Kafrelsheikh University
Faculty of Engineering
Electrical Power and Machines Dep.
Final Exam: 2nd semester
Year: 3rd Electrical power (R. 2007)
Academic Year: 2020-2021

KSU
Kafrelsheikh University
جامعة كفر الشيخ

Subject: Electrical Machines (2)
course code: EPM3209
Full Mark: 100 Marks
Time allowed: 3 hours
Exam Date: June 14, 2021
No of pages: 2

This exam measures the following LOs [a1, a2, b2, b3, b4, c1, c2].
Please attempt to solve the following questions:

Question (1): (25 M)

(a) **What** is meant by Electric transformer? And **why** it is widely used? (5 M)

(b) **Choose** the correct answer and **explain** your choice **briefly.** (20 M)

1. Can Ac Transformer deliver DC power from one circuit to another? (2 M)

A. Yes, but with specific considerations | B. No, it is technically impossible
C. Yes, if they are magnetically coupled | D. No, unless if they electrically not isolated

2. Ideal Transformer delivers constant power at ? (2 M)

A. fixed frequency | B. fixed turns ratio
C. different voltage and current levels | D. all the previous is true

3. Distribution transformer is? (2 M)

A. Step down transformer | B. step up transformer
C. auto transformer | D. isolation transformer

4. Transformer core is laminated to....... (2 M)

A. Reduce hysteresis loss | B. Reduce eddy current loss
C. Reduce copper loss | D. Reduce all above losses

5. Harmonics in transformer result in........ (2 M)

A. Increase of core and winding losses | B. Reduction feeder capacity
C. Magnetic interference and resonance | D. all the previous is true

6. Zero voltage regulation can be considered as an operating point for ... (2 M)

A. Lagging power factor | B. Leading power factor
C. Unity power factor | D. different loads power factor

7. Technically transformer maximum efficiency can be achieved when: (2 M)

A. core losses equals copper losses | B. copper losses equals core losses
C. eddy current and hysteresis losses are equal | D. transformer losses is neglected

8. Auto transformer can not be used as ? (2 M)

A. Step up boost transformer | B. Isolation Transformer
C. Step down compensate transformer | D. Both step up and step-down transformer

9. Which connection type is suitable for power step up transformer? (2 M)

A. Star-delta connection | B. Delta-star connection
C. Star-star connection | D. Scott connection

10. Which instrument transformers can be used for providing neutral and ground point? (2 M)

A. Tertiary transformer | B. potential transformer
C. Current transformer | D. Zigzag transformer

Question (2): (25 M)

(a) **Drive** an expression for transformer efficiency as a function of loading? And **show how** the load power factor affects the efficiency ? (5 M)

All the best, Dr. /Muhammed Shafik

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(b) **mention** the conditions or constraints to connect two transformers in parallel and how they share the load? **(5 M)**

(c) A 5 kVA, 500/250 V, 50 Hz, 1-phase transformer is required to be tested for its name plate data so the following tests are performed:

OC test: 500 V, 1 A, 50 W (LV side)   SC test: 25 V, 10 A, 60 W (LV side)

Determine: **(10 M)**
  i. Efficiency and maximum efficiency on full load of 0.8 lag. Pf.
  ii. Voltage regulation on full load of 0.8 lead. Pf.
  iii. Efficiency on 60 % of full load of 0.8 lead. Pf.

Question (3): **(25 M)**

(a) **Mention** the transformer necessary tests and **what** is the importance of each test? **(5 M)**

(b) **Explain** why auto-transformer is not preferred for stepping voltage down? And **mention** it's applications? **(5 M)**

(c) A 220/22 V, 2 kVA, two winding transformer is used for getting a small boost auto-transformer 220/242 V. find:
  i. Connection polarity, transformation ratio and kVA rating of the auto transformer. **(15 M)**
  ii. Most current loaded part of the auto-transformer winding.
  iii. Auto-transformer maximum efficiency at full load, 0.85 leading pf, if the core losses is 50 W and copper losses is 90 W. Compare it with the 2-winding transformer efficiency.

Question (4): **(25 M)**

(a) **Explain** which is better as 3- phase power transformer 3-phase transformer bank or three 1-phase transformers? **(5 M)**

(b) **Drive** the output and volt/turn equations for 3- phase core type transformer? **(5 M)**

(c) 3-phase, 3 leg core type power transformer, 750 kVA, 11000/3300 V, 50 Hz, star-delta connection, natural cooling, Determine the main dimensions of the core and windings number of turns and cross-sectional area of the conductors. **(15 M)**

- Assume constant K for 3- phase power transformer is 0.65, Maximum flux density is 1.25 T, Current density 250 A/cm^2, window space factor is 0.27, window height is 3 times window width.

Please Manage your time

All The best, Dr. /Muhammed Shafik.