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UPES

# UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

**End Semester Examination, December 2017**

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| **Program** | **:** | **B.Tech - Electrical Engineering** | **Semester – III** | |
| | | **B.Tech – Power System Engineering** | | |
| **Subject (Course):** | | **DC Machines & Transformer** | **Max. Marks** | **: 100** |
| **Course Code** | **:** | **ELECG 252** | **Duration** | **: 3 Hrs** |
| **No. of page/s** | **:** | **2** | | |

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| | **Section A ( Attempt All questions)** | | |
| 1. | Explain the function of Buchholz Relay used in oil immersed transformers . | **[4]** | **CO1** |
| 2. | What is meant by 'equivalent resistance referred to primary' and 'equivalent resistance referred to secondary' ? | **[4]** | **CO2** |
| 3. | Explain why a starter is required for starting a dc motor . | **[4]** | **CO2** |
| 4. | Distinguish between Power and Distribution Transformer | **[4]** | **CO4** |
| 5. | A 400 V , 10 kW series motor drives a fan when running at 800 rpm . The motor draws 50 A from the supply . The resistance of the armature and series are 0.2 Ω and 0.1 Ω respectively . Determine the electromagnetic torque developed by the motor . | **[4]** | **CO2** |
| | **SECTION B** | | |
| 6. | Write in short<br>(i) Construction and function of commutator<br>(ii) Why are electro-magnets preferred over permanent magnets for use in large dc machines ? | **[10]** | **CO1** |
| 7. | In a 50 KVA , 11kV/400V transformer , the iron loss is 500 W and copper loss at ½ load is 150 W under rated conditions . Calculate the efficiency on 0.85 power factor when the transformer is working 5 % overloaded . Find also the load at this power factor for | **[10]** | **CO1 , CO4** |

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| | maximum efficiency and the iron and copper losses corresponding to this load | | |
| 8. | A 20 kW , 250 V d.c shunt motor has full – load armature current of 85 A at 1100 rpm.The armature resistance is 0.18 Ω . Determine :<br>(i) the internal torque developed .<br>(ii) the internal torque , if the field current is suddenly reduced to 80 % of its original value | | **CO3** |
| 9. | Deduce expressions for load shared by two transformers connected in parallel having equal turns ratio | | **CO4** |
| | **SECTION C (**Attempt any **Two Questions)** | | |
| 10(a) | A 10 kW , 200 V short-shunt compound dc generator has a full-load efficiency of 90 % . If the armature , series and shunt field resistance are 0.2 Ω, 0.1 Ω and 50 Ω respectively , find the combined mechanical and core loss of the machine . | | **CO1 , CO3** |
| 10(b) | Explain how the efficiency of a dc machine is calculated from Swinburne's test . Why can this test not be applied in dc series machines ? | | **CO2** |
| 11(a) | What is meant by the vector group of transformers ? Mention various transformer connection in the groups . | | **CO4** |
| 11(b) | A load takes 200 A at 0.9 p.f. lag from a three – phase 11 Kv/440 V star – delta transformer Determine the power consumed by the load , kVA rating of the transformer , phase and line currents on both sides of the transformer . | | **CO4** |
| 12(a) | Explain how to plot the magnetization characteristics of DC shunt generator .Explain in brief how to obtain critical field resistance from the curve . | | **CO2** |
| 12(b) | Voltage regulation of a transformer varies with power factor . Validate the statement through suitable derivations . At what power factor will the regulation be (i) maximum and (ii) zero ? Does the maximum efficiency of the transformer also depend on power factor ? Justify . | | **CO1 , CO2** |

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| | **Section A ( Attempt All questions)** | | |
| 1. | What is the function of Oil used in transformer . | **[4]** | **CO4** |
| 2. | What is the all-day efficiency of the transformer .How does it differ from ordinary efficiency | **[4]** | **CO3** |
| 3. | Explain why a dc series motor is never run on no-load . | **[4]** | **CO2 , CO3** |
| 4. | Discuss the applications of DC Shunt and DC series motor based on their characteristics | **[4]** | **CO3** |
| 5. | What are instrument Transformer . | **[4]** | **CO1 , CO4** |
| | **SECTION B** | | |
| 6. | Derive the equivalent circuit of transformer. Also draw phasor diagram for loaded transformer for a lagging load . | **[10]** | **CO2** |
| 7. | A 50 kVA , 440/110 V single – phase transformer has an iron loss of 250 W . With the secondary winding short-circuited , full-load currents flow in the windings when 25 V is applied to the primary , and the power input being 500 W . For this transformer , determine (a) the percentage voltage regulation at full – load , 0.8 p.f. lagging and (b) the fraction of full load at which the efficiency is maximum . | | **CO2** |
| 8. | A 450 V 4 – pole dc shunt motor runs at 600 rpm on full load and the armature current is 25 A . The armature is lap wound with 500 conductors and flux per pole is expressed by the relation $\Phi = 1.7 \times 10^{-2} \times I_a^{0.5}$ webers .If supply voltage and torque are both halved , calculate the speed at which the motor will run . Ignore stray losses . | | **CO2** |
| 9. | What do you understand by armature reaction ? Explain the concept of demagnetizing and cross magnetizing ampere – turns | | **CO2 , CO3** |
| | **SECTION C (**Attempt any **Two Questions)** | | |
| 10.(a) | A 10 kW , 250 V , 1200 rpm dc shunt motor has a full – load efficiency of 80 % . The | **[10]** | **CO2** |

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| | field and armature resistances are 125 Ω and 0.2 Ω respectively . The speed of the motor is to be reduced to 75 % with load torque remaining constant .<br>(i) What resistance should be inserted in the armature circuit ?<br>(ii) With field current at its normal value , what voltage should be supplied to the armature ? | | |
| 10(b) | What are the methods used for improving commutation in dc machines ? | **[10]** | **CO1, CO2** |
| 11(a) | What are the reasons for operating transformers in parallel . State the conditions necessary to parallel 3 – phase transformers. | | **CO4** |
| 11(b) | A 20 kVA , 4000/200 V , 50 Hz transformer with an equivalent impedance of 0.02 Ω is to operate in parallel with a 15 kVA , 4000/200 V , 50 Hz transformer with an equivalent impedance of 0.025 Ω . The two transformers are connected in parallel and made to cary a load of 25 kVA . Assume both the impedances to have the same angle .<br>(i) Find the individual load currents<br>(ii) What percent of the rated capacity is used in each transformer ? | | **CO4** |
| 12(a) | What are the methods of speed control of a dc motor ? Explain with necessary equations any one method to control the speed of dc shunt motor . | | **CO2** |
| 12(b) | Find the resistance of the load which takes a power from 5 kW from a shunt generator whose external characteristics is given by the equation V = ( 250 – 0.512) | | **CO2** |

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