3E1145

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B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019

PCC Electrical & Electronics Engineering

3EX4-07 Electrical Machines-I

EE, EX

Time: 3 Hours **Maximum Marks: 120**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 What is magnetizing current in transformer?

Q.2 What is meant by permeability of material?

Q.3 What is B – H curve of magnetic material?

Q.4 What are linear and non-linear magnetic circuits?

Q.5 Explain induced e.m.f. in an armature coil.

Q.6 What are lap and wave windings?

Q.7 Explain principle of dc motor.

Q.8 What is meant by back e.m.f.?

Q.9 What is armature reaction in d.c. machines?

Q.10 Explain critical field resistance and critical speed in d.c. generator.

PART – B

(Analytical/Problem solving questions) **[5×8=40]**

Attempt any five questions

Q.1 Explain Ampere Law and Biot – Savart Law. Show the magnetic fields produced by bar magnet and by a current carrying coil. Clearly mention the difference between the two.

Q.2 Derive an equation for force developed as a partial derivative of stored energy with respect to motion of a moving element.

Q.3 Derive the equation for torque developed in a d.c. motor.

Q.4 Explain the voltage build -up in a d.c. shunt generator. What are different types of d.c. generators?

Q.5 Sketch the speed – load characteristics of a d.c. -

(i) shunt motor (ii) series motor, and explain them.

Q.6 Explain principle of operation and construction of a single – phase transformer. Derive an expression for the induced e.m.f. of the transformer.

Q.7 Develop the exact equivalent circuit of a 1 – phase transformer. State the various assumptions made.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [4×15=60]

Attempt any four questions

Q.1 (a) State and prove the condition of maximum efficiency of a transformer.

(b) When a 100 kVA, single phase transformer was tested, the following results were obtained:

On open circuit, the power consumed was 1300 W and on short circuit at full load current, the power consumed was 1200W. Calculate the efficiency of transformer on full load and half load, when working at Unity Power Factor.

Q.2 (a) Explain the speed - current, torque – current and speed – torque characteristics of d.c. series motor.

(b) A series motor with total resistance of 0.5Ω, when running at a certain speed takes 60 Amps at 500 Volt. If the load torque varies as the cube of the speed, calculate the resistance required to reduce the speed by 25%.

Q.3 (a) What do you mean by linear communication, under communication and over communication in a d.c. machine? Explain.

(b) Explain why the external characteristics of a d.c. shunt generator is more drooping than that of a separated excited generator.

Q.4 Derive an expression for saving in conductor material in an autotransformer over a two winding transformer of equal rating. State the advantage and disadvantages of autotransformer over two-winding transformers.

Q.5 (a) Explain the influence of highly permeable materials on magnetic flux lines, with the help of diagrams.

(b) Explain Ohm's law for magnetic circuits.
