# PRESIDENCY UNIVERSITY
## BENGALURU
## SCHOOL OF ENGINEERING

### TEST 1

**Sem & AY**: Odd Sem 2019-20          **Date**: 27.09.2019

**Course Code**: EEE 210          **Time**: 2.30 PM to 3.30 PM

**Course Name**: ELECTRICAL MACHINES-II          **Max Marks**: 40

**Program & Sem**: B.Tech (EEE) & V          **Weightage**: 20%

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**Instructions:**

    *i.   Read the question properly and answer accordingly.*

    *ii.  Question paper consists of 3 parts.*

    *iii.  Scientific and Non-programmable calculators are permitted*

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## Part A (Memory Recall Questions)

### Answer all the Questions. Each Question carries four marks.          (3Qx4M=12M)

1. Differentiate between ideal transformers and practical transformers.
<div align="right">(C.O.NO.1) [Knowledge]</div>

2. Draw the no-load phasor diagram of a transformer and Write the expressions for magnetizing and core-loss components of no-load current.     (C.O.NO.1)[Knowledge]

3. Explain why Iron losses are constant from no load to full load.(C.O.NO.1)[Knowledge]

## Part B (Thought Provoking Questions)

### Answer both the Questions. Each Question carries eight marks.          (2Qx8M=16M)

4. The maximum flux density in the core of 250V/3000V,50Hz single phase transformer is 1.2 wb/m$^2$. If the emf/turn is 8V, Compute all the possible quantities from the given data.
<div align="right">(C.O.NO.1) [Comprehension]</div>

5. Justify your answer
    i). Is the efficiency of a transformer same at 0.8 pf lag and 0.8 pf lead when connected to the same load.
    ii). Which test gives the copper losses of a single phase transformer? Justify.
<div align="right">(C.O.NO: 2) [Comprehension]</div>

**Answer the Question. The Question carries twelve marks.**          (1Qx12M=12M)

6. The customer need a transformer with an efficiency of 90% for his specific application. He wants to operate it at 0.8 pf and at full load.

    Company provided a 4 kVA, 200/400V single phase transformer. The following tests are conducted and observations tabulated as follows.

    OC test: 200V, .8A, 70 W - LV side;

    SC test 20V, 10A, 60W - HV side.

    Do you think the customer buy this transformer?  Validate your answer

    (C.O.NO.2) [Comprehension].

# SCHOOL OF ENGINEERING

Semester: V

Course Code: EEE 210

Course Name: ELECTRICAL MACHINES –II

Branch & Sem: EEE & 5th Semester

Date: 27.09.2019

Time: 2.30 to 3.30 pm

Max Marks: 40

Weightage: 20%

## Extract of question distribution [outcome wise & level wise]

| Q.NO | C.O.NO | Unit/Module Number/Unit /Module Title | Memory recall type [Marks allotted] Bloom's Levels | | Thought provoking type [Marks allotted] Bloom's Levels | | Problem Solving type [Marks allotted] | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | K | | C | | C | | |
| 1 | 1 | 1 | 4 | | | | | | 4 |
| 2 | 1 | 1 | 4 | | | | | | 4 |
| 3 | 1 | 1 | 4 | | | | | | 4 |
| 4 | 1 | 1 | | | | | 8 | | 8 |
| 5 | 2 | 1 | | | 8 | | | | 8 |
| 6 | 2 | 1 | | | | | 12 | | 12 |
| | Total Marks | | 12 | | 8 | | 20 | | 40 |

K =Knowledge Level   C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I here certify that All the questions are set as per the above lines   Dr Sneha prabha ]

# SCHOOL OF ENGINEERING

## SOLUTION

**Semester:** V
**Course Code:** EEE 210
**Course Name:** ELECTRICAL MACHINES –II
**Branch & Sem:** EEE & 5th Semester

**Date:** 27.09.2019
**Time:** 2.30 to 3.30 pm
**Max Marks:** 40
**Weightage:** 20%

Part A                                    (3Q x4 M = 12 Marks)

| Q No | Solution | Scheme of Marking | Max. Time required for each Question |
|------|----------|-------------------|-------------------------------------|
| 1 | Differentiate between ideal transformers and practical transformers. | 2+2 | 4m |
| 2 | Draw no-load phasor diagram of a transformer and write expressions for magnetizing and core-loss components of no-load current. | Phasor Diagram-2 Expressions-2 | 4m |
| 3 | Explain why iron losses are constant from no load to full load. | Explanation 4 | 4m |

Part B                                    (2Q x 8M = 16 Marks)

| Q No | Solution | Scheme of Marking | Max. Time required for each Question |
|------|----------|-------------------|-------------------------------------|
| 4 | The maximum flux density in the core of 250/3000V, 50 Hz single phase transformer is 1.2 wb/m². if the emf/turn is 8V , determine 1)primary and secondary turns. | $N_1=32;N_2=375$ 4+4 | 10m |
| 5 | Justify your answer i). Is the efficiency of a transformer same at 0.8 pf lag and 0.8 pf lead when connected to the same | Efficiency equation and explanation -4 SC test – Explanation-4 | 10m |

| | load. ii) Which test gives the copper losses of a single phase transformer? | | |
|---|---|---|---|

<div align="center">Part C</div>   <div align="right">(Q x M = Marks)</div>

| Q No | Solution | Scheme of Marking | Max. Time required for each Question |
|---|---|---|---|
| 6 | I₂=10A; 3M   Wcu=60W   -2M<br>Wi=70W 2M ; η=96.1%   -5M | I₂=10A;  3M   Wcu=60W   -2M<br>Wi=70W  -2M η=96.1%   -5M | 20m |

**8 min to recheck**

# PRESIDENCY UNIVERSITY
## BENGALURU
## SCHOOL OF ENGINEERING

### TEST – 2

**Sem & AY**: Odd Sem 2019-20

**Course Code**: EEE 210

**Course Name**: ELECTRICAL MACHINES-II

**Program & Sem**: B.Tech (EEE) & V

**Date**: 16.11.2019

**Time**: 2.30 to 3.30 PM

**Max Marks**: 40

**Weightage**: 20%

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### Instructions:
  i.  *Read the question properly and answer accordingly.*
  ii. *Question paper consists of 3 parts.*
  iii. Scientific and Non-programmable calculators are permitted

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## Part A [Memory Recall Questions]
**Answer both the Questions. Each Question carries four marks.      (2Qx4M=8M)**

1. Does the transformer draw any current when its secondary is open, justify your answer.                                                    (C.O.NO.2) [Knowledge]

2. In a 2 winding transformer the primary and secondary induced emf's $E_1$ and $E_2$, in are always anti-phase with each other. True or False? - justify your answer.
                                                    (C.O.NO.2) [Comprehension]

## Part B [Thought Provoking Questions]
**Answer both the Questions. Each Question carries ten marks.      (2Qx10M=20M)**

3. A 3-Phase 50-Hz transformer has a delta connected primary and star connected secondary, the line voltages being 22000 V and 400 V respectively. The secondary has a star-connected balanced load at 0.8 power factor lagging. The line current on the primary side is 5A. Determine the current in each coil of the primary and in each secondary line. What is the output of the transformer in kW?
                                                    (C.O.NO.2) [Comprehension]

4. A 200 KVA single phase transformer is in circuit continuously. For 8 hours in a day, the load is 160kw at 0.8 pf. For 6 hours, the load is 80 kW at unity pf and for the remaining period of 24 hours it runs on no-load. Full-load copper losses are 3.02 kW and the iron losses are 1.6 kW. Find all day efficiency.
                                                    (C.O.NO.2) [Comprehension]

## Part C [Problem Solving Questions]
**Answer the Question. The Question carry twelve marks.      (1Qx12M=12M)**

5. You are provided with 2 identical transformer. Find the regulation of the transformer (counting accurate temp rise) by a suitable method. Draw the necessary circuit diagram with brief procedure.
                                                    (C.O.NO.2) [Comprehension]

# SCHOOL OF ENGINEERING



GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

**Semester**: V

**Course Code**: EEE 210

**Course Name**: ELECTRICAL MACHINES –II

**Branch & Sem**: EEE & 5th Semester

**Date**: 16.11.2019

**Time**: 2.30 to 3.30 pm

**Max Marks**: 40

**Weightage**: 20%

## Extract of question distribution [outcome wise & level wise]

| Q.NO. | C.O.NO | Unit/Module Number/Unit /Module Title | Memory recall type [Marks allotted] Bloom's Levels | | | Thought provoking type [Marks allotted] Bloom's Levels | | | Problem Solving type [Marks allotted] | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | K | | | C | | | C | | | |
| 1 | 2 | 2 | 4 | | | | | | | | | 4 |
| 2 | 2 | 2 | | | | 4 | | | | | | 4 |
| 3 | 2 | 2 | | | | | | | 10 | | | 10 |
| 4 | 2 | 2 | | | | | | | 10 | | | 10 |
| 5 | 2 | 2 | | | | | | | 12 | | | 12 |
| | Total Marks | | 4 | | | 4 | | | 32 | | | 40 |

K =Knowledge Level   C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines. [Dr. Snehaprabha T V]

# SCHOOL OF ENGINEERING



GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

## SOLUTION

**Semester:** V

**Course Code:** EEE 210

**Course Name:** ELECTRICAL MACHINES –II

**Branch & Sem:** EEE & 5th Semester

**Date:** 16.11.2019

**Time:** 2.30 to 3.30 pm

**Max Marks:** 40

**Weightage:** 20%

**Part A**  (2Q x 4 M = 8 Marks)

| Q No | Solution | Scheme of Marking | Max. Time required for each Question |
|---|---|---|---|
| 1 | Since the secondary of the transformer is open, the primary draws only no-load current, which will have some copper loss. Since no current passes through the secondary windings, no magnetic field is created, which means zero current is induced on the primary side. | Explanation -2 Equations-2 | 4 m |
| 2 | Diagram & Explanation | Diagram-2, proper justification -2 | 4 m |

**Part B**  (3Q x 10M = 20Marks)

| Q No | Solution | Scheme of Marking | Max. Time required for each Question |
|---|---|---|---|
| 3 | Phase voltage on primary side=2200 v<br>Phase voltage on secondary side= 400/√3.<br>K=1/55√3<br>Primary phase current= 5/√3<br>Secondary phase current =275 A<br>Secondary line current=275 A<br>Output power=15.24 kW | Calculating Prim & Sec Voltage-4<br>Finding k & prim phase current & line current-(2+1+1)<br>Finding output power-2 | 10 m |
| 4 | Iron loss for 24hrs=38.4kwh<br>Copper loss for 24 hrs=27.059kwh<br>Output=1760kwh<br>Input-1825.4592kwh<br>H=96.41% | Finding Iron loss for 24 hrs -2<br>Finding copper loss for 24 hrs-2<br>Finding output power -2<br>Finding the input power-2<br>Finding efficiency -2 | 10 m |

**Part C**  (1Q x 12M = 12Marks)

| Q No | Solution | Scheme of Marking | Max. Time required for each Question |
|---|---|---|---|
| | | | |

| 5 | For drawing the necessary diagram & related equations. | Drawing-3<br>Explanation-3<br>Equations-3 | 12 m |
|---|---|---|---|

# PRESIDENCY UNIVERSITY
# BENGALURU
## SCHOOL OF ENGINEERING

### END TERM FINAL EXAMINATION

**Semester:** Odd Semester: 2019 - 20

**Course Code:** EEE 210

**Course Name:** ELECTRICAL MACHINES -II

**Program & Sem:** B.Tech (EEE) & V

**Date:** 23 December 2019

**Time:** 9.30 AM to 12:30 PM

**Max Marks:** 80

**Weightage:** 40%

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**Instructions:**

(i) *Read the all questions carefully and answer accordingly.*

(ii) *Scientific and Non-programmable calculators are permitted*

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## Part A [Memory Recall Questions]

### Answer all the Questions. Each Question carries 6 marks.          (5Qx4M=20M)

1. Explain with reasons what happens when the primary of a single phase transformer is connected to DC supply of the same voltage rating.          (C.O.No.2) [Knowledge]

2. Explain the steps taken to minimize iron losses in a single phase transformer.          (C.O.No.1) [Knowledge]

3. Short circuit test on a single phase transformer gives the copper loss alone practically. Justify your answer.          (C.O.No.1) [Knowledge]

4. How can the direction of rotation of the 3-phase induction motor be reversed? Why does the induction motor never runs on synchronous speed?          (C.O.No.3) [Knowledge]

5. Draw and briefly explain the phasor diagram of a 3-phase induction motor.          (C.O.No.4) [Knowledge]

## Part B [Thought Provoking Questions]

### Answer all the Questions. Each Question carries 6 marks          (5Qx6M=30M)

6. Bring out clearly, with the help of neat sketches the differences between the 3-phase slip ring induction motor and the 3-phase squirrel cage induction motor.          (C.O.No.3) [Comprehension]

7. Draw the torque speed characteristics of poly phase induction motor and clearly indicate the effect of change rotor resistance.          (C.O.No.4) [Comprehension]

8. If the full load speed of an induction motor is 960rpm, what will be the synchronous speed? Give an intuitive answer.          (C.O.No.4) [Comprehension]

9. Explain the phenomenon of negative voltage regulation of a single phase transformer. What is the condition for maximum and minimum voltage regulation?

10. Explain the necessity of starters for 3 phase Induction motor.          (C.O.No.4) [Comprehension]

## Part C [Problem Solving Questions]
**Answer all the Questions. Each Question carries 10 marks.** **(3Qx10M=30M)**

11. The power input to a 3 phase induction motor is 60 kW. The stator losses is 1kW. Find the mechanical power developed and the rotor copper loss/ ph if the motor is running with a slip of 3%.

    (C.O.No.4) [Comprehension]

12. A 3 Phase 400 V ,14.9 kW Induction motor gave the following test results .No load test: 400V, 1250W, 9A. Short circuit test: 150 V, 4 kW,38A. From the circle diagram that is drawn for the data given determine the power scale in order to find the different losses.

    (C.O.No.4) [Comprehension].

13. A three phase 240 Volts, 50 Hz induction motor having a 6 pole star connected stator winding has rotor resistance of 12 ohms and stand still reactance 0.85 ohms per phase. The ratio of stator to rotor turns is 1.8. Full load slip is 4% .Calculate the developed torque at full load.

    (C.O.No.4) [Comprehension]

# SCHOOL OF ENGINEERING

## END TERM FINAL EXAMINATION

### Extract of question distribution [outcome wise & level wise]

| Q.NO. | C.O.NO (% age of CO) | Unit/Module Number/Unit /Module Title | Memory recall type [Marks allotted] Bloom's Levels | Thought provoking type [Marks allotted] Bloom's Levels | Problem Solving type [Marks allotted] | Total Marks |
|---|---|---|---|---|---|---|
| | | | K | C | A | |
| 1 | 2 | 2 | 4 | | | 4 |
| 2 | 2 | 2 | 4 | | | 4 |
| 3 | 1 | 1 | 4 | | | 4 |
| 4 | 1 | 1 | 4 | | | 4 |
| 5 | 1 | 1 | 4 | | | 4 |
| 6 | 3 | 3 | | 6 | | 6 |
| 7 | 4 | 4 | | 6 | | 6 |
| 8 | 4 | 4 | | 6 | | 6 |
| 9 | 3 | 3 | | 6 | | 6 |
| 10 | 3 | 3 | | 6 | | 6 |
| 11 | 4 | 4 | | | 10 | 10 |
| 12 | 4 | 4 | | | 10 | 10 |
| 13 | 4 | 4 | | | 10 | 10 |
| | Total Marks | | 20 | 30 | 30 | 80 |

K =Knowledge Level   C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must

be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature: _(signature)_ 12/12/19 .

Reviewer Commend: All Co's are tested in the question paper

## Format of Answer Scheme

### SCHOOL OF ENGINEERING

### SOLUTION

| | |
|---|---|
| **Semester**: Odd Sem. 2019-20 | **Date**: 23.12.2019 |
| **Course Code**: EEE 210 | **Time**: 3 HRS |
| **Course Name**: ELECTRICAL MACHINES-II | **Max Marks**: 80 |
| **Program & Sem**: B.Tech(EEE) & V | **Weightage**: 40% |

**Part A** (5Q x 4M = 20 Marks)

| Q No | Solution | Scheme of Marking | Max. Time required for each Question |
|---|---|---|---|
| 1 | Explain with reasons what happens when the primary of a single phase transformer is connected to DC supply of the same voltage rating.<br>No mutual Induction- No transformer action- Only resistive , so high current and may damage winding  - 2 points . | 2+2 | 6 Minutes |
| 2 | If the full load speed of an induction motor is 960rpm, what will be the synchronous speed? Justify your answer.<br>Assume P- 1000 rpm  Ans - 2  Justification - 2 | 2+2 | 6 Minutes |
| 3 | Explain the steps taken to minimize iron losses in a single phase transformer.  eddy current - 2  Hysterisis  - 2<br>Laminations and silicon content material | 2+2 | 6 Minutes |
| 4 | What does the power input to a single phase transformer during the open circuit test indicate?<br>Losses - 2  Explanation - 2 | 2+2 | 6 Minutes |

| 5 | Short circuit test on a single phase transformer gives the copper loss alone practically. Justify your answer | 2+2 | 6 Minutes |
|---|---|---|---|
| | Iron loss neglected  - 2 <br> Explanation          - 2 | | |
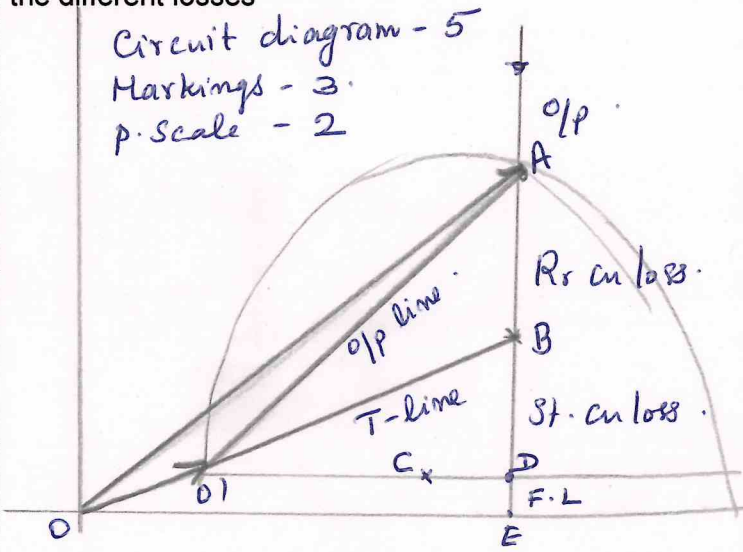
**Part B**                                        (5Q x 6M = 30 Marks)

| Q No | Solution | Scheme of Marking | Max. Time required for each Question |
|---|---|---|---|
| 6 | Bring out clearly, with the help of neat sketches the differences between the 3-phase slip ring induction motor and the 3-phase squirrel cage induction motor. <br> Diagram - 2 + 1 - explanation. <br> Slip ring · <br> Sg. Cage - Diagram + Explanation <br> 2+1 | 3+3 | 12 Minutes |
| 7 | Draw the torque speed characteristics of poly phase induction motor and clearly indicate the effect of change rotor resistance.  Chs - 2  explanation - 1 <br> Effect of Rr Resistance - 3 | 3+3 | 12 Minutes |
| 8 | Explain the phenomenon of negative voltage regulation of a single phase transformer. <br> Chs - 3 <br> Explanation - 3 | 3+3 | 12 Minutes |
| 9 | Draw the phasor diagram and equivalent circuit of a 3-phase induction motor. <br> eq ckt - 3 <br> Phasor diagram - 3 | 3+3 | 12 Minutes |
| 10 | How can the direction of rotation of the 3-phase induction motor be reversed? Why does the induction motor never runs on synchronous speed? <br> Explanation - 1  - 3 marks · <br> Explanation - 2 - 3 marks · | 3+3 | 12 Minutes |

| Q No | Solution | Scheme of Marking | Max. Time required for each Question |
|------|----------|-------------------|--------------------------------------|
| 11 | The power input to a 3 phase induction motor is 60 kW . The stator losses is 1kW. Find the mechanical power developed and the rotor copper loss/ ph if the motor is running with a slip of 3% $$P_2 = 60 - 1 = 59 \, kw. \qquad -3$$ $$P_{cu\,loss} = .03 \times 59 = 1770 w \; -4$$ $$P_m \qquad 57230 \, w \qquad -3$$ | $$3 + 4 + 3$$ $$= 10$$ | 20 **Minutes** |
| 12 | A 3 Phase 400 V , 14.9 kW Induction motor gave the following test results . No load test: 400V, 1250W, 9A. Short circuit test: 150 V, 4 kW,38A. From the circle diagram that is drawn for the data given determine the power scale in order to find the different losses  Circuit diagram - 5 Markings - 3. p. Scale - 2 | $$5 + 3 + 2$$ | 30 **Minutes** |
| 13 | A three phase 240 Volts, 50 Hz induction motor having a 6 pole star connected stator winding has rotor resistance .12 ohms and stand still reactance 0.85 ohms per phase. The ratio of stator to rotor turns is 1.8 . Full load slip is 4% .Calculate the developed torque at full load $$K = \frac{1}{1.8} \,^{(1)}, \quad E_2 = 77 \, V \quad S = 0.04$$ $$T_f = \frac{3}{2\pi n_s} \,^{(2)} \cdot \frac{S E_2^2 \cdot R_2}{R_2^2 + (S X_2)^2} \,^{(2)} = 52.4 \, Nm$$ $$^{(5)}$$ | $$1 + 2 +$$ $$2 + 5 = 10$$ | 20 **Minutes** |

20 **Minutes to recheck the answers.**