

THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
Department of Electrical & Electronic Engineering

EE321: Electromechanics and Electrical Machines

Assignment 4: Induced Voltages and Torque in Rotating Machines (Due 10/10/11)

1. A conductor on the armature of a motor is 18 cm long and carries a current of 25 A. At the conductor location the magnetic field is 1 T. Determine the force created on the conductor.
2. A 6-pole armature is wound with 456 conductors. The speed and flux are such that 1 V is generated in each conductor. The conductor current is 40 A. Determine the generated voltage if the winding is
 - (a) lap connected
 - (b) wave connected?
3. A two-pole motor has 260 conductors on its armature, and 70% are directly under the pole faces. The armature length is 16 cm, its radius is 12 cm, and the field is 0.8 T at the conductor locations. The armature current is 60 A and the motor is rotating at 1600 r/min. Calculate
 - (a) the total force developed by the armature
 - (b) the mechanical power developed by the motor
 - (c) the total counter induced voltage in the armature

Assignment 5: DC Generators. (Due 14/10/11)

1. If the no-load voltage of a separately excited generator is 125 V at 900 r/min, what will be the voltage if the speed is increased to 1200 r/min? Assume constant field excitation.
2. A separately excited generator has an open-circuit terminal voltage of 144 V. When loaded, the voltage across the load is 120 V. Determine the load current if the armature resistance is 0.52 Ω .
3. A 120-V shunt generator is to maintain constant terminal voltage. At full load the speed drops 10%, as compared to no-load value, and the armature voltage drop is 12 V. The open-circuit characteristic of the generator when driven at 1200 r/min is given as

Field current (A)	0.25	0.5	0.75	1.0	1.5
Generated emf (V)	52	83	120	134	148

Determine the change in field resistance from no-load to full-load.

Assignment 6: DC Motors. (Due 18/10/11)

1. A 120-V shunt motor has the following parameters: $R_a = 0.40 \Omega$, $R_f = 120 \Omega$, rotational loss 240 W. On full load the line current is 19.5 A and the motor runs at 1200 r/min. Determine at full load
 - (a) the developed power,
 - (b) the output torque, and
 - (c) the efficiency.
2. A dc series motor takes 40 A at 460 V when hoisting a load at 6m/s. The armature plus field resistance is 0.48 Ω . Determine the resistance to be placed in series with motor to slow the hoisting speed to 4 m/s. Assume linear operation on the magnetisation curve.

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ASSIGNMENT 7: THREE PHASE POWER SYSTEMS (*Due 21/10/11*)

1. Three similar coils, each of resistance $10\ \Omega$ and reactance $10\ \Omega$, are connected
 - (a) in star
 - (b) in deltaacross a 400-V, 3-phase supply. Find in each case,
 - (i) the line current and
 - (ii) the sum of the readings of the two wattmeters connected to measure the power.

2.
 - (a) A balanced 3-phase load has power factor of 0.447 lagging. Two wattmeters are connected to measure the power input to this load which is known to be 20 kW. Find the readings of the instruments.

 - (b) Each of the two wattmeters connected to measure the power input to a 3-phase circuit reads 10 kW on balanced load when the power factor is unity. What does each instrument read when the power factor falls to
 - (i) 0.866 lagging
 - (ii) 0.5 lagging,the total three phase power remaining unaltered?

3. Three coils, each having a resistance of $20\ \Omega$ and a reactance of $15\ \Omega$, are connected in star to a 415-V, 3-phase, 50-Hz supply. Calculate the
 - (a) line current,
 - (b) active power supplied and
 - (c) power factor.If three identical capacitors are connected in delta to the same supply so as to form a parallel network with the above coils, calculate the
 - (d) capacitance of each capacitor to obtain a resultant power factor of 0.95 lagging and
 - (e) the line current taken by the combined circuits.