

**DC MACHINES AND TRANSFORMERS***Time Allowed: 3 Hours**Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No 1, out of 2 marks for each MCQ, 1 mark is allotted for right answer and 1 mark is allotted for correct explanation of the answer.

Answer any Five (05) Questions from the rest.

Group-A

1. Choose the correct answer from the given alternatives and explain your answer (any ten): $2 \times 10 = 20$
- i) In which of following DC generators the value of armature current is equal to the field current
a) Shunt Generator. b) Series Generator. c) Separately excited DC Generator d) None of those
- ii) A belt driven cumulatively compounded DC generator is delivering power to DC mains. If the belt snaps the machine will run as a) cumulatively compounded motor in same direction b) differentially compounded motor in same direction
c) cumulatively compounded motor in opposite direction d) differentially compounded motor in opposite direction.
- iii) Voltage regulation of a transformer at full load and 0.8 pf lagging is 2.6%. The voltage regulation at full load and 0.8 pf leading is (-1%). Zero voltage regulation will occur at
a) 0.84 pf leading b) 0.9 pf leading c) 0.95 pf leading d) 0.9 pf lagging
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- iv) A 10 kVA, 400/200V, single phase transformer with 10% leakage impedance draws a steady short-circuit line current of a) 50A b) 150A c) 250A d) 350A
- v) The starters are required to
a) Start a motor b) Protect the motor from any fault c) Both a & b. d) None of these
- vi) A single-phase transformer has a rating of 15 kVA, 600V/ 120V. It is recommended as an autotransformer to supply at 720V from a 600V primary source. The maximum load it can supply is:
a) 90kVA b) 180kVA c) 15kVA d) 18kVA
- vii) A DC shunt generator has an induced voltage of 127 volts, on full load its terminal voltage is 120 volts. If the value of armature resistance is 0.2Ω armature current is: a) 350 A b) 35 A
c) 3500 A d) 3.5 A
- viii) If the speed of the DC motor increases with load torque, then it is a
a) series motor b) permanent magnet motor c) differentially compounded motor d) cumulatively compounded motor



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ix) If the applied voltage of a certain transformer is increased by 50% and the frequency is reduced to 50% (assuming that magnetic circuit remains unsaturated), the maximum core flux density will
a) Change to three times the original value b) Change to 1.5 times the original value c) Change to 0.5 times the original value d) Remains the same as the original value

x) Interpoles are used to

a) Provide better commutation b) High induced voltage c) Provide high current d) None of these

xi) The effect of armature reaction will

a) Demagnetize the Field mmf b) Magnetize the field mmf c) Cross-magnetize the field mmf
d) All of these

xii) Two transformers of different kVA ratings working in parallel share the load in proportion to their ratings when their

1. Per unit leakage impedances on the same kVA base are equal
2. Per unit leakage impedances based on their respective kVA ratings are equal
3. Ohmic values of the leakage impedances are inversely proportional to their ratings
4. Ohmic values of the magnetizing reactances are same.

From these, the correct answer is

a) 1,3,4 b) 2,3 c) 2,3,4 d) 1,4

xiii) A 40 kVA transformer has a core loss of 400W and a full-load copper loss of 800W. The proportion of full-load at maximum efficiency is

a) 50% b) 62.3% c) 70.7% d) 100%



xiv) When compared with a power transformer, a distribution transformer has

a) Low %age impedance and high I^2R loss to Core-loss ratio b) High %age impedance and high I^2R loss to Core-loss ratio
c) High %age impedance and low I^2R loss to Core-loss ratio d) Low %age impedance and low I^2R loss to Core-loss ratio

xv) Scott connected transformers can convert

a) Three phase to two phase. b) Two phase to three phase c) Both a&b d) Three phase to Four phase <https://www.wbscteonline.com>

GROUP-B

2. i) For a DC Generator find out the expression of the induced voltage.

ii) A 6 pole lap connected DC machine has 300 conductors and each conductor is capable of carrying 80 A without excessive temperature rise. The flux per pole is 0.015 Wb and the machine is driven at 1800 RPM. Compute the

a) total current, b) e.m.f. c) power developed in the armature & d) electromagnetic torque. (4+4)



- 3. i) Draw and write down the external characteristics of a DC shunt generator.
ii) Write down the commutation process of a DC generator. (4+4)

- 4. i) Write down the working principle of a 3 point starter.
ii) Write down the different types of methods for speed control of a DC motor. (5+3)

- 5. i) Obtain the expression of maximum efficiency on a single phase transformer.
ii) For a 4 KVA 200/400 volt 50 Hz single phase transformer the following test result are given
Open circuit test: 200 volt 0.7 A , 70 watt in low voltage side
Short circuit test: 15 vol , 10 A , 80 watt in high voltage side
Find the equivalent parameters of the transformer (4+4)

- 6. i) A 50 Hz transformer having equal hysteresis and eddy-current losses at rated excitation is operated at 45 Hz and 90% of rated voltage compared to rated operating point. Determine the percentage change of core loss under this condition.
ii) A single-phase transformer has a maximum efficiency of 90% at full load and unity power factor. Calculate the efficiency of the transformer at half load and same power factor. (4+4)

- 7. i) Draw and write down the working principle of a open delta connected transformer.
ii) Write down the condition for parallel operations of two three phase transformers. (5+3)

- 8. i) Derive the common expression for voltage regulation of a single phase transformer for any power factor of the load.
ii) The maximum efficiency of a 500 KVA 3300/500 volt 50 Hz single phase transformer is 97% occurs at 75% of full load at unity power factor. If the impedance of the transformer is 10% .Then calculate its regulation on full load at 0.8 lagging power factor (4+4)

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- 9. i) Draw and explain the working principle of pulse transformer.
ii) Derive the relation between copper weights of a two winding transformer and an autotransformer. (3+5)