Reg No.:_____ Name:_____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Third Semester B.Tech Degree (S,FE) Examination December 2020 (2015 Scheme)

**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 | | Name any five parts of a dc machine and write their functions. | (5) |
| 2 | | What is armature reaction? What are the effects of armature reaction on the performance of dc machine? | (5) |
| 3 | | Why dc series motor is never started on no-load? Write necessary equations. | (5) |
| 4 | | What are the characteristics of an ideal transformer? | (5) |
| 5 | | Derive the expression for voltage regulation in terms of resistance and leakage reactance as referred to secondary. | (5) |
| 6 | | A back to back test is conducted on two similar 125kVA single phase transformers. Wattmeter reading at primary side = 7kW and wattmeter reading at secondary side = 10kW. Find the efficiency of each transformer at half full load and 0.5 power factor load. | (5) |
| 7 | | A three phase, 22000/400 V, 50 Hz, Δ-Y connected transformer is connected to a balanced star connected load at 0.6 power factor lagging. The phase current on the secondary is 275A. What is the output of the transformer in KW? | (5) |
| 8 | | What are the necessary conditions for parallel operation of 3-phase transformers? | (5) |

**PART B**

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

| | | | |
|---|---|---|---|
| 9 | a) | Enumerate any three differences between lap winding and wave winding. | (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) |
| 10 | a) | What are the methods to reduce the effect of armature reaction? | (3) |

b) A dc shunt generator has a full load output of 9.5KW at 220V. The armature and shunt field winding resistances are 0.4Ω and 150Ω respectively. The sum of mechanical and iron losses is 800W. Calculate the power required at the driving shaft at full load condition. (7)

11 The magnetisation characteristics of a separately excited dc shunt generator running at 500rpm is as follows. (10)

| $I_f$ (A) | 0 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| E (V) | 0 | 100 | 160 | 180 | 216 | 240 | 252 | 265 | 270 |

Calculate :

(i) The voltage generated by the generator when the field circuit resistance is 40Ω.

(ii) Find the additional field circuit resistance to reduce the emf to 220V

(iii) Critical value of the shunt field resistance

(iv) Critical speed when the field circuit resistance is 40Ω

## PART C

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

12 a) What is the necessity of starter in a dc motor? (5)

b) With a neat diagram, explain the working of three point starter. (5)

13 With necessary diagrams and phasor diagrams, explain the working of a single phase transformer (10)

(i) on no-load, and (ii) on load

14 a) A 240V, 12KW shunt motor runs at 750rpm and draws a current of 82.6A at full load. The resistances of armature and shunt field are 0.2Ω and 150Ω respectively. Determine percentage reduction in field flux in order to obtain a speed of 1500 rpm when armature current drawn is 45A. (5)

b) A single phase, 50Hz, core type transformer has square cores of 25cm side. The maximum permissible flux density is 1.5 Wb/$m^2$. Calculate the number of turns per limb on HV and LV sides for a 4000/200V ratio. (5)

## 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 Two single phase transformers are connected in scott connection to feed two single phase furnaces of 500KW each at 120V and 0.7 lag power factor from a balanced three phase supply at 6.6kV. Calculate (10)

i. Currents in the main and teaser transformer

ii. Line currents

17 a) Define voltage regulation. At what condition of load, negative and positive regulation occurs? (5)

b) With the aid of three phase transformer connections and phasor diagram, explain the vector group Dy11 and Yd1. (5)

****