

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

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

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

**Course Code: EE311**

**Course Name: ELECTRICAL DRIVES & CONTROL FOR AUTOMATION (AU, ME)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

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

- |   |  | Marks |
|---|--|-------|
| 1 | a) Derive an expression for the e.m.f generated in a d.c machine.  | (4)   |
|   | b) What is meant by armature reaction? How does it will affect the main field flux?  | (2)   |
|   | c) List out the different methods of excitation. Explain.  | (4)   |
| 2 | a) A d.c shunt generator operating at 850rpm is given below<br>Eg(V): 12 40 102 176210 240 256<br>If(A): 0 0.5 1 2 345<br>The machine has 6 poles. The type of winding is lap. The number of conductors in the armature is 540.<br>i) Calculate residual flux per pole.<br>ii) The no load e.m.f for a total shunt field resistance of $120\Omega$ .<br>iii) The critical field resistance of the field circuit.<br>iv) The critical speed for the shunt field resistance of $120\Omega$ . | (8)   |
|   | b) Define critical speed and critical field resistance of a d.c shunt generator.   | (2)   |
| 3 | a) Derive an expression for the electromagnetic torque developed in a d.c motor.   | (2)   |
|   | b) A d.c shunt motor runs at 1300rpm on no-load drawing 5A from 220V mains. Its armature and field resistance are $0.24\Omega$ and $110\Omega$ respectively. When loaded .the motor draws 60A from the mains. Calculate the speed when the motor is loaded. Assume that the armature reaction demagnetizes the field by 3%. Also calculate the internal torque developed at no load and on load. What is the motor shaft torque at load?   | (8)   |
| 4 | a) Derive the speed-torque characteristics of a d.c shunt and d.c series motor.  | (4)   |
|   | b) What are the losses occurring in a d.c motor and how do they vary with load current?  | (3)   |
|   | c) Why a starter is required for starting a d.c motor?   | (3)   |

**PART B**

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

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|---|---|-----|
| 5 | a) Derive the e.m.f equation of a single phase transformer.                                       | (4) |
|   | b) Draw the phasor diagram of a 1-phase transformer at no load and derive the equivalent circuit. | (4) |
|   | c) Explain the difference between an ideal transformer and an actual transformer                  | (2) |
| 6 | a) What are the losses produced in a transformer and derive the condition for                     | (4) |

- maximum efficiency.
- b) A 40kVA single phase transformer has iron loss of 450W and full load copper loss of 850W. If the pf of the load is 0.8 calculate: (4)
- The full load efficiency.
  - The maximum efficiency.
  - The load at which maximum efficiency occur.
- c) Write short notes on instrument transformers. (2)
- 7 a) Explain the principle of operation of a 3-phase induction motor (4)
- b) Differentiate between squirrel cage and slipring induction motor. (2)
- c) Write short notes on torque-slip characteristics of a 3-phase induction motor (4)
- 8 a) Explain no load and blocked rotor test on a 3-phase induction motor and derive the equivalent circuit parameters. (4)
- b) What is meant by circle diagram of a induction motor? What are the information that can be obtained from the circle diagram? (1)
- c) Explain with the help of neat diagram the working of any two methods of starting a 3-phase induction motor. (5)

### PART C

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

- 9 a) Derive the e.m.f equation of an alternator. (3)
- b) What is meant by regulation of an alternator? (1)
- c) How can you determine the regulation of an alternator by e.m.f method? Explain. (6)
- 10 a) Explain the principle of operation of 1-phase induction motor. (2)
- b) Explain the pitch factor and distribution factor of an alternator. (4)
- c) What is a universal motor? What are the applications of this type of motors? (4)
- 11 a) Why synchronous motor has no net starting torque. (2)
- b) Explain the methods of starting synchronous motor (6)
- c) What is synchronous condenser? (2)
- 12 a) With a neat sketch, explain the working of a permanent magnet stepper motor. (7)
- b) List out the classification of stepper motor and compare them. (3)
- 13 a) Draw and explain the torque-speed characteristics of stepper motor. (3)
- b) Write short notes on servo control and digital controllers. (7)
- 14 a) What is machine tool controller? (3)
- b) With neat diagram explain programmable logic controllers. (7)

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