

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), November 2017

B. Tech. in Electrical Engineering, Semester III

Roll No.....

EE302: Electrical Machine-I

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. Critical resistance of a DC generator is associated with
 - (a) Self excitation of a DC generator
 - (b) Resistance of the field circuit
 - (c) Slope of the linear part of the OCC
 - (d) All of the above
- ii. The back emf of a 240 V, DC shunt motor is 220 V. If the armature resistance is 2 Ohm, the armature current of motor for this condition will be:
 - (a) 20 A
 - (b) 100 A
 - (c) 10 A
 - (d) 0.1 A
- iii. In relation to DC machines, match the following and choose the correct combination

List-I

Performance Variables

P. Armature emf (E)

Q. Developed torque (T)

R Developed power (P)

List-II

Proportional to

1. Flux(ϕ), speed (ω) and armature current (I_a)

2. ϕ and ω only

3. ϕ and I_a only

4. I_a and ω only

5. I_a only

Codes:

	P	Q	R
(a)	3	3	1
(b)	2	5	4

- | | | | |
|-----|---|---|---|
| (c) | 3 | 5 | 4 |
| (d) | 2 | 3 | 1 |

- iv. Transformer core is generally tightly clamped in order to:
- (a) Reduce the noise in the transformer (b) Reduce the copper loss
(c) Reduce iron loss (d) None
- v. Iron core of a single phase transformer is replaced with a wooden core of same dimensions and rated voltage at rated frequency is applied on the primary winding. Which of the following is correct?
- (a) There will be very high voltage on secondary winding
(b) There will be rated voltage on the secondary winding
(c) There will be almost zero voltage on the secondary winding
(d) None of these
- vi. A DC shunt motor runs at no load speed of 1140 r.p.m. At full load, armature reaction weakens the main flux by 5% whereas the armature circuit voltage drops by 10%. The motor full load speed in r.p.m. is
- (a) 1080 (b) 1203 (c) 1000 (d) 1200
- vii. A 500 KVA transformer has a turns ratio of $N_1/N_2 = 10$. The impedance of primary winding is $3+j5$ ohms while that of secondary winding is $0.5+j0.8$ ohms. The impedance of transformer when referred to primary will be
- (a) $3.5+j5.8\Omega$ (b) $8+j13\Omega$ (c) $53+j85\Omega$ (d) $3.05+j5.08\Omega$
- viii. Mechanical power developed by D.C motor is maximum When
- (a) back e.m.f is equal to applied voltage (b) none of above
(c) back e.m.f is zero. (d) back e.m.f is equal to half applied voltage
- ix. In a dc machine 6 pole lap winding is used. The number of parallel paths is?
- (a) 6 (b) 4 (c) 2 (d) 1
- x. Which of the following tests can be conducted on other than shunt machine
- (a) Swinburne's test (b) Field's test
(c) Retardation test (d) Back to back test

Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

i. Justify:

- (i) C.T secondary should never be kept open in any circumstances.
(ii) Pole shoe section of DC machine is made larger than its body

- ii. How magnetic leakage is reduced to a minimum in commercial transformers and mentions the factors on which hysteresis loss depends?
 - iii. Why in DC machine brushes are made up of carbon?
 - iv. Differentiate between long shunt & short shunt compound generator.
- Q.3A Explain critical resistance and speed for DC generator with its significance. 05
Also explain the working of principle of the DC Motor.
- Q.3B Define "All day efficiency" and % regulation of transformer. Write down 05
specific characteristics of each DC Motor along with their peculiar application area.
- Q.4A With the help of suitable diagram, explain Hopkinson's test and also draw 05
characteristics of DC series and shunt generator.
- Q.4B What is the necessity of starter in DC motor? Explain four point starter with neat 05
sketch.
- Q.5A Define armature reaction. Explain armature reaction effect in DC machine. How 05
it can be minimized.
- Q.5B Derive expression which shows comparison of copper required in auto 05
transformer and two-winding transformer. Also write down desirable conditions for parallel operation of two 3-phase transformer.
- Q.6A A 4-pole, long-shunt lap wound generator supplies 25 kW at a terminal voltage 05
of 500 V. The armature resistance is 0.03Ω , series field resistance is 0.04Ω and shunt field resistance is 200Ω . The brush drop may be taken as 1V. Determine the e.m.f. generated. Also calculate the No. of conductors if the speed is 1200 r.p.m. and flux per pole is 0.02 Weber. Neglect armature reaction
- Q.6B A shunt generator delivers 195A at terminal voltage of 250V. The armature 05
resistance and shunt field resistance are 0.02Ω and 50Ω respectively. The iron and friction losses equal 950 W
Find:
(i) Emf generated
(ii) Cu losses
(iii) Output of the prime mover

OR

- Q.6B A 4 pole wave wound motor armature has 880 conductors and delivers 120A. 05

The brush has been displaced through angular degrees from geometrical axis.

Calculate (a) Demagnetizing AT per pole (b) Cross magnetism AT per pole

Q.7A Draw the vector diagram and winding connections for Scott connection 05

Q.7B A Δ - Δ bank consisting of three 20 KVA, 2300/230V transformers supplies a load of 40KVA. If one transformer is removed, find for the resulting V-V connection. 05

(i) KVA load carried by each transformer

(ii) Percent of rated load carried by each transformer

(iii) Total KVA rating of the V-V bank

OR

Q.7B With the help of neat diagram, explain open circuit and short circuit tests for transformer. 05

Q.8 (a) Briefly explain the working of OFF Load tap changing transformers 06

(b) A single phase transformer with turn's ratio 2, delivers 10A, 220V to resistive load, while primary draws 6A at 0.9 pf lagging from 450V supply. Calculate efficiency and voltage regulation. 04

Q.9A (a) Briefly describe the principle of operation of a transformer and draw phasor diagram at no load and full load for a practical transformer. 06

(b) With the help of neat diagram, explain the Swinburne's test on DC motor with circuit diagram. 04

Q.9B (a) Draw neat and clean constructional diagram of a DC machine and also mention function of each parts. 10

(b) Derive the expression of armature torque developed in a dc motor using fundamental equation and power equation.

OR

Q.9B Write a short note on construction, working principle and applications of any one machine as below 10

(i) Hybrid stepper motor

(ii) Permanent magnet DC motor