

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2018****Subject Code:2152001****Date:11/12/2018****Subject Name:Electro Mechanical Energy Conversion****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1**
- | | | |
|-----|---|-----------|
| (a) | Define: (1) Magnetic Flux Density (2) Reluctance (3) Self Inductance | 03 |
| (b) | Explain with usual expression Faraday's law and Lenz's law. | 04 |
| (c) | Derive expression for force on current carrying conductor placed in a magnetic field. | 07 |

- Q.2**
- | | | |
|-----|--|-----------|
| (a) | What is fringing and Leakage flux? Explain in brief. | 03 |
| (b) | Define Hysteresis and explain hysteresis loop for magnetic material. | 04 |
| (c) | Explain Doubly Excited magnetic system and also derive the torque equation for the same. | 07 |

OR

- | | | |
|-----|---|-----------|
| (c) | Classify DC generator with respect to their excitation and explain any one of them in detail. | 07 |
|-----|---|-----------|
- Q.3**
- | | | |
|-----|--|-----------|
| (a) | What is electromechanical energy conversion? Explain it with block diagram. | 03 |
| (b) | State principle of operation of dc generator and derive its expression for the emf. | 04 |
| (c) | A 4 pole dc shunt motor has a flux per pole of 0.05 Wb and the armature is lap wound with 720 conductors. The shunt field resistance is 220 Ω and armature resistance is 0.2 Ω . Brush contact drop is 1 V per brush. Determine the speed of machine when running (a) as a motor taking 60 A and (b) as generator supplying 60 A. The terminal voltage in each case is 440 Volt. | 07 |

OR

- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Derive torque equation of DC motor. | 03 |
| (b) | A 4 pole, 220 V, dc shunt motor has a lap connected armature with 960 conductors. The flux per pole is 0.02Wb. Calculate the torque developed by the armature when the current taken by motor is 25A. The armature resistance is 0.15 Ω and the field resistance is 110 Ω . | 04 |
| (c) | Define: Slip. Derive an expression for the frequency of rotor current in an induction motor. Also derive equation for starting torque of 3 phase induction motor. | 07 |

- Q.4**
- | | | |
|-----|---|-----------|
| (a) | Explain various power stages in 3 phase induction motor using suitable power flow diagram. | 03 |
| (b) | Write short note on Reluctance Motor. | 04 |
| (c) | In a 3-phase 4 pole, 50Hz slip-ring induction motor with its rotor star-connected, the rotor resistance per phase is 0.5 Ω , the reactance at standstill is 2 Ω per phase and an emf between slip-rings on open circuit is 300V. Calculate (i) slip at a speed of 1440 rpm (ii) rotor emf per phase (iii) rotor frequency at a speed of 1440 rpm and (iv) reactance at speed of 1440 rpm. | 07 |

OR

- Q.4 (a) A 3-phase star connected synchronous motor rated for 500kVA, 3.3kV, 87A, 50 Hz, 300 rpm has an effective armature resistance and synchronous reactance per phase of 1Ω and 10Ω respectively. Determine the internal mechanical power developed by the motor when it is operating at rated current and 0.866 power factor leading. **03**
- (b) Derive e.m.f equation for an alternator. **04**
- (c) Why single phase induction motor not self starting? Explain double field revolving theory. **07**
- Q.5 (a) State advantages of servomotors over large industrial motors. **03**
- (b) Write short note on capacitor start capacitor run single phase induction motor. **04**
- (c) Name the most types of stepper motors. Describe the operation of a variable reluctance type of stepper motor. **07**
- OR**
- Q.5 (a) State some important applications of stepper motors. **03**
- (b) Explain the principle of operation of a.c. servomotors. Give advantages of it. **04**
- (c) Describe the construction of a PMDC motor. What are the advantages and disadvantages of PMDC motors compared with conventional shunt dc motors? **07**

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