

# Motilal Nehru National Institute of Technology Allahabad

## DEPARTMENT OF ELECTRICAL ENGINEERING

$$\text{Speed}(n) \propto \frac{1}{\Phi}$$

End semester Examination, 2016

B.Tech (EED-IV<sup>th</sup> Semester)

SUBJECT: Basics of Electrical Machine (EE-101)

Duration: 3 hrs.

Maximum Marks: 60

Instructions: Answer all the questions .  
Take necessary assumptions, if required

1. a) What is meant by commutation in a dc machine? Differentiate between good commutation and bad commutation. Also explain the methods of improving commutation in dc machines. (4)
- b) A dc series motor connected to a 440 V supply, runs at 600 rpm, when taking a current of 50 A. Calculate the value of resistance which when inserted in series with the motor, will reduce the speed to 400 rpm, the gross torque being then half its previous value. The resistance of the motor is 0.2  $\Omega$ . (4)

2. a) Explain the process of voltage build up in a dc shunt generator. State the various conditions under which a dc shunt generator fails to excite. (4)
- b) A dc generator is connected to a 220 V dc mains. The current delivered by the generator to the mains is 100 A. The armature resistance is 0.1  $\Omega$ . The generator is driven at a speed of 400 rpm. Calculate (a) the induced emf (b) the electromagnetic torque (c) the mechanical power input to the armature neglecting iron, windage and friction losses (d) the power input and output of the armature when the speed drops to 350 rpm. State whether the machine is generating or motoring. Assume constant flux. (4)

3. a) Describe in detail the four phasor groups pertaining to 3-phase transformers. Draw the phasor diagrams and connection schemes for each of these groups. (4)
- b) A 3-phase step down transformer is connected to 6.6 kV mains and takes 10 Amps. Calculate the secondary line voltage and line current for the (i)  $\Delta / \Delta$  (ii) Y/Y (iii)  $\Delta / Y$  and (iv) Y/ $\Delta$  connections. The ratios of turns per phase is 12 and neglect no load losses. (4)

4. a) A single phase, 50 Hz, 40 kVA transformer has got a maximum efficiency of 97 % at 80 % of full load at unity power factor. During the day it is loaded as follows:  
6 A.M. to 3 P.M: 6 kW at 0.6 p.f. lagging  
3 P.M. to 11 P.M: 25 kW at 0.8 p.f. lagging  
11 P.M. to 6 A.M: 30 kW at 0.9 p.f. lagging  
Determine the all-day efficiency of the transformer (4)

- b) How would the main pole tips be constructed to minimize the effect of armature reaction on the main field? If the brushes are shifted in the direction of rotation, the flux per pole is reduced in a generator. Explain. What would happen if the brushes are given a backward shift in a generator? (4)

5.

- a) What is the function of conservator and breather in a transformer? Explain. (3)
- b) A 5 kVA, 200 V/ 100 V, 50 Hz, single phase ideal two winding transformer is used to step up a voltage of 200 V to 300 V by connecting it like an auto transformer. Show the connection diagram to achieve this. Calculate the maximum kVA that can be handled by the autotransformer (without over loading any of the HV and LV coil). How much of this kVA is transferred magnetically and how much is transferred by electrical conduction. (5)

6.

- a) What is the requirement of starter in a dc machine? Explain the working principle of a three point starter with schematic diagram. (4)
- b) Initially a d.c shunt motor having armature resistance equal to  $0.5 \Omega$  and field winding resistance of  $220 \Omega$  is running at 1000 rpm, drawing 20 A from 220 V supply. If the field resistance is increased by 5%, calculate the new steady state armature current and speed of the motor. Assume the load torque to be constant. (4)

7. Answer the following:

(4x3=12)

- a) Explain armature reaction phenomena in a DC machine. Which methods are generally used for neutralizing the effects of armature reaction?
- b) Explain the method of speed control of a dc motor by ward leonard method.
- c) Explain the different conditions required for connecting two three phase transformer in parallel.