Indian Institute of Technology, Delhi
Centre for Energy Studies
2018-2019
ESL 730: Direct Energy Conversion

Minor-I Examinations
Duration: 60 minutes.

Marks: 20
04 Feb. 2019

Answer all questions

1. In a Faraday generator: **[2]**
   a. Give the expression for the loading parameter.
   b. What is the role of the seed electrons?

2. **[3+2+2=7]**
   a. State the basic working principle of a MHD generator having continuous electrodes connected externally through a load resistance, R_L.
   b. Estimate the electrical efficiency of such a generator.
   c. Given the following parameters for such a generator: electrode area = 0.24 m^2; inter- electrode distance = 0.4 m; mean gas flow velocity = 1250 m/s; magnetic field intensity = 1.5 T; estimate the open circuit voltage across the electrodes.

3. Starting from the force equation for charged particles carrying a current **j** in a MHD generator duct with a magnetic field **B** and electron partial pressure p_e, derive a relation between the current and electrical components in a right handed coordinate system with **B** along z-direction. **[4]**

4. In a Hall-type generator: **[1x3=3]**
   a. Describe the electrode configuration.
   b. Derive an expression for the electrical efficiency of such a generator.
   c. Estimate the region at which one can obtain the maximum efficiency.

5. **[1+3=4]**
   a. *Define magnetic Reynold's number.*
   b. *Using the Ampere's law and generalized Ohm's law for a conducting fluid gas, derive a relation between the gas induced magnetic field and the magnetic Reynold's number.*