

**B.Tech. - VIEP - ELECTRICAL ENGINEERING
(BTELVI)**

Term-End Examination

00415

December, 2014

**BIEE-008 : ELECTRO-MECHANICAL ENERGY
CONVERSION - I**

Time : 3 hours

Maximum Marks : 70

Note : Attempt any *seven* questions out of ten. Use of scientific calculator is allowed. Assume suitable data, if needed.

1. (a) Show that the reaction of coupling magnetic field on the electrical or mechanical system is essential for the electro-mechanical energy conversion device. 5

(b) An aeroplane having a wingspan of 52 m is flying horizontally at 800 km/hr. If the vertical component of the Earth's magnetic field is 38×10^{-6} T, find the emf generated between the wing tips. 5

2. (a) Derive the significance of co-energy in the derivation of torque or force in an electro-mechanical energy conversion device. 5
- (b) A 60-turn coil is pivoted within a magnetic field having a flux density of 1.1 T. The current through the coil is 100 μA , its axial length is 1 cm and radius is 0.75 cm. Find the torque acting on the coil. 5
3. (a) How do lap windings differ from wave windings? 5
- (b) Explain the $L \frac{di}{dt}$ voltage problem in conductors undergoing commutation. 5
4. (a) What are commutating poles or interpoles? How are they used? 5
- (b) Derive the equation for torque developed in the armature of d.c. motor. 5
5. (a) Describe the Ward-Leonard speed control system for d.c. machines. 5
- (b) Derive the torque-current characteristics for the most suitable motor for traction type loads. 5

6. (a) Discuss the process of self-excitation in a d.c. machine. 5
- (b) A 4-pole lap wound machine has 124 coils, each having two turns. The flux per pole is 0.015 Wb. The speed is 1500 rpm. Find the induced emf. 5
7. (a) Derive an expression for the emf induced in a transformer winding. Show that emf per turn in primary is equal to emf per turn in secondary. 5
- (b) Describe the concept of a single-phase ideal transformer with the help of emf equation and its phasor diagrams at no-load and on-load. 5
8. (a) Describe the open circuit test for a single-phase transformer. Why does this test essentially show only excitation losses and not i^2R losses ? 5
- (b) Discuss the principle of operation of step down autotransformer. List applications of autotransformers. 5
9. (a) Describe in brief, few possible ways of connection of 3-phase transformers with the help of suitable diagrams. 5
- (b) Why does one hear a hum when standing near a large power transformer ? 5

10. (a) Discuss the points of similarity in transformers and rotating electrical machines. 5
- (b) A 100 KVA, 11,000/400 V, $\Delta - Y$ distribution transformer has a resistance drop of 1% and leakage reactance drop of 6%. Find
- (i) the transformer impedance per phase as referred to high voltage side.
 - (ii) voltage regulation at full load, 0.8 lagging power factor. 5
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