TUTORIAL - D.C. GENERATORS 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 generator converts_____energy to_____energy.

   (a) electrical, mechanical

   (b) electrical, electrical

   (c) chemical, electrical

   (d) mechanical, electrical

2. The principle by which emf's are generated in a DC generator is:

   (a) electromagnetic induction.

   (b) Lenz's law .

   (c) self inductance.

   (d) chemical reaction.

3. The function of the commutator in a DC generator is to:

   (a) connect the AC generated in the windings directly to an external circuit.

   (b) convert the AC generated in the windings to DC when connecting to an external circuit.

   (c) supply an external current to the armature to drive the generator.

   (d) allow the generator to be converted to a motor.

4. The windings for the magnetic field system are mounted on the:

   (a) Armature.

   (b) Commutator.

   (c) Frame.

   (d) Pole cores.

5. The value of the generated emf's in the armature conductors is_____to the field flux, and_____to the armature speed.

   (a) Proportional, proportional

   (b) Proportional, inversely proportional

   (c) inversely Proportional, proportional

   (d) inversely Proportional, inversely proportional

6. To increase the output of a generator you could either_____the field current or _____ the armature speed.

   (a) decrease, decrease

   (b) increase, decrease

   (c) increase, increase

   (d) decrease, increase

7. The relationship between current, magnetic flux and the force applied to a conductor within a generator can be determined by:

   (a) Fleming's right hand rule.

   (b) Fleming's left hand rule.

   (c) Faraday's right hand rule.

   (d) Faraday's left hand rule.

Section B:

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

8. The conductors for the field system of a generator are located in the_____.

9. To connect the generated emf's to an external circuit, a_____and carbon___-_____are employed.

10. The function of the_____is to convert the_____voltage generated within the armature conductors to the D.C. voltage available at the generator terminals.

11. The generator field can be either_____excited or_____excited.

12. To determine the polarity of the induced emf's within the armature conductors you would use Flemming's_____hand rule.

13. Maximum emf will be induced in the armature conductors when cutting the field flux at_____.

14. If more turns are added to the armature conductors, the generated voltage will_____.

15. The emf induced into a conductor is proportional to the_____of the magnetic field, the_____of the conductor and the_____of the conductor through the magnetic field.

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.

16. A single conductor of 150mm length is rotated through a field flux of 0.8T at a velocity of 10m/s. Determine the emf induced in the conductor. (1.2V)

17. Determine the flux density of the magnetic field required to generate 12.6V in a conductor with an effective length of 2m which moves through the magnetic field at 90^0 with a uniform velocity of 10.5m/s. (0.6T)

18. A generator is wound with 6 series connected coils, each wound with 40 turns. If the length of the armature is 200mm, the density of the flux is 1.25 Tesla and the armature rotates with a velocity of 2m/s, determine the generated output voltage of the generator. (240V)

19. A separately excited generator has an effective field flux of 0.02T, and is spins at 400 rpm. If the machine constant is 12, determine the generated voltage. (96V)

20. For the diagram of figure 27, label the following:

    (a) the frame

    (b) the field coil

    (c) the armature

    (d) the field pole

Include the diagram with your answer sheet.

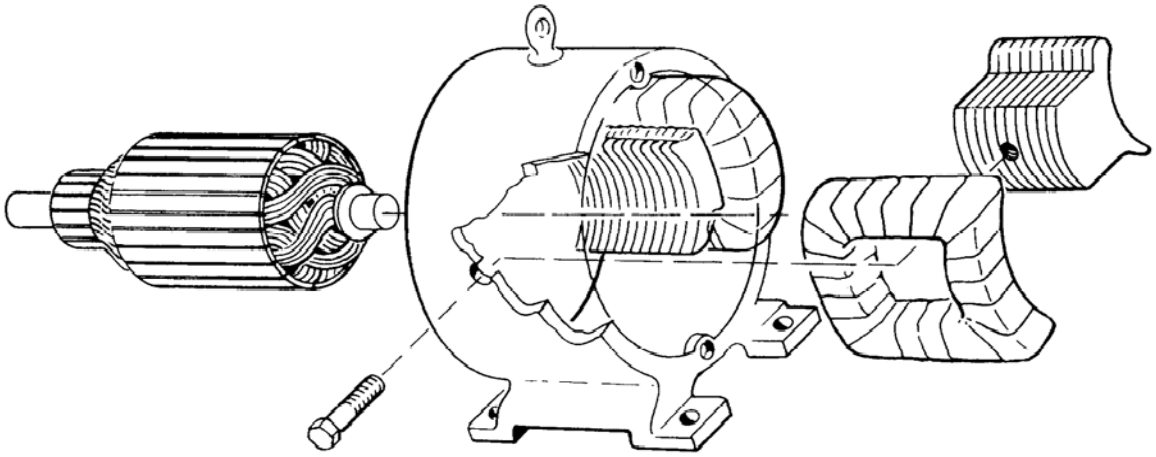

Figure 27.

TUTORIAL - DC GENERATORS PART 2

NAME:

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- 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. If a generator is connected for a shunt configuration, the field connections would be a _____ resistance field connected in_____with the armature.

   (a) High, series

   (b) High, parallel

   (c) Low, series

   (d) Low, parallel

2. A self-excited shunt generator relies on _____ _____ for its initial magnetic flux.

   (a) Separate excitation

   (b) Residual magnetism

   (c) Field flashing

   (d) Good luck

3. The generator type which is used for certain welding applications would be a _____ type.

   (a) Differentially compounded

   (b) cumulatively compounded

   (c) shunt

   (d) Series

Section B

For the following questions, complete the statements on your answer sheet with the word or phrase you think fits best.

4. When the field current in a separately excited generator is zero, the output voltage is not zero due to_____.

5. If the speed of the prime mover driving a generator is reduced, the output voltage will _____ .

6. Increasing the load on a generator causes the prime mover speed to _____ due to the_____developed by the armature current.

7. As the load on a generator increases, the terminal voltage_____. This is due to_____and the_____voltage drop.

8. The terminal voltage of a generator is the_____between the generated voltage and the_____voltage drop.

9. The open circuit characteristic of a separately excited generator shows the _____ of the magnetic material used in core.

10. For a self-excited generator to build up a generated emf, there must be _____ in the magnetic circuits of the machine.

11. Three types of self-excited generators are_____connected, _____ connected and_____connected.

12. A shunt connected generator will have a_____terminal voltage at full load than at no load. This is due to the_____effect of _____ and the_____in the armature circuit.

13. If the speed of the prime mover driving a self-excited generator is_____, then the small emf generated by_____will not increase sufficiently to build up the required magnetic flux.

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 separately excited generator has an effective flux of 8mWb and is operated at a speed of 292 rpm. If the machine constant is 12, determine the:

    (a) generated voltage; (28V)

    (b) no-load terminal voltage. (28V)

15. Determine the field flux required to produce a no-load voltage of 240V in a separately excited generator rotating at 600rpm with a machine constant of 15. (26**.**7mWb)

16. Determine the speed a prime mover must drive a generator under no load to produce a terminal voltage of 300V. The generator has an effective flux of 20mWb and a machine constant of 15. (1000rpm)

17. A generator has an armature resistance of 0**.**15Ω and a full load resistance of 25Ω. If the open circuit voltage is 250V, determine the terminal voltage at full load. (248**.**5V)

18. A separately excited generator has an effective field flux of 0**.**02Wb, a machine constant of 12 and spins at 400 rpm. If the generator has an armature circuit resistance of 0.15Ω and an armature current of 20A, determine the load voltage for this condition. (93V)

19. The generator shown in figure 36 has a machine constant of 10, and effective flux of 25mWb and is driven at 1000rpm. Determine the:

    (a) Field current; (111 mA)

    (b) Generated voltage; (250V)

    (c) Armature current; (16**.** 54A)

    (d) Terminal voltage (248V)

    (e) Armature circuit voltage drop. (2V)

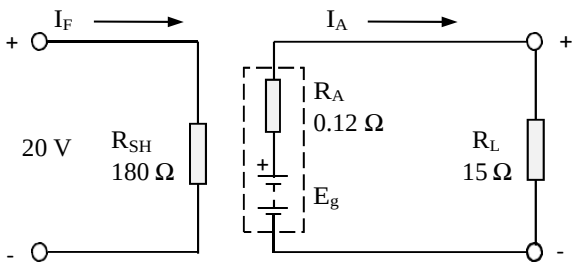

Figure 36.

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