SET 2

Scheme of Valuation/Answer Key

(Scheme of evaluation(marks in brackets) and answers of problems/key)

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

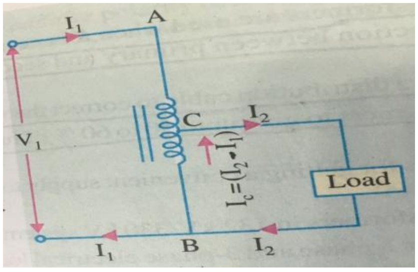
THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EE205

Course Name: DC MACHINES AND TRANSFORMERS

Max. Marks:100 Duration: 3 Hours

PART A

		Answer all questions, each carries 5 marks.	Marks
1		Lap: V*I = 10kW, I = 10kW/250 = 40A (1) Wave: I_a = I/2 = 40/2 = 20 A (2), V = 500 V (1), P = 20*500 = 10kW (1)	(5)
2		Give 5 marks for complete derivation, partial marks may be given for incomplete answers.	(5)
3		Since E_b=0, starting current is high. So to limit the starting current, starter is used (3) Variable resistor (2)	(5)
4		Phasor diagram with I_0 lagging by a large angle -(3). Name of components - (2)	(5)
5		Regulation= $\frac{\text{No load voltage} - \text{load voltage}}{\text{no load voltage}}$ (1) Regulation is negative when Load voltage is greater than no load voltage or regulation = $\frac{\text{load voltage} - \text{no load voltage}}{\text{no load voltage}}$ (3) Leading load/Capacitive Load (1)	(5)
6		$K = \frac{V_2}{V_1} = \frac{800}{1000} = 0.8$, V_1I_1= 8*1000/1000=8A , $I_2=I_1/K$=8/0.8=10A  Diagram (2) Showing input current 8A (1) output current10A (1) Current 2A in the common portion in right direction (1)	(5)
7		I_{hv}= 500/(√3*11)=26.24A (2.5), I_{lv}= 500000/(√3*400)=721.71A (2.5)	(5)
8		Explaining vector group (3). Yd1 Star Delta Phase shift (-30)° (2)	(5)

PART B

Answer any two full questions, each carries 10 marks.

9		$Y_F = \frac{Z}{P} - 1$, $Y_B = \frac{Z}{P} + 1$, Z=12*2=24 (2) Y_F=5 (2), Y_B=7 (2) pole pitch = Z/P = 24/4 = 6 (1). Draw 2 conductors, one solid and one dotted line in one slot and other 2 conductors, one solid and one dotted line in other slot with a pole pitch of 6 (2). According to back and front pitches complete the interconnections (1). Marks may be given to rough sketch also. Name the number of conductor.	(10)
10		Drawing 2 poles (1) Drawing trapezoidal mmf and flux due to poles (2). Drawing armature mmf and armature flux (2) Drawing of MNA and Load neutral (2) Drawing resultant flux (3)	(10)
11		Residual voltage = 10V (2) Since graph is linear for currents from 0.1 to 0.3 Critical resistance can be calculated as R_c= 150/0.3=500 ohms (3). The point (1A, 300V) will lie on OCC as well as critical resistance line. Hence max voltage buildup =300V (3) Now critical speed = 1000*(300/500) = 600 rpm (2). ***If students attempted to answer from rough OCC,*** OCC graph – (2) , residual voltage – (2), R_c - (2) V_{max} - (2) and N_c – (2) Marks may be given to approximate answer.	(10)
		PART C	
		Answer any two full questions, each carries 10 marks.	
12		I_f =V/R_f=250/250 = 1A (2), I_{a1}=I_L-I_f= 10-1=9A (2) E_{b1}=V-$I_{a1}R_a$=250-(9*0.2)=248.2V (3), Since load torque is constant, I_{a2} = 9A (1), E_{b2}=V-(I_{a1}*(R_a+R_{add}))=250 – 9*(0.2+10)=158.2V (1), $E_{b1}\alpha N_1$, $E_{b2}\alpha N_2$, N_2= N_1*(E_{b2}/E_{b1})= 100*(158.2/248.2)=637.4 rpm (1). Give some marks for circuit is drawn and equations are written.	(10)
13	a)	No load input = V*I_L=250*3=750W , I_{sh}=V/R_{sh}=250/250=1A , I_{a0}=I_L-I_{sh}=3-1=2A (1) ${I_{a0}}^2R_a$=22*0.2=0.8 ,Constant loss= No load input-${I_{a0}}^2R_a$ =750-0.8=749.2W (1) I_a=I_L+I_{sh}=20+1=21A , ${I_a}^2R_a$ =212*0.2=88.2W , Total loss=Constant loss+${I_a}^2R_a$ =749.2+88.2=837.4W (1) Output= V*I_L= 20*250=5000W (1) , Input=output+losses=5000+837.4=5837.4W Efficiency= 5000/5837.4=85.65% (1)	(5)
	b)	The idea that current depends on kVA rating of the load not on kW. Alternatively it can be explained that low power factor loads draw more current. Give full credit for proper explanation.	(5)

14		Basic circuit with two windings = (3) Equations to get secondary parameters transferred from primary side or vice versa - (3) shunt branch - (2) complete equivalent circuit - (2)	(10)
		PART D	
		Answer any two full questions, each carries 10 marks.	
15		$Efficiency = \frac{xScos\varphi}{xScos\varphi + x^2W_c + W_i}$ $= \frac{0.9 \times 10000 \times cos0.8}{0.9 \times 10000 \times cos0.8 + 0.9^2 \times 120 + 80}$ =98% Equation for efficiency - (4) Substitution - (4) Answer - (2) If *Wc* and *Wi* are interchanged and calculated, 4 marks may be given to	(10)
16	a)	Essential: Polarity and voltage ratio (3) Desirable: Same PU / percentage impedance OR impedance inversely proportional to capacity, Same X/R ratio (2)	(5)
	b)	Yes (2). Phase shift should be same (3).	(5)
17		Connection diagram with currents marked (5) Phasor diagram (3 marks – 1.5 marks for voltage phasors and 1.5 marks for current phasors). Derivation (2)	(10)
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