

5 Attempt any two parts :

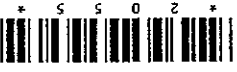
2×10

- (a) Two single phase transformers rated 1000 kVA and 500 kVA have p.u. leakage impedance of  $(0.02+j0.06)$  and  $(0.025+j0.08)$  respectively. What is the largest kVA load that can be delivered by the parallel combination of these two transformers without overloading anyone?
- (b) What are the distinguishing features of Y-Y, Y- $\Delta$  and  $\Delta$ - $\Delta$  phase connections? Compare their advantages and disadvantages. Also explain open delta connection with suitable diagram.
- (c) Two transformers connected in open delta supply 375 kVA, 0.9 p.f. load. The load voltage is 480V. Find :
- (1) kVA supplied by each transformer,  
(2) kW supplied by each transformer.

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Paper ID and Roll No. to be filled in your Answer Book

Roll No.

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B. Tech.

(SEM. IV) (EVEN SEM.) EXAMINATION, 2013  
**ELECTROMECHANICAL ENERGY  
CONVERSION - I**

Time : 3 Hours

[Total Marks : 100

Note : - Answer all five questions.

1 Answer any four parts out of the following : 4×5

- (a) What do you mean by electromechanical energy conversion? Explain it with example.
- (b) Distinguish between singly excited systems and doubly excited systems. Also mention examples of these systems.
- (c) What is field energy and co-energy? Prove that: In a singly excited linear system, field energy is always equal to the co-energy.
- (d) In an electromagnetic relay, functional relation between the current  $i$  in the exciting coil, the position of armature  $x$  and the flux linkages  $f$  is given by,  $i = 2\phi^3 + 3\phi(1 - x + \dot{x}^2)$ ,  $x > 0.5$ . Find the force on the armature as a function of flux linkage  $\phi$ .

2055]

4

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2055]

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- (e) Explain electromagnetic torque and reluctance torques in cylindrical rotor machines.
- (f) How torque is produced in machines? Discuss in detail.

2. Answer any four parts out of the followings : 4×5

- (a) Sketch the cross-sectional diagram of 4 pole dc machine and show its magnetic circuit. Also explain the constructional features of dc machine.
- (b) What do you mean by armature reaction? Explain it with diagram and show the position of new MNA in case of both the generator and motor.
- (c) A 5 kW, 250 V dc shunt motor takes a no load armature current of 4 A at rated voltage and runs at 1200 rpm. The armature circuit resistance is 0.4 ohm and the field resistance is 250 ohm. At rated load and rated voltage, the motor draws line current of 26 A and the armature reaction weakens the field flux by 3%. Calculate the full load speed and corresponding electromagnetic torque of the motor.
- (d) Derive generated emf and electromagnetic torque developed in case of dc machine.
- (e) Draw and explain the performance characteristics of dc shunt generator.
- (f) What are the needs of inter-poles in DC machines?

2055J

2

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3 Answer any two parts : 2×10

- (a) What are the performance characteristics of dc motor ? Draw and explain the performance characteristics of dc series and dc shunt motor. Choose the one which is suitable for high starting torque.
- (b) A 500 V, 18 kW, dc shunt motor draws a current of 2.5 A at no load. The field and armature resistances are 600 ohm and 0.5 ohm respectively. Calculate the full load efficiency, assuming total brush drop of 2V.
- (c) Explain different methods of speed control of dc motor. Also describe Swinburne's test for efficiency.

4 Attempt any two parts : 2×10

- (a) Draw the equivalent circuit of single phase transformer with phasor diagrams at no load, inductive load and capacitive loads. Also describe open circuit test and short circuit tests on transformer.
- (b) A 20 kVA, 2500/250V, 50Hz, single phase transformer give the following tests results:  
Open circuit test (on L.V. side)- 250 V, 1.4 A, 105 watts  
Short circuit test (on H.V. side)- 104 V, 8 A, 320 watts  
Compute the parameters of the approximate equivalent circuit referred to H.V. and L.V. sides. Also draw the equivalent circuit referred to the L.V. side.
- (c) List different types of testing of transformers. Also, describe Sumpner test on two identical single phase transformers with suitable circuit diagram.

2055J

3

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