# GUJARAT TECHNOLOGICAL UNIVERSITY
**BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2019**

**Subject Code: 2152001**                                      **Date: 20/06/2019**

**Subject Name: Electro Mechanical Energy Conversion**

**Time: 02:30 PM TO 05:00 PM**                          **Total Marks: 70**

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

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| **Q.1** | **(a)** | What is electromagnetic induction? State and explain Faraday's laws. | **03** |
| | **(b)** | Explain various effects of Air gap in Ferromagnetic Circuit. | **04** |
| | **(c)** | Explain how magnetic field is established in a long solenoid when a dc current is passes through it using suitable diagrams and expressions. | **07** |
| **Q.2** | **(a)** | What is hysteresis loss? Explain hysteresis loop with diagram. | **03** |
| | **(b)** | State and explain different approximation made while analyzing electromagnetic devices. | **04** |
| | **(c)** | Draw and explain doubly excited magnetic field system. | **07** |
| | | **OR** | |
| | **(c)** | Explain DC series generator in detail with load characteristics. | **07** |
| **Q.3** | **(a)** | Define field energy and coenergy. What is the significant of coenergy? | **03** |
| | **(b)** | Draw and explain the characteristics of a DC shunt motor. | **04** |
| | **(c)** | A 746 kW, 3-phase, 50 Hz, 16-pole induction motor has a rotor impedance of $(0.02 + j\, 0.15)\ \Omega$ standstill. Full load torque is obtained at 360 rpm. Calculate (i) the speed at which maximum torque occurs; (ii) the ratio of maximum to full load torque; (c) the external resistance per phase to be inserted in the rotor circuit to get maximum torque at starting. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Describe with neat sketches the construction of a 3-phase wound induction motor. | **03** |
| | **(b)** | What are the advantages of rotating field alternator? | **04** |
| | **(c)** | A 120 V dc shunt motor having an armature circuit resistance of $0.2\ \Omega$ and field circuit resistance of $60\ \Omega$, draws a line current of 40 A at full load. The brush voltage drop is 3 V and rated full load speed is 1800 rpm. Calculate: (i) the speed at half load; (ii) the speed at 125 per cent full load. | **07** |
| **Q.4** | **(a)** | Compare cage and wound 3-phase induction motor with reference to construction, performance and applications. | **03** |
| | **(b)** | A short shunt compound dc generator delivers 100 A to a load at 250 V. The generator has shunt field, series field and armature resistance of $130\Omega$, $0.1\Omega$ and $0.1\Omega$ respectively. Calculate the voltage generated in armature winding. Assume 1 V drop per brush. | **04** |
| | **(c)** | Describe the construction and working of a shaded pole induction motor. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Calculate the highest speed at which (i) 50 Hz (ii) 60 Hz alternator can be operated. | **03** |
| | **(b)** | Write a short note on repulsion motor. | **04** |
| | **(c)** | Using double revolving field theory, explain why a single phase induction motor is not self starting. | **07** |

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| **Q.5** | **(a)** | Briefly explain the principle of operation of dc servomotors. | **03** |
| | **(b)** | Write a short note on hysteresis motor. | **04** |
| | **(c)** | Describe the construction, working and uses of a reluctance motor. | **07** |

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**OR**

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| **Q.5** | **(a)** | What are the advantages and disadvantages of PMDC motors compared with conventional dc motors? | **03** |
| | **(b)** | Discuss the modifications necessary to operate a dc series motor satisfactorily on single phase ac supply. | **04** |
| | **(c)** | Name the most popular types of stepper motors. Describe the operation of a permanent magnet (PM) type of stepper motor. | **07** |

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