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QUESTION BANK (Descriptive)

Subject with Code : Electrical Machines-II **(**16EE215**)** **Regulation:** R16

Course & Branch: B.Tech– EEE **Year & Sem:** II-B.Tech & II-Sem

UNIT –I

SINGLE PHASE TRANSFORMERS

1) a) With relevant phasor diagrams, explain the operation of a practical single phase transformer under no load condition. [6M]

b) A 230/2300V transformer takes a no load current of 6.5A and absorbs 187W. If the resistance of **primary is 0.06Ω, find (a) Core loss (b) no load power factor** (c) active component of current and (d) magnetizing current. [6M]

2. a) Discuss the constructional features of transformers. Draw neat diagrams. [8M]

b) A 10KVA, 2200/400V transformer has R1=5 **Ω, X1=12 Ω, R2=0.2 Ω and X2=0.48 Ω. Determine** the equivalent impedance of the transformer referred to (i) primary side (ii) secondary side. [4M]

3. a) In a transformer, derive the condition for maximum efficiency and thus find the load current at which the efficiency is maximum. [6M]

b) A 20KVA,2000/200V single phase transformer has the following parameters H.V winding: R1=3Ω , X1=5.3Ω, L.V winding: R2=0.05 Ω ,X2=0.1 Ω. Find the Voltage Regulation at (i) p.f of 0.8 lagging (ii) UPF (iii) 0.707 p.f leading [6M]

4. a) Explain the principle of operation of an transformer. [6M]

b) Derive the e. m. f. equation of a transformer. [6M]

5. a) Explain the effect of variations of frequency and supply voltage on iron losses. [4M]

b) Write a short notes on practical Transformer. [8M]

6 (a) What are the various losses taking place in transformer? How these losses can be minimized? [6M]

(b) The No-Load current of a 4400/440 V, 1-**Φ,** 50 Hz transformer is 0.04 A. It consumes power 80 W at no-load when supply is given to LV side and HV side is kept open. Calculate the following: (i) Power factor of no-load current.(ii) Iron loss component of current.(iii)Magnetizing component of current. [6M]

7. (a) Draw the Expression for Voltage regulation of a transformer form the simplified approximate equivalent circuits of 1-Φ transformer and also obtain condition for zero regulation. [6M]

(b) A 10KVA, 2000/400V single phase transformer has the following data: R_1**=5Ω,** X_1**=12Ω,** R_2=0.2 **Ω,** X_2**=0.48 Ω. Determine the** secondary terminal voltage at full load, 0.8 power factor lagging when the primary supply voltage is 2000V. [6M]

8. (a) What is an ideal transformer? Also explain the operation of an ideal single phase transformer under no load condition. [6M]

(b) An ideal 25KVA transformer has 500 turns on the primary winding and 40 turns on the secondary winding. The primary is connected to 3000V, 50HZ supply. Calculate (i) primary and secondary currents at full load (ii) secondary emf and (iii) the maximum core flux. [6M]

9. a) Define a transformer? [2M]

b) Why the transformer core is laminated? [2M]

c) Write the Emf equation of a transformer and define each term [3M]

d) A 1100/400 V, 50 Hz single phase transformer has 100 turns on the secondary Winding. Calculate the number of turns on its primary, transformation ratio and turns ratio. [3M]

e) Full load copper loss in a transformer is 1600 watts. What will be the copper loss at half full load and $3/4^{th}$ full load? [2M]

10. a) Define efficiency and regulation of a transformer. [3M]

b) Formulate the efficiency of a transformer at full load. [2M]

c) Formulate the Regulation of a transformer at any load x . [2M]

d) Define all day efficiency of a transformer. [2M]

e) Why transformers are rated in KVA but not in KW? [3M]

UNIT-II

PERFORMANCE OF SINGLE PHASE TRANSFORMERS

1. Discuss how you will perform O.C and S.C tests on a single phase transformer in the Laboratory. [12M]

2. A 2 kVA, 115/230 V, 50HZ transformer gave the following test results:

Short-circuit test: 13 V, 8.7 A, 100 W

Open circuit test : 115 V, 1.1 A, 50 W

Determine (i) the transformer equivalent circuit referred to primary and insert all the values in it.

(ii) Calculate the voltage regulation and efficiency at full load at 0.8 power factor lagging.

(iii) Maximum efficiency at 0.8 power factor lagging [12M]

3. Explain the procedure for conducting Sumpner's test along with all precautions to be taken while Conducting the test with neat diagram. [12M]

4. Explain the procedure for conducting Separation of losses test along with all precautions to be taken while Conducting the test with neat diagram. [12M]

5. In a 50KVA Transformer, the iron loss is 500W and full load copper loss is 800W. Find the efficiency at full load and half load at 0.8 power factor lagging. [12M]

6. A 40KVA transformer has iron loss of 450W and full load copper loss of 850W. If the power factor of the load is 0.8 lagging. Calculate (i) Full load efficiency (ii) the load at which maximum efficiency occurs and (iii) maximum efficiency. [12M]

7. **The primary and secondary windings of a 50KVA, 6600/220V transformer have resistances of 7.8Ω and 0.0085Ω respectively. The transformer draws no load current of 0.328A at power factor** of 0.3 lagging. Calculate the efficiency at full load if the power factor of the load is 0.8 lagging. [12M]

8 (a) Describe the Parallel operation of transformers with equal voltage ratios. [6M]

(b) Describe the Parallel operation of transformers with unequal voltage ratios. [6M]

9 a) Why the open circuit test on a transformer is conducted at rated voltage and also draw circuit diagram? [6M]

b) What is the SC test on a transformer is conducted at rated Current &also draw circuit diagram? [6M]

10. a) Compare a Two-winding transformer with Auto transformer in detail. [6M]

(b) Draw the equivalent circuit of an Auto transformer. [6M]

UNIT-III

THREE PHASE TRANSFORMERS AND INDUCTION MOTORS

1. Explain the Scott connection of two single phase transformers with neat circuit diagram. [12M]
2. (a) Explain the principle of operation of Induction motor. [6M]

   (b) A three phase induction motor is wound for 4 poles and is supplied from 50 HZ System. Calculate (a) synchronous speed (b) speed of the motor when slip is 4% and (c) Rotor current frequency when the motor runs at 600rpm. [6M]
3. Describe the constructional details of cage and wound rotor induction machines. [6M]
4. A 6-pole, 3-phase 50HZ induction motor is running at full load with a slip of 4%. The rotor is Star connected and its resistance and standstill reactance are 0.25 **Ω and 1.5 Ω per phase**. The emf between slip rings is 100V. Find the rotor current per phase and power factor assuming the slip rings are Short circuited. [6M]
5. (a) Explain how rotating magnetic field of constant amplitude is produced. [8M]

   (b) A 4 pole, 3-phase induction motor operates from a supply whose frequency is 50Hz. Calculate.

   i. the speed at which the magnetic field of the stator is rotating.

   ii. the speed of the rotor when the slip is 0.04

   iii. the frequency of the rotor currents when the slip is 0.03

   iv. the frequency of the rotor currents at standstill. [4M]
6. How does the rotor speed differ from synchronous speed explain in detail with neat diagram? Also what is meant by the term slip and explain its significance. [12M]
7. A 3-phase induction motor runs at 1440 rpm at full load when supplied power from 50 Hz, 3-phase line. Calculate: (i) The number of poles. (ii) Slip of full load.

   (iii) Speed of the stator field w.r.t Stator structure and rotor structure.

   (iv) Speed of the rotor field w.r.t Stator structure and rotor structure. [12M]
8. (a) Define slip of Induction motor. Write an expression for the slip of an induction motor. [3M]
   (b) A 3-phase, 50 Hz squirrel cage induction motor runs at 4% slip. What will be Frequency of rotor currents? And speed of the machine? [3M]
   (c) What is synchronous speed of an induction motor? [2M]
   (d) What are the applications of Squirrel cage rotor and phase wound rotor [2M]
   (e) Why an induction motor will never run at its synchronous speed? [2M]
9. (a) Draw and explain the Connection diagram of Y- Y & Δ-Δ connected three-phase transformer. [L2][6M]
   (b) Draw the Connection diagram of Y-Δ & Δ - Y connected three-phase transformer. [L2][6M]
10. (a) Draw the Connection diagram of open delta connected three-phase transformer. [6M]

    (b) Compare a Three –phase transformer with single phase transformer in detail. [6M]

UNIT-IV

3-PHASE INDUCTION MOTOR CHARACTERISTICS

1. Derive the following (i) Torque equation of an induction motor (ii) Condition for Maximum Torque under running condition? [12M]
2. Explain the Torque-Slip and Torque Speed characteristics of an 3-phase Induction motor [12M]
3. A 50HZ, 8 pole induction motor has full load slip of 4%. The rotor resistance and standstill reactance are 0.01 **Ω and 0.1 Ω** per phase respectively. Find (i) the speed at which maximum torque occurs and (ii) the ratio of the ratio of maximum torque to full load torque. [12M]

4 (a) Develop the Equivalent circuit of a poly phase induction motor. [6M]

(b) The input power to a 6-pole, 3-phase, 50HZ induction motor is 42KW and the speed is 970rpm. The Stator losses are 1.2KW and the friction and windage losses are 1.8KW. Find (i) rotor cu loss and (ii) the efficiency of the motor. [6M]

5. Explain no load tests and blocked rotor tests for an 3-phase induction motor. [12M]
6. In a no load test, an induction motor took 10 A and 450 W with a line voltage of 110 V. If stator **resistance per phase is 0.05 Ω and friction and windage losses amount to 135** W. calculate the exciting conductance and susceptance/ph. [12M]
7. A 6-pole,50HZ,3-phase induction motor running on full load develops a useful torque of 160 N-m and the rotor e.mf is absorbed to make 120 cycles/min . Calculate the net mechanical power developed . if the torque loss in windage and friction is 12N-m,Find the copper loss in the rotor windings ,the input to the motor and effciency . Give Stator losses=200W(inclusive of core loss). [12M]
8. A 6-pole, 50HZ, 3-phase induction motor runs at 960rpm when the torque on the shaft is 200Nm. If the stator losses are 1500W and the friction and windage losses are 500W. Find (i) rotor copper loss and (ii) the efficiency of the motor. [12M]

9. (a) From fundamentals, deduce a relationship between Rotor power input, rotor copper loss and mechanical power developed in case of Induction motor. [6M]

(b) Explain various losses in an induction motor and draw power flow diagram? [6M]

10. (a) Write the expression for torque produced by three phase induction motor? [2M]
    (b) Write the relation between rotor input, copper losses and mechanical power developed? [2M]
    (c) Give the expression for starting torque and maximum torque of an induction motor. [2M]
    (d) Give the expression for starting torque to maximum torque and full load torque to maximum torque of an induction motor. [3M]
    (e) Draw the Torque – Slip and Torque – Speed characteristics of an induction motor. [3M]

UNIT-V

STARTING AND SPEED CONTROL OF INDUCTION MOTORS

1. List out the types of starters used for starting of 3 – phase induction motors. Explain line starting of an induction motor. [12M]

2. A 4 pole , 50Hz, 3 phase induction motor has rotor resistance of 0.2Ω per phase and rotor stand still reactance of 1Ω per phase. On full load it is running with a slip of 4%, calculate the extra resistance required in the rotor circuit per phase to reduce the speed to 1260 r.p.m, on the same load condition. [12M]

3. (a) Briefly explain the working of star delta starter with a neat diagram [6M]

(b) A 3-phase cage induction motor has a short circuit current equal to 5 times the full load current. Find the starting torque as the % of full load torque, if the motor is started by (i) DOL starter (ii) Star-Delta starter (iii) an Auto Transformer starter with X% tapping (iv) Rotor resistance starter. Starting Current in (iii) and (iv) is to be limited to 2.5 times the full load current. Full load slip is 4%. [6M]

4. (a) Explain in detail about the working of rotor rheostat starter with a suitable diagram. [6M]

(b) Calculate the value of resistance elements of 5 – step starter for 3-phase, 440V, wound rotor induction motor. The full load slip is 3%, rotor resistance / ph is 0.015. If (i) The starting current is limited to full load current. (ii) The starting current is limited to 1.5 times full load current. [6M]

5. (a) Explain the V/f control methods of the speed control of induction motor is achieved from stator side? [6M]

(b) A cascaded set consists of 2 motors 4-pole and 6-poles respectively. The Supply frequency is 50 Hz , While the frequency in rotor circuit of 6 pole motor s 1Hz.Determine the slip of each machine and combined speed of the set. [6M]

6. (a) With the help of circuit diagram and equations, explain Auto Transformer starting of Induction motor. [6M]

(b) A Three phase induction motor has a ratio of maximum torque to full load torque as 2.5:1 . determine the ratio of starting torque to full load torque if star-delta starter is used. The rotor resistance and standstill reactance per phase are 0.4Ω and 4Ω respetively. [6M]

7. (a) Explain about the speed control of induction motor by Tandem operation and derive the formula of speed. [6M]

(b) Two 50 Hz, 3-**Φ induction motor having 6 and 4**-poles respectively are cumulatively cascaded. The 6-pole motor being connected to the main supply. Determine frequencies of rotor currents and the slips referred to each stator field. If the set has slip of 2%. [6M]

8. Explain how the speed of induction motor is controlled by injecting emf into the rotor Circuit. [12M]

9. A 220V,3 phase, 50Hz,4 pole indution machine is running as generator.Stator resistance per phase = 0.545Ω.At a perticular value of slip,the observed data are as underv:
V= 220V,stator urrent 12A/phase. Output =3910 watts,Slip speed =72 r.p.m. constant losses from no load run =213 watts of whih 65 watts represent friction and winding .find the efficiency. [12M]

10. (a) What are the starting methods used in three phase induction motor? [3M]

(b) Mention three possible methods of speed control of cascaded connection of induction motor. [2M]

(c) Draw the Stator resistor/reactor starter diagram of Induction motor. [3M]

(d) Mention any two speed control methods from stator side of Induction motor. [2M]

(e) The starting current and starting torque of induction motor increases with decrease in supply frequency. How is the starting current and starting torque related to the supply frequency? [2M]

**********ALL THE BEST**********

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