TUTORIAL - D.C MOTORS PART 1

NAME: _____

Please note the following requirements in relation to tutorial work -

- All tutorial work is to be completed on ruled A4 pad paper, with multiple pages stapled together. Write on one side only of the answer sheets.
- All work is to be completed in ink.
- In the case of multiple choice type questions, the question number and answer letter are to be written on the answer sheet.
- All relevant equations and working are to be shown in the case of calculation type questions.
- All diagrams are to be drawn using appropriate drawing instruments. Drawings are not to be freehand.

Section A

In the following statements one of the suggested answers is best. Place the identifying letter on your answer sheet.

1. A DC motor converts_____energy to_____energy.

   (a) electrical, mechanical

   (b) electrical, electrical

   (c) chemical, electrical

   (d) mechanical, electrical

2. To determine the forces acting on a current carrying conductor within a magnetic field, you would use:

   (a) Flemming's right hand

   (b) Lenz's law

   (c) right hand conductor rule

   (d) Flemming's left hand rule

3. The torque produced in a DC motor is _____ to the armature current and_____to the main field flux.

   (a) Inversely Proportional, proportional

   (b) Proportional, proportional

   (c) Inversely Proportional, Inversely proportional

   (d) Proportional, Inversely proportional

4. An increase in the load applied to a DC motor will cause the motor speed to _____ and the motor torque to_____.

   (a) Increase, increase

   (b) Decrease, decrease

   (c) decrease, increase

   (d) Increase, decrease

5. Whilst driving a load, a_____is generated in the armature conductors which _____ the applied motor voltage.

   (a) Counter emf, opposes

   (b) Counter emf, increases

   (c) Mutual emf, opposes

   (d) Mutual emf, increases

Section B:

Blank spaces in the following statements represent omissions. Write the appropriate information.

6. The force acting upon a current carrying conductor depends on the_____of the magnetic field, the_____flowing in the conductor and the_____of the conductor within the magnetic field.

7. The torque developed within a DC motor is proportional to the_____acting on the conductor and the_____of the armature.

8. If the load applied to a DC motor is decreased, the:

   (a) speed will_____,

   (b) the back emf will_____,

   (c) the armature current will_____and

   (d) the torque developed by the motor will_____.

9. The emf generated within the armature conductors_____the applied voltage, and is known as a_____.

10. The field system of a DC motor is mounted on the_____and the current in the armature conductors is transferred from the supply via the_____and_____.

11. The current flowing in the armature conductors is dependent on the _____ generated within the armature conductors.

12. If the load applied to a DC motor is increased, the:

    (a) speed will_____,

    (b) the back emf will_____,

    (c) the armature current will_____and

    (d) the torque developed by the motor will_____.

13. Motor torque is produced when the main_____reacts with the armature _____ .

Section C:

The following problems are to be solved with the aid of a calculator. Any working for a problem is to be fully shown. Where a problem involves calculating for circuit conditions, a neat and fully labelled circuit diagram (if not provided) is to accompany the question. Answers are to be expressed in the appropriate multiple or sub-multiple.

14. A 150mm long conductor carries a current of 40A at right angles to a magnetic field with a flux density of 0.5T. Determine the force acting on the conductor. (3N)

15. Determine the increase in flux density required in question 1 to increase the force acting on the conductor to 7N. (0.667T)

16. An armature has a radius of 125mm, and an effective conductor length of 150mm under the field pole. If the main flux is 0.4T and the armature current is 100A, determine

    (a) the force acting on the conductor; (6N) and

    (b) the torque developed on the conductor under the field poles. (0.75Nm)

17. An armature with a radius of 125mm is wound with 4 coils each of 100 turns. If the effective length of one half of a loop under the field poles is 200mm, the current in the conductors is 250A and the flux is 0.2T, determine the torque developed within the armature. (1000Nm)

18. A DC motor has a machine constant of 20, a main flux of 0.015Wb and runs at 750rpm. Determine the emf generated within the armature conductors. (225V)

19. If the motor in question 18 is connected to a 250V supply and has an armature circuit resistance of 0.15Ω, determine the amount of current flowing in the armature (167A)

20. The motor shown in figure 12 has a field flux of 0.0125Wb, runs at 250rpm, and hasa machine constant of 8. For these conditions, determine the:

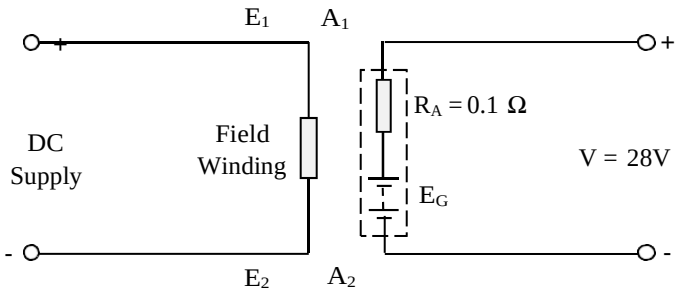

Figure 12.

(a) Back emf; (25V)

(b) Armature current; (30A)

(c) developed torque; (3Nm)

(d) armature circuit voltage drop. (3V)

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