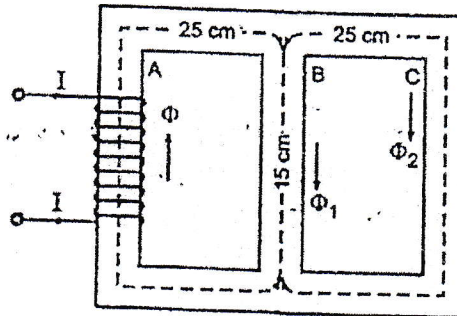


Level	BE	Full Marks	60
Programme	BEL	Pass Marks	24
Year / Part	II / I	Time	3 hrs.

Subject: - Electrical Machine I (ENEE 202)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. A cast steel magnetic structure made of a bar of section 2 cm x 2 cm is shown in figure. Determine the current that the 500 turns magnetizing coil on the left limb should carry so that a flux of 2 mWb is produced in the right limb. Take $\mu_r = 600$ and neglect leakage. [6]



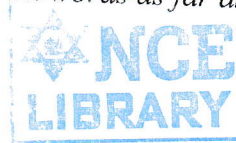
2. During open circuit and short circuit test of a 2200/110 V, 40 kVA transformer, following results were obtained. The meters for open circuit test were placed on LV side and for short circuit test on HV side.
- Open circuit - $P = 320$ W; $I = 8.4$ A; $V = 110$ V [6]
 Short circuit - $P = 650$ W; $I = 18.2$ A; $V = 85$ V
 Determine;
- R_0 and X_0
 - The efficiency at full load with pf 0.85 lag
 - The approx. voltage regulation
3. Why do we need to connect transformers in parallel? Also explain the conditions that need to be fulfilled for parallel operation of transformers with detailed explanation for operation. [2+4]
4. Explain the principle of Sumpner's test. Why is it necessary to use two identical transformer in Sumpner's test? [3+3]
5. Why DC shunt generator shall not be started at load? Explain the voltage build-up process of a DC shunt generator. [2+4]
6. The armature and field resistances of a 200 V DC shunt motor are 0.12Ω and 250Ω respectively. The rotational loss of the motor is 250 W. The full load line current is 10 A and motor rpm is 1500. Determine; [6]
- The mechanical power developed.
 - The power output
 - The load torque
 - The full load efficiency
7. Explain the need of starter in a DC motor and describe the working principle of 4 point starter with a neat sketch. [6]
8. Explain the construction and working principle of 3-phase induction motor. [6]
9. A 4 pole, 3 phase, 50 Hz, 1440 rpm induction motor is drawing 35 kW. The stator and friction losses are 1 kW and 1.5 kW respectively. Find. [6]
- rotor copper losses
 - efficiency of motor
10. Explain why do we need a starter to start an induction motor? Also explain different methods of induction motor starting. [6]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Chaitra

Exam.	Regular (New Course)	
Level	BE	Full Marks 60
Programme	BEL	Pass Marks 24
Year / Part	II / I	Time 3 hrs.

Subject: - Electrical Machine I (ENEE 202)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.



1. A circular ring of magnetic material has a mean length of 0.8 m, cross sectional area of 120 cm^2 and an air gap of 5mm. Calculate the magnetizing current required to produce a flux of 1 mWb in the air gap if the ring is wound uniformly with a coil of 220 turns. Take relative permeability of the ring material = 500 and neglect leakage and fringing. [6]
2. Define referred quantities in transformer. Derive the expression for the referred quantities (voltage, current, impedance) in a transformer. [1+5]
3. Daily loading of a 150 kVA transformer having iron loss of 400 W and full load copper loss of 1700 W is given below. [6]

Time	Load (kW)	Power factor
6:00 – 10:00	50	0.9
10:00 – 17:00	60	0.85
17:00 – 21:00	70	0.8
21:00 – 6:00	10	0.95

Determine the all-day efficiency of the transformer.

4. A single phase, 100kVA, 2000/200 V, 50Hz transformer has an impedance drop of 10% and resistance drop of 5%. Calculate; [3+3]
 - a) The regulation at full load 0.8 power factor lagging.
 - b) The value of power factor at which regulation is zero.
5. Define armature reaction in DC machine. Explain its effects on the operation of DC machine. What measures can be taken to reduce its effect? [2+2+2]
6. A 220 V DC series motor draws full-load line current of 38A at the rated speed of 600 rpm. The motor has armature resistance of 0.4Ω and the series field resistance is 0.2Ω . The brush voltage drop irrespective of load is 3.0 volts, find: [3+3]
 - a) The speed of the motor when the load current drops to 19 A.
 - b) The speed on removal of load when the motor takes only 1 A from the supply.
7. Explain the necessity of testing in DC machines. Explain how is the retardation test different from the Swinburne's test? [3+3]
8. Mention the basic difference between slip ring and squirrel cage induction motor. Discuss their application and its characteristics. [4+2]
9. A 440 V 3-phase 50 Hz, 4-pole Y-connected Induction motor has a full load 1425 rpm. The rotor has an Impedance of $(0.4 + j 4) \Omega$ per phase and rotor/ stator turn ratio is 0.8. Calculate; [2+2+2]
 - (i) Full-load torque
 - (ii) Rotor current and
 - (iii) Full-load rotor Cu loss.
10. Explain the operation of three phase induction motor as induction generator in isolated mode. Explain the role of induction machines in renewable energy applications. [4+2]