



COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING
BACHELOR OF ENGINEERING PROGRAMME, YEAR 3 (BENG 3)
EEE782 ELECTRICAL MACHINES

SUPPLEMENTARY/RE-SIT EXAMINATION
(PENSTER 4, 2017)

DATE/TIME/ROOM – Refer to Timetable

Total Marks – 100

Time Duration – 3 hours & 10 Minutes

INSTRUCTIONS TO CANDIDATES

1. You are allowed 10 minutes extra time during which you are not to write.
2. Begin each answer on a fresh new page and use both sides of the sheets.
3. Write your identification number on the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper etc. in their correct sequence and secure with string provided.
5. For all sheets of paper in which has been done, cross it through and you must attach to your answer script.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. *ANSWER ONLY TEN QUESTIONS.*

1. Explain the open circuit and short circuit test for determination of the equivalent circuit parameters of the transformer. Develop the exact equivalent circuit of a single phase transformer. [10 Marks]
2. A transformer has 1200 primary turns and 200 secondary turns. The primary and secondary resistances are 0.2Ω and 0.02Ω respectively and the corresponding leakage reactance are 1.2Ω and 0.05Ω respectively. Calculate the equivalent resistance, reactance and impedance referred to the primary winding. [10 Marks]
3. Define armature reaction in alternator. How it affects the main field under unity, 90° lagging and 90° leading power factor conditions. Explain with the help of suitable diagrams. [10 Marks]
4. A three phase star connected, 1500 r.p.m., 4 pole alternator has 8 conductors per slot which total of 24 slots. The coil span is 150° electrical. Assume distributed winding with flux per pole as 0.06 Wb. Calculate the phase and line induced emf. [10 Marks]
5. A three phase, 6 pole, star connected synchronous generator revolves at 1000 rpm. The stator has 90 slots and 8 conductors per slot. The flux per pole is 0.05 Wb. Calculate the voltage generated, if the winding factor is 0.96. [10 Marks]
6. Write short notes on any two of the following:
 - (a) Principle of working of an induction motor. [5 Marks]
 - (b) Torque-slip characteristics of a three-phase induction motor. [5 Marks]
 - (c) The effect of rotor resistance on torque of induction motor. [5 Marks]
7. Show and explain through power flow diagram, how electrical input is converted into mechanical power output in an induction motor, and hence show that [10 Marks]

$$P_g : \text{rotor cu loss} : P_m = 1 : s : (1-s) \quad ; \text{ where } s \text{ is slip.}$$
8. The stator loss of 3 phase induction motor is 2 KW. When the input is 90 KW, what will be rotor mechanical power developed and rotor copper loss, if the motor is running at slip of 4%. [10 Marks]
9. A 6 pole 3 phase induction motor is connected across a 400 V, 50 Hz supply source. Calculate the speed of the rotating magnetic field produced. What would be the speed of the rotor when slip is 3%. Also calculate the frequency rotor current at standstill and at a slip of 2%. [10 Marks]
10. Explain the principle of operation of DC motor. Derive the expression for the back emf in a DC generator. [10 Marks]
11. Draw and explain torque-speed characteristics for the following types of DC motor
 - (i) Shunt motor
 - (ii) Series motor. [10 Marks]

[THE END]