

Reg. No. \_\_\_\_\_ Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION, JANUARY 2017****Course Code: EE 205****Course Name: DC MACHINES AND TRANSFORMERS (EE)**

Max. Marks: 100

Duration: 3 Hours

**PART A***(Answer all questions, each question carries 5 marks)*

1. Explain the working of a DC motor. What is the significance of back e.m.f in DC motors?
2. What is armature reaction in dc machines? How it affects the main flux distribution and how can armature reaction be reduced?
3. Draw the phasor diagram of a practical transformer on load at (a) lagging p.f (b) leading p.f (c) u.p.f.  
Also draw the phasor diagram of an ideal transformer at no load.
4. Define the terms critical resistance and critical speed and bring out their roles in the process of self excitation in dc machines. What are the conditions for voltage build up in a DC shunt generator?
5. A 4 kVA, 400/200 V single phase transformer has resistance of 0.02 p.u and reactance of 0.06 p.u. What is the value of its resistance and reactance referred to h.v side?
6. What are the necessary and desirable conditions for parallel operation of transformers?
7. Explain the principle of operation of a transformer. Derive the emf equation of a single phase transformer.
8. What are the different connections of three phase transformers?

**PART B***(Answer any 2 questions, each question carries 10 marks)*

9. Give the constructional features and working principle of a DC generator. Draw the cross-sectional view of a 4 pole DC generator and label all the parts. Explain the function of each part.
10. Explain the different methods of excitation of DC generators with suitable diagrams.

11. A short shunt compound generator has armature, series field & shunt field resistances of  $0.06\Omega$ ,  $0.03\Omega$  and  $110\Omega$  respectively. It supplies 100 lamps rated at 250V, 40W. Find the generated e.m.f. Assume that contact drop per brush = 1V.

**PART C**

*(Answer any 2 questions, each question carries 10 marks)*

12. Why is a starter necessary for a motor? Give the diagram and explain the working of a three- point starter for a shunt motor including the features of 'no volt release' and 'overload release'.
13. A 200V series motor has a total resistance of  $0.5\Omega$ . It runs at 800 rpm taking an input current of 10A. Find the series resistance required to reduce the speed to 600 rpm, the input current being kept constant.
14. A transformer on no load has a core loss of 50W, draws a current of 2A (rms) and has an induced emf of 230V (rms). Determine the no load power factor, core loss current and magnetizing current. Also calculate the no load circuit parameters of the transformer. Neglect winding resistances & leakage flux.

**PART D**

*(Answer any 2 questions, each question carries 10 marks)*

15. Explain sumpner's method of testing transformers. What are its advantages over OC and SC tests?
16. Explain the operation of an autotransformer. How saving of copper is achieved in an autotransformer as compared to an ordinary two winding transformer. What are the advantages of autotransformer over conventional two winding transformer?
17. The efficiency of 100kVA, 110V/220V, 50Hz single phase transformer is 98.5% at half full load and 0.8 pf lead and 98.8% at full load upf, find (a) Iron loss (b) Full load copper loss (c) maximum efficiency at upf.

Reg. No. \_\_\_\_\_ Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017**

Course Code: **EE205**Course Name: **DC MACHINES AND TRANSFORMERS (EE)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions.*

1. Compare lap and wave windings used for DC machine armature (5)
2. Draw the magnetization characteristic of self excited DC shunt generator and explain. (5)
3. How back emf is generated in a DC motor? Explain its significance. (5)
4. Draw and explain the detailed phasor diagram of a practical transformer supplying lagging power factor load. (5)
5. Define all-day efficiency of a transformer. What is done to improve the all-day efficiency of a distribution transformer? (5)
6. List out and explain the necessary and desirable conditions for parallel operation of transformers. (5)
7. Enumerate the purposes which dictate the use of tertiary winding in a three winding transformer. (5)
8. Draw the diagram for V-V connection of transformers and explain the voltage and current relations of line and phase values. Derive the capacity ratio as a fraction of  $\Delta$ - $\Delta$  capacity. (5)

**PART B**

*Answer any 2 questions.*

9. a. Derive the electro-dynamic equation of rotating electrical machines and explain the principle of energy conversion. (5)  
b. Draw the developed winding layout of a lap connected simplex double layer DC armature with 16 slots and 4 poles. Furnish the winding table and show connections to 4 equalizer rings. (5)
10. a. Derive the EMF equation of a DC generator, from first principles (5)  
b. A shunt generator delivers 195 A at a terminal voltage of 250 V. The armature and shunt field resistances are  $0.02 \Omega$  and  $50 \Omega$  respectively. The iron and frictional losses

- are equal to 950 W. Find (i) emf generated (ii) Copper losses (iii) output of prime mover (iv) commercial, mechanical and electrical efficiencies. (5)
11. a. What is armature reaction and explain its effects? Derive expressions for cross magnetizing and demagnetizing ampere turns per pole (5)
- b. A 4 pole, wave wound armature of a DC machine has 880 conductors and delivers 120 A. The brushes are displaced through 3 angular degrees from the geometrical axis. Calculate (i) demagnetizing ampere turns per pole (ii) cross-magnetizing ampere turns per pole and (iii) the additional field current for neutralizing the demagnetization if the field winding has 110 turns per pole. (5)

### PART C

*Answer any 2 questions.*

12. a. Draw and explain the electrical and mechanical characteristics of DC shunt motors. (5)
- b. A 250 V DC shunt motor has an armature resistance of  $0.5 \Omega$  and a field resistance of  $250 \Omega$ . The motor draws 21 A when driving a constant torque load at 600 rpm. What will be the new speed of the motor if an additional  $250 \Omega$  resistance is inserted in the field circuit? (5)
13. a. Enumerate the losses in a loaded transformer. Derive the condition for maximum efficiency in a transformer. (5)
- b. A 200 / 2000 V transformer is fed from a 200 V supply. The total winding resistance and leakage reactance as referred to the LV side is  $0.15 \Omega$  and  $0.6 \Omega$  respectively. The resistance representing core loss is  $450 \Omega$  and magnetizing reactance is  $250 \Omega$ . A load of impedance  $(600+j400) \Omega$  is connected across the secondary terminals. Calculate (i) input current (ii) secondary terminal voltage and (iii) primary power factor. (5)
14. a. With neat diagrams, explain the speed control methods in separately excited DC motors. (5)
- b. The efficiency of a 200 KVA, single phase transformer is 98.75% when delivering full load at 0.8 pf and 99% at 80% of full load at 0.9 pf. Calculate (i) the iron loss and (ii) the full load copper loss. (5)

### PART D

*Answer any 2 questions.*

15. a. With a neat diagram, describe the Sumpner's method of testing transformers. How can the voltage regulation be predetermined using this test? (5)
- b. A 3  $\phi$  step down transformer is connected to 6.6 kV supply mains and takes 80A. Calculate its secondary line voltage and line current for the following connections if the ratio of turns per phase is 16 (i) Y-Y (ii) Y-  $\Delta$  (iii)  $\Delta$  - Y (iv)  $\Delta$  -  $\Delta$ . (5)
16. a. Derive expression for saving in copper effected by using an autotransformer instead of a two winding transformer. (5)
- b. A load of 6 kW is supplied by an autotransformer at 120 V and upf. If the primary voltage is 240 V, determine (i) transformation ratio (ii) secondary current (iii) primary current (iv) number of secondary turns if the total number of turns is 280 (v) power transformed and (vi) power conducted directly from supply mains to load. (5)
17. a. Explain with neat circuit diagram and phasors, how a 2-phase supply can be obtained from a 3-phase supply. (5)
- b. Explain the vector groupings Yy0, Dd0, Yd1, Dy1, Yd11 and Dy11 in three phase transformers. (5)

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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

**Course Code: EE205**

**Course Name: DC MACHINES AND TRANSFORMERS (EE)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 5 marks.*

		Marks
1	What is the function of equalizer ring in a lap wound dc machine?	(5)
2	Derive the emf equation of a dc generator.	(5)
3	What is starter? What is the necessity of starter in dc motor?	(5)
4	Distinguish between core and shell type transformer?	(5)
5	What is an auto transformer? Derive an expression for the saving of copper in an autotransformer as compared to an equivalent two winding transformer?	(5)
6	Derive the condition for maximum efficiency of transformer.	(5)
7	What are the necessary conditions for parallel operation of three phase transformer?	(5)
8	What is the purpose of tertiary winding on transformer?	(5)

**PART B**

*Answer any two full questions, each carries 10 marks.*

9	With neat diagram explain the construction of dc generator.	(10)
10	a) A 250V short shunt compound generator is delivering 80A. Armature, series and shunt field resistances are $0.05\Omega$ , $0.03\Omega$ and $100\Omega$ respectively. Calculate the induced emf.	(5)
	b) Define commutation. Explain the process of commutation with neat sketches.	(5)
11	What are the effects of armature reaction on the operation of dc machine? What are the remedial measures taken to counter effects of armature reaction?	(10)

**PART C**

*Answer any two full questions, each carries 10 marks.*

12	a) Explain with neat sketch how speed control of a dc motor is done.	(5)
	b) Draw the phasor diagram of a single phase transformer supplying to inductive load.	(5)
13	A 6 pole 250V series motor is wave connected. There are 240 slots and each slot has 4 conductors. The flux per pole is $0.175\text{mWb}$ when the motor is taking 80A. The field resistance is $0.05\Omega$ , the armature resistance is $0.1\Omega$ and the iron and frictional loss is $0.1\text{kW}$ . Calculate (a) speed (b) BHP (c) shaft torque (d) the pull in newtons at the rim of the pulley of diameter 25cm.	(10)
14	What are the different cooling methods used in transformer?	(10)

**PART D**

*Answer any two full questions, each carries 10 marks.*

15	a) The following test results were obtained on a 20kVA, 2200/220V, 50Hz single phase transformer	(5)
	OC Test(LV side) 220V 1.1A 125W	
	SC Test(HV side) 52.7V 8.4A 287W	

The transformer is loaded at unity power factor on secondary side with a voltage of 220V. Determine the maximum efficiency and load at which it occurs.

- b) Explain the working of Off-Load tap changing transformer with help of neat diagram. (5)
- 16 In detail explain scott connection in three phase transformer. (10)
- 17 a) A 220kVA single phase transformer is in circuit continuously. For 8 hours in a day, the load is 60kW at 0.8 pf. For 6 hours, the load is 80kW at unity pf and for the remaining period of 24 hours it runs on no load. Full load copper losses are 3.02kW and the iron losses are 1.6kW. Find all day efficiency. (6)
- b) What are the advantages and disadvantages of delta-delta connection? (4)

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018**

**Course Code: EE205**

**Course Name: DC MACHINES AND TRANSFORMERS (EE)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 5 marks*

Marks

- |   |   |     |
|---|---|-----|
| 1 | Point out the necessity of equalizer rings in a lap wound dc machine. Why this is not applicable in wave wound machines   | (5) |
| 2 | What is armature reaction and how it is eliminated in DC machines   | (5) |
| 3 | Compare the electrical and mechanical characteristics of a DC shunt motor with those of a DC series motor. Based on this point out the application areas of these motors. | (5) |
| 4 | What is the principle of operation of a transformer? Show how the flux is balanced when the transformer is supplying a load.  | (5) |
| 5 | With supporting phasor diagrams, derive the expression for secondary side voltage regulation of a transformer for lagging and leading power factor loads.                 | (5) |
| 6 | What are the necessary and desirable conditions to be satisfied for parallel operation of two single phase transformers?  | (5) |
| 7 | Distinguish the vector groupings Yy0, Dd0, Dy1, Yd11 in three phase transformer connections   | (5) |
| 8 | Show how three phase power is obtained by using two single phase transformers connected in open delta.  | (5) |

**PART B**

*Answer any two full questions, each carries 10 marks*

- |    |   |      |
|----|---|------|
| 9  | For a 6 pole DC armature with 16 slots having two coil sides per slot and single turn coils, calculate the relevant pitches for a wave winding and draw the developed winding diagram.  | (10) |
| 10 | Draw the magnetisation characteristics of a DC shunt machine. Point out the conditions for voltage build-up of a DC shunt generator. Give the significance of the terms critical resistance and critical speed as applicable to a DC shunt generator.   | (10) |
| 11 | A short shunt compound DC generator supplies a current of 100A at 220V. If the resistance of the shunt field is 50 $\Omega$ , of the series field is 0.02 $\Omega$ , of the armature is 0.05 $\Omega$ , the iron and friction losses amount to 1KW. Find:<br>i) The generated emf            ii) The copper losses<br>iii) Output power of the prime-mover driving the generator<br>iv) The generator efficiency. | (10) |

**PART C**

*Answer any two full questions, each carries 10 marks*

- 12 With a neat sketch, explain the working of three-point starter. What is its main drawback? How this is eliminated in four point starters? (10)
- 13 a) With supporting diagrams, show how the retardation test can be employed to find out the various losses occurring in a DC machine. (6)
- b) Explain the working principle of  $1\phi$  transformers. (4)
- 14 Readings from O.C and S.C test on a 8kVA, 400/200V, 50Hz transformer are (10)  
OC Test : 200V, 2A, 80W ;meters on low voltage side  
SC Test : 10V, 20A, 120W; meters on high voltage side  
Compute equivalent circuit of the transformer as referred to high voltage side.

**PART D**

*Answer any two full questions, each carries 10 marks*

- 15 a) Derive the condition for maximum efficiency for a transformer. (5)
- b) Distinguish between auto transformers and two winding transformers. Derive the expression for saving in copper in an auto transformer. (5)
- 16 a) Derive the condition to be satisfied for zero voltage regulation and maximum voltage regulation for a transformer. (4)
- b) With neat circuit diagram, explain how a two-phase supply can be obtained from a three-phase supply. (6)
- 17 Draw the connection diagram for T-T connection of transformers and explain the formation of three phase four wire system with two single phase transformers. Point out its advantages and disadvantages (10)

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**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 | The armature of a 250 V, 10kW, 4 pole lap connected generator was reconnected in wave. Find the new voltage, current and power ratings.   | (5)   |
| 2 | Derive the E M F equation of a DC generator.  | (5)   |
| 3 | Why a starter is required to start a DC motor? What is the essential element of a starter?  | (5)   |
| 4 | Draw the phasor diagram of a transformer on no load. Show the two components of the no load current and write their names.  | (5)   |
| 5 | What is meant by negative voltage regulation? For what type of load you may get negative voltage regulation?  | (5)   |
| 6 | A 1000/800V, 8kVA autotransformer supplies rated current to a load on low voltage side. Draw a schematic diagram and mark input current, output current and current in the section of the winding common to high voltage and low voltage sides. | (5)   |
| 7 | Find the rated line currents on high voltage and low voltage sides of a 500kVA 11kV/400V delta-star transformer.  | (5)   |
| 8 | What is meant by vector group? What is Yd1 vector group?  | (5)   |

**PART B**

*Answer any two full questions, each carries 10 marks.*

- 9 Draw the developed view of a double layer lap winding of a 4 pole 12 slot armature. Commutator and brushes need not be drawn. (10)
- 10 Draw the developed view of mmf and flux distribution of a loaded 2 pole machine. (10)
- 11 The table shows OCC of a dc shunt generator at a speed 1000 rpm. What is the residual voltage? Find the critical resistance. Also find the maximum voltage build up at 1000 rpm and critical speed for a field resistance of 300  $\Omega$ . (You can find the answers by carefully observing the table. If necessary you may draw a rough sketch. Graph sheet is not required)

$I_f$	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
E	10	50	100	150	190	220	245	260	275	285	300

(10)

**PART C**

*Answer any two full questions, each carries 10 marks.*

- 12 A 250 V shunt motor has resistances 0.2  $\Omega$  and 250  $\Omega$ . The motor is driving a (10)

- constant load torque and running at 1000 rpm drawing 10 A current from the supply. Calculate the new speed and armature current if an external armature resistance of value  $10 \Omega$  is inserted in the armature circuit. Also find the stalling current. Neglect armature reaction and saturation.
- 13 a) During Swinburne's test a 250V DC machine was drawing 3A from the 250V supply. The resistances are  $250 \Omega$  and  $0.2 \Omega$ . Find the constant loss of the machine. Also find the efficiency of the machine when it is delivering a 20A at 250V. (5)
- b) Why transformers are rated in kVA not in KW? (5)
- 14 Develop the equivalent circuit of a transformer. (10)

#### PART D

*Answer any two full questions, each carries 10 marks.*

- 15 Two standard tests were conducted on a 10kVA, 1000/200V transformer. Current in one test was 2A. Voltage in one test was 15V. Power factors were 0.8 and 0.2. Find the efficiency at 90% full load and 0.8 power factor. (10)
- 16 a) What are the necessary and desirable conditions for successful parallel operation of two single phase transformers? (5)
- b) Can a Yd transformer be operated in parallel with a Dy transformer? What additional condition is to be satisfied over and above the conditions listed in question 16 a). (5)
- 17 In Scott connection prove that the 3-phase currents will be balanced if the 2-phase currents are balanced. Assume upf load. (10)

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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019**

**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 | Name the parts of dc machine and state the functions of any two parts.   | (5) |
| 2 | Derive the emf equation of dc generator.   | (5) |
| 3 | With the help of speed-armature current characteristics, explain why the series motors should not be started without any load.   | (5) |
| 4 | Why the rating of transformer in kVA?  | (5) |
| 5 | List out the necessary and desirable conditions for parallel operation of two single phase transformers.   | (5) |
| 6 | Define all day efficiency. How this efficiency of a transformer varies with load?  | (5) |
| 7 | A 10 kVA, 1500/150 V, single phase transformer has following parameters:<br><i>HV side: <math>r_1 = 4.2\Omega</math> <math>x_1 = 5.1\Omega</math> LV side: <math>r_2 = 0.05\Omega</math> <math>x_2 = 0.062\Omega</math> Find the per unit values of equivalent resistance and inductive reactance.</i> | (5) |
| 8 | What is the purpose of tertiary winding in three winding transformer?  | (5) |

**PART B**

*Answer any two full questions, each carries 10 marks.*

- |    |  |     |
|----|--|-----|
| 9  | a) Draw the winding diagram of a dc machine with 4 poles, 12 slots progressive double layer lap winding.   | (7) |
|    | b) Name the different losses occur in dc machine. How the magnetic losses are minimized in dc machine?   | (3) |
| 10 | a) A 4 pole wave connected armature of a dc generator has 120 conductors and runs at 1200 rpm. If the flux per pole is 0.015 Wb, find the emf generated. Keeping the flux constant, suggest a change in the armature of the generator so that the generator is capable to generate half of the no load voltage when running at the same speed. | (7) |
|    | b) What is self excitation? What are the conditions for building up of voltage in dc shunt generator?  | (3) |
| 11 | a) A 10 KW shunt generator having resistances $1\Omega$ and $100\Omega$ , delivers full load at a  | (7) |

terminal voltage of 230 V. Determine the efficiency of the generator at full load, assuming the iron, friction and windage losses amount to 500 W.

- b) Write any three differences between wave winding and lap winding. (3)

### PART C

*Answer any twofull questions, each carries 10 marks.*

- 12 What is the necessity of a starter for motor? With a suitable diagram, explain the working of 3 point starter. (10)
- 13 a) With suitable diagram, how the Swinburne's test can be employed to predetermine the efficiency at full load condition when running as a generator (6)
- b) Differentiate between core type and shell type transformers. (4)
- 14 Explain the working of a transformer on no-load and load condition. (10)

### PART D

*Answer any twofull questions, each carries 10 marks.*

- 15 a) Derive the condition for maximum efficiency of transformer. How the efficiency of a transformer depends on load? (5)
- b) Why the star delta three phase transformer is used to step down the voltage in transmission system (5)
- 16 A 600W single phase transformer working at unity power factor has an efficiency of 95 percent at both half full load and full load. Determine the efficiency at 70 percent of full load. (10)
- 17 With neat circuit diagram, explain how a two phase supply can be obtained from a three phase supply. Prove that three phase currents will be balanced, for a balanced upf load on 2-phase side. (10)

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Reg No.: \_\_\_\_\_

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**THIRD SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019**

**Course Code: EE205**

**Course Name: DC MACHINES AND TRANSFORMERS**

Max. Marks: 100

Duration: 3 Hours

*Graph sheets shall be provided*

**PART A**

*Answer all questions, each carries 5 marks.*

Marks

- |   |  |     |
|---|--|-----|
| 1 | Dummy coils are not used in lap winding. Justify with suitable example   | (5) |
| 2 | What is armature reaction? What are the effects of armature reaction on the performance of dc machine?   | (5) |
| 3 | Derive the condition for gross mechanical power developed by motor is maximum?   | (5) |
| 4 | Draw the phasor diagram of a practical transformer under no-load condition. Name the no-load components and write its equation.  | (5) |
| 5 | A 11000/230V, 200kVA, 50Hz single phase transformer has core loss of 1200 W and copper loss of 1700 W at full load condition. Find the load in kVA at which maximum efficiency occurs? | (5) |
| 6 | What are the essential and desirable conditions to be satisfied for parallel operation of single phase transformers?   | (5) |
| 7 | What is vector grouping? Name the vector groups commonly used in three phase transformers?   | (5) |
| 8 | What is tertiary winding?  | (5) |

**PART B**

*Answer any twofull questions, each carries 10 marks.*

- |   |   |     |
|---|---|-----|
| 9 | a) There are 60 conductors in a 4 pole dc machine. Whether lap winding or wave winding is preferred? What type of coil arrangements needed in this armature core? | (5) |
|   | b) i. $Y_B$ and $Y_F$ should be odd number for simplex winding. Why?  | (2) |
|   | ii. Find the back pitch and front pitch of a simplex 2-layer lap winding with 12 coils. Average pitch = 6, Resultant pitch = 2.                                   | (3) |

- 10 The open circuit characteristics of a dc shunt generator running at 850 rpm is given below.

$I_f$ (A)	0	0.8	1.6	2.4	3.2	4
Emf (V)	0	28	57	76	90	100

Calculate

- |    |   |     |
|----|---|-----|
|    | i. emf to which the machine will excite, when the shunt field resistance is $22\Omega$  |     |
|    | ii. emf when an additional resistance of $8\Omega$ is included in the shunt field circuit   |     |
|    | iii. shunt field resistance for a normal voltage of 100V  |     |
|    | iv. Critical speed with shunt field resistance for a voltage of 100V  | (5) |
| 11 | a) What is equalizer rings? Why it is generally used in lap windings instead of wave windings?  | (5) |
|    | b) A long shunt compound generator supplies a load at 250V. The load consists of five motors each drawing 60A and a lighting load of 250 lamps at 100W each. The armature, series field and shunt field resistances are 0.01, 0.02 and $75\Omega$ | (5) |

respectively. Find (i) load current (ii) armature current (iii) emf generated.

### PART C

*Answer any two full questions, each carries 10 marks.*

- 12 a) Explain the characteristics curves of a dc series motor with the help of relevant equations? (5)  
 b) Why transformer rating is in kVA and not in KW? (5)
- 13 A 250V dc shunt motor takes 5A on no-load. The armature and field resistances are  $1\Omega$  and  $125\Omega$  respectively. Find its efficiency when it takes a line current of 25A. (10)
- 14 The OC and SC test results of a 5kVA, 200/400V, 50Hz single phase transformer is as follow.

OC Test			SC Test		
$V_1$ (V)	$I_1$ (A)	$W_1$ (W)	$V_2$ (V)	$I_2$ (A)	$W_2$ (W)
220	0.7	60	22	10	120

Draw the equivalent circuit of transformer as referred to low voltage side. (10)

### PART D

*Answer any two full questions, each carries 10 marks.*

- 15 a) Draw the circuit diagram of Sumpner's test and derive the equation for efficiency of each transformer? (5)  
 b) Explain how the Scott connection can be used to obtain two phase supply from a three phase supply? (5)
- 16 a) The primary and secondary voltages of an autotransformer are 1200V and 600V respectively. Calculate the economy of  $C_u$  when the secondary current is 120A. Draw the circuit and show the current distribution in the winding. (5)  
 b) Define all day efficiency of transformer. Why this efficiency is less than commercial efficiency? (5)
- 17 a) A 10 kVA, 200/400V, 50Hz single phase transformer gave the following result.  
 O.C test: 200V, 1.3A, 120W .....on L.V side  
 S.C test: 22V, 30A, 200W .....on H.V side  
 Calculate (i) the magnetising current and the component corresponding to core loss at normal frequency (ii) the magnetising branch impedances. (5)  
 b) With the aid of three phase transformer connections and phasor diagram, explain the vector group Dy11. (5)

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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Third semester B.Tech examinations (S) September 2020

**Course Code: EE205****Course Name: DC MACHINES AND TRANSFORMERS**

Max. Marks: 100

Duration: 3 Hours

*Graph sheets shall be provided***PART A***Answer all questions, each carries 5 marks.*

Marks

- 1 Explain the phenomenon of electromechanical energy conversion in the case of a DC generator. What are the torques involved? (5)
- 2 Derive the expression for generated emf in DC generator. (5)
- 3 Explain significance of back emf? (5)
- 4 Explain different methods of cooling of a transformer. (5)
- 5 Derive the condition for maximum efficiency of a single-phase transformer. (5)
- 6 What is the difference between commercial efficiency and all day efficiency? (5)
- 7 What are the necessary conditions to be satisfied for parallel operation of a three phase transformer? (5)
- 8 What are the advantages and disadvantages of delta-delta connection? (5)

**PART B***Answer any two full questions, each carries 10 marks.*

- 9 a) Explain construction of DC machine with the help of neat diagram (10)
- 10 a) Equalizer ring is not needed for wave winding of a dc machine. Give reason. (5)
- b) An 8 pole lap wound armature having 40 slots with 12 conductors/ slot generates 500V. Determine speed at which machine is running if the flux per pole is 50 mWb. (5)
- 11 A shunt generator gave the following open circuit characteristics: (10)

Field current (A)	0.5	1	1.5	2	2.5	3	3.5
OC emf (V)	54	107	152	185	210	230	245

The armature and field resistances are  $0.1\Omega$  and  $80\Omega$  respectively. Calculate :

- i) The voltage to which the machine will excite when run as a generator at the same speed.

- ii) The voltage lost due to armature reaction when 100A are passing in the armature at terminal voltage of 175V.
- iii) The percentage reduction in speed for the machine to fail to excite on open circuit.

**PART C**

*Answer any two full questions, each carries 10 marks.*

- 12 a) A 460V dc series motor runs at 500 rpm taking a current of 40A. Calculate the speed and percentage change in torque if the load is reduced so that the motor is taking 30A. The total resistance of the armature and field circuits is  $0.8\Omega$ . Assume that flux is proportional to the field current. (10)
- 13 a) Explain different methods of speed control of dc shunt motor. (5)
- b) Distinguish between core and shell type transformer? (5)
- 14 a) Draw the phasor diagram of an ideal transformer on no load. Also, draw a phasor diagram of a practical transformer supplying lagging power factor load. (7)
- b) Why transformers are rated in KVA? (3)

**PART D**

*Answer any two full questions, each carries 10 marks.*

- 15 The test results of 2.5kVA, 230/115V single-phase transformer are as follows: (10)  
OC Test : 115V, 1.2A, 60W  
SC Test : 12V, 10.86A, 120W  
Find i. efficiency at 50% full load, 0.8 pf  
ii. regulation at 30% full load, 0.8 pf lag and lead
- 16 a) Derive an expression for the saving of copper in an autotransformer as compared to an equivalent two winding transformer. (5)
- b) Explain the working of off-load tap changing transformer with help of neat diagram. (5)
- 17 a) Draw the connection diagram for T-T connection of transformers and explain the formation of three-phase four wire system with two single phase transformers. Point out its advantages and disadvantages. (10)

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