Pages: 03   <u>**B.TECH**</u>
                                                                                    PEL3I103

3rd Semester Regular Examination 2016-17
ELECTRICAL MACHINE - I
BRANCH: EEE
Time: 3 Hours
Max Marks: 100
Q.CODE:Y532
Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.
<u>**Part – A (Answer all the questions)**</u>

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

   a) In a transformer, zero voltage regulation at full load is
     (A) not possible
     (B) possible at unity power factor load
     (C) possible at leading power factor load
     (D) possible at lagging power factor load

   b) The slip of an induction motor normally does not depend on
     (A) rotor speed (B) synchronous speed
     (C) shaft torque (D) core-loss component

   c) For a single phase capacitor start induction motor which of the following statements is valid?
     (A) The capacitor is used for power factor improvement
     (B) The direction of rotation can be changed by reversing the main winding terminals
     (C) The direction of rotation cannot be changed
     (D) The direction of rotation can be changed by interchanging the supply Terminals

   d) A three-phase 440 V, 6 pole, 50 Hz, squirrel cage induction motor is running at a slip of 5%. The speed of stator magnetic field to rotor magnetic field and speed of rotor with respect of stator magnetic field are
     (A) zero, −5 rpm (B) zero, 955 rpm
     (C) 1000 rpm, −5 rpm (D) 1000 rpm, 955 rpm

   e) Distributed winding and short chording employed in AC machines will resultin
     (A) increase in emf and reduction in harmonics
     (B) reduction in emf and increase in harmonics
     (C) increase in both emf and harmonics
     (D) reduction in both emf and harmonics

   f) A 500 kVA, 3-phase transformer has iron losses of 300 W and full load copper losses of 600 W. The percentage load at which the transformer isexpected to have maximum efficiency is
     (A) 50.0% (B) 70.7%(C) 141.4% (D) 200.0%

   g) A single phase transformer has a maximum efficiency of 90% at full loadand unity power factor. Efficiency at half load at the same power factor is
     (A) 86.7% (B) 88.26%(C) 88.9% (D) 87.8%

h) The type of single-phase induction motor having the highest power factorat full load is

(A) shaded pole type (B) split-phase type

(C) capacitor-start type (D) capacitor-run type

i) It is desired to measure parameters of 230 V/115 V, 2 kVA, single-phase transformer. The following wattmeters are available in alaboratory:

$W1$: 250 V, 10 A, Low Power Factor $W2$: 250 V, 5 A, Low Power Factor

$W3$: 150 V, 10 A, High Power Factor $W4$: 150 V, 5 A, High Power Factor

The Wattmeters used in open circuit test and short circuit test of the transformer will respectively be

(A) $W1$ and $W2$ (B) $W2$ and $W4$ (C) $W1$ and $W4$ (D) $W2$ and $W3$

j) The direction of rotation of a 3-phase induction motor is clockwise when itis supplied with 3-phase sinusoidal voltage having phase sequence A-B-C.For counter clockwise rotation of the motor, the phase sequence of the powersupply should be

(A) B-C-A (B) C-A-B(C) A-C-B (D) B-C-A or C-A-B

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

a) Why the voltage regulation of a transformer is zero or negative for leading power factor load?

b) A single phase transformer has a hysteresis and eddy current loss of 150W and 100W respectively when supplied from 250V, 50Hz. What will be the corresponding losses when supplied from 220V, 30Hz?

c) Draw the phasor diagram of a transformer supplying power at full load 0.8 leading power factor.

d) A 3-phase I.M. has slots/pole/phase=5. If the coil span=13 slots, determine the winding factor.

e) Explain the advantage of using tertiary winding in 3 phase transformer?

f) Three single phase transformer connected in Dd0, delivering full load, if one of the transformer is taken out of operation, find the % overloading of each transformer?

g) Explain why an induction motor at no load operates at a very low power factor?

h) Why you need a starter to start a poly phase induction motor?

i) Draw the torque slip characteristics of a single phase Induction motor?

j) Explain how the speed of a single phase induction motor can be controlled?

Part – B (Answer any four questions)

Q3 a) A 5KVA, 2200/220 V, single phase transformer has the following parameters R_1=3.4Ω, R_2=0.028 Ω, X_1=7.2 Ω and X_2=0.06 Ω. Determine a) the input current and power factor, b) Terminal voltage when a load of 4+j5 Ω is connected (c) Equivalent circuit refer to both side.   **(10)**

b) Derive the expression for voltage regulation for a single phase transformer.   **(5)**

Q4 **a)** A single-phase, 50 kVA, 250 V/500 V two winding transformer has an **(10)** efficiency of 95% at full load, unity power factor. If it is re-configured as a500 V/750 V auto-transformer, calculate its efficiency at rated load and unity power factor. Also show the current distribution and calculate the KVA output for both additive and subtractive polarity connection.

b) Explain the procedure for conducting an open and short circuit test in **(5)** a laboratory of a single Phase transformer by drawing a neat circuit diagram. Also explain the information is obtained from this test to draw the equivalent circuit of the single phase transformer ?

Q5 **a)** Show that in a scott connected transformer if the load is balance then **(5+5)** the three phase input current are also balanced.
Two single phase furnaces are supplied at 250V from a 6.6kV, 3 phase system through a pair of Scott connected transformers. If the load on the main transformer is 85kW at 0.9p. f (lag) and on the teaser transformer is 69kW at 0.8 p.f (lag) Find the values of line current on the three phase side? (Neglect the magnetizing and core loss currents in the transformer).

b) Explain phasor group Dy1 & yZ11 with reference to three phase **(5)** transformer showing suitable clock diagram? Also show the connection and phasor diagram for the above group.

Q6 **a)** Explain different methods available for controlling speed of 3 phase **(10)** induction motor?

b) A 3 phase induction motor having a 6pole star connected stator **(5)** winding runs at 240V , 50HZ supply .The rotor resistance and stand still reactances are 0.12 Ω and 0.85 Ω per phase .The ratio of stator to rotor turns is 1.8 and full load slip is 4%. Calculate the developed torque at full load and maximum torque

Q7 **a)** A 3 phase induction motor having a 6pole star connected stator **(10)** winding runs at 240V, 50HZ supply. The rotor resistance and stand still reactance are 0.12 Ω and 0.85 Ω per phase. The ratio of stator to rotor turns is 1.8 and full load slip is 4%. Calculate the developed torque at full load and maximum torque? Also calculate the slip at which maximum efficiency occurs?

b) Explain various method of starting a three phase Induction motor. **(5)**

Q8 **a)** Explain double field revolving theory? **(10)**
b) Draw the circuit model of a single phase induction motor, and explain **(5)** how the parameters can be calculated from no load and blocked rotor test.

Q9 **Write short notes on any three:** **(5X3)**
a) Back to Back Test.
b) Starting of single phase Induction motor.
c) Crawling
d) Open Delta (V) Connection