Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course : DC Machines & Transformers (EPEG 2002) **Semester : III**
Programme: B.Tech – PSE & ELECTRICAL ENGINEERING
Time : 03 hrs. **Max. Marks: 100**
Instructions: All sections are compulsory

SECTION A

S. No.		Marks	CO
Q 1	A six – pole , wave wound , 1000 rpm DC machine has length and diameter of armature as 80 cm and 25 cm , respectively . It has 600 conductors wound uniformly around the armature . The pole arc is 70 per cent of the pole pitch . Air gap flux density is 1.8 wb/m^2 . Determine the induced EMF in the armature	**4**	**CO1**
Q 2	Why are tappings provided in transformer ? Give reasons for tappings being generally provided on the high – voltage side of the transformer .	**4**	**CO1**
Q 3	Derive the equation for torque in case of a DC motor .	**4**	**CO1**
Q 4	A 25 kVA , 11 kV/230 V single phase transformer when supplied with 11kV and 50 Hz has core loss of 350 W but when it is supplied with 550 V and 25 Hz , the core loss is 150 W . Find the hysteresis and eddy current losses at 11 kV and 50 Hz.	**4**	**CO1**
Q 5	Define critical field resistance and critical speed of a DC shunt generator .	**4**	**CO2**

SECTION B

Q 6	A DC shunt generator produces full load output of 250 kW at 500 V . The following test results are obtained . (1) When it runs as a motor on no load at full speed , the line current is 35 A , the field current is 12 A , and the supply voltage is 500 V. (2) With the machines at rest , a potential drop of 5 V is produced and an armature current of 400 A flows through the armature . Find the efficiency of the generator at full load .	**8**	**CO2**
Q 7	A 200 kVA , 50 Hz , 220/1100 V , single phase transformer has an efficiency of 98.2 % when supplying full load current at 0.8 lagging power factor , and an efficiency of 99 % when supplying half load current at a power factor of unity . Calculate core and copper losses at full load current . At what load current will the efficiency be maximum ?	**8**	**CO2**
Q 8	Develop the exact equivalent circuit of a single-phase transformer . From this derive the approximate and simplified equivalent circuits of transformer . State the various	**8**	**CO3**

	assumptions made .		
Q 9	Discuss how polarity of a transformer is determined from polarity test	**8**	**CO1, CO3**
	OR		
Q 9	Explain with the help of connection and phasor diagrams how a Scott connection is used to obtain two-phase supply from three-phase supply .	**8**	**CO3**
Q 10	Explain dynamic breaking method for a DC motor , How does it differ from rergenerative braking method .	**8**	**CO4**
	OR		
Q 10	Why the starting current of a DC motor is very high .What are the functions of no-load and overload release coil of starter .	**8**	**CO4**
	SECTION-C		
Q 11	(a) An engine – room ventilator fan series motor has a total resistance of 0.5 Ω and runs from a 110 V supply at 1000 rpm when the current is 28 A . What resistance in series with the motor will reduce the speed to 750 rpm ? The load torque is proportional to the square of the speed and the field strength can be assumed to be proportional to the current . (b) Using the connection diagram and the speed relation equations , Explain how the speed of a DC series motor is controlled by (i) shunting the armature (ii) shunting the field winding .	**10+10**	**CO3, CO4**
Q12	Describe the four phasor groups pertaining to 3 – phase transformers . Draw the connection schemes and phasor diagrams for each of these four groups .	**10+10**	**CO3, CO4**
	OR		
Q12	(a) Two three phase transformers of 500 kVA and 450 kVA capacities have percentage resistance and reactances of (2.5 + j6) % and (1.6 + j7) % , respectively How they share a load of 1000 kVA at 0.8 pf lagging . (b) For which types of fault Bucholz's relay is used in Transformer .. Describe using schematic diagram working of the Bucholz's relay .	**10+10**	**CO3, CO4**

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SECTION A

S. No.		Marks	CO
Q 1	What are the functions of interpoles and compensating windings in dc machines ?	4	CO1, CO2
Q 2	Compare the speed current characteristics and armature torque Vs armature current of DC shunt and series motors .	4	CO2
Q 3	Why open circuit test of a transformer is done with rated voltage and at rated frequency	4	CO1
Q 4	A 220 V DC shunt motor has an armature resistance of 0.4 Ωand at a certain load has armature current of 30 A and runs at 1350 rpm . If the load on the shaft of the motor is increased so that the armature current increases to 45 A , determine the speed of the motor , assuming the flux remains constant .	4	CO1
Q 5	What are the applications of grounding transformers ?	4	CO3
	SECTION B		
Q 6	A 250 kW , 400 V , six-pole lap connected armature has 720 armature conductors . It is given a brush lead of 2.5^0 mechanical from GNA . Calculate demagnetizing and cross magnetizing AT per pole.	8	CO2
Q 7	Explain the role of :- (a) Commutator and brushes in dc machines (b) Conservator and breather in transformer.	8	CO2 , CO3
Q 8	A 400 V DC shunt motor takes 4 A at no load . Its armature and field circuit resistances are 0.4 Ωand 200 Ω respectively . Estimate the efficiency of the machine when it operates as a generator with output of 20 kW at 400 V.	8	CO2 , CO3
Q 9	Explain how maximum temperature rise of a transformer is obtained from Sumpner's test .	8	CO3
	OR		
Q 9	A transformer has its maximum efficiency of 0.98 at 20 kVA at u.p.f. During the day , it is loaded as follows : 12 hours : 2 kW at 0.6 p.f. 6 hours : 10 kW at 0.8 p.f. 6 hours : 20 kW at 0.9 p.f. Find the all day efficiency of the transformer .	8	CO3
Q 10	A 10 kW , 200 V short – shunt compound dc generator has a full – load efficiency of	8	CO3

	90 % . If the armature , series and shunt field resistances are 0.2 , 0.1 and 50 Ω respectively , find the combined mechanical and core loss of the machine .		
	OR		
Q 10	A 600 V dc motor drives a 60 kW load at 700 rpm . The shunt – field resistance is 100 Ωand armature resistance is 0.16 Ω. If the motor efficiency is 85 % , calculate the speed at no-load and speed regulation .	**8**	**CO3**
SECTION-C			
Q 11	(a) Develop the phasor diagram of a single – phase transformer under load condition . Assume lagging power factor load . (b) Describe the effects of armature reaction on the operation of DC machines . How the armature reaction is minimized.	**10+10**	**CO3**
Q12	(a) State and explain the conditions of parallel operation of two three phase transformers (b) Explain Yd11 and Dy11 connection for three phase transformer using connection diagram and phasor diagram .	**10+10**	**CO4**
	OR		
Q12	(a) A 2000 kVA , 6.6/1.1 kV , 3 phase , delta-star connected transformer has the following test result. SC Test : 200 V , 120 A , 25 KW Calculate percentage resistance , reactance drop , and regulation on full – load at p.f. of 0.8 (lag) . The iron loss during OC test = 20 kW . b) For which type of transformer loading , the voltage regulation is negative ? Derive conditions for (a) zero regulation (b) maximum regulation .	**10+10**	**CO4**

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