Hall Ticket No | | | | | | | | | | |  Question Paper Code: AEEB11

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

Four Year B.Tech III Semester End Examinations(Regular) - November, 2019

**Regulation: IARE – R18**

## ELECTRICAL MACHINES - I

**Time: 3 Hours** **(EEE)** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Define magnetic flux and magnetic flux density. Explain the concept of magnetic hysteresis loop in B-H curve. **[7M]**

   (b) An iron ring of circular cross section of 5X $10^{-4}m^2$ has a mean circumference of 2m. It has a saw cut of 2 X$10^{-3}$m length and is wound with 800 turns of wire. Determine the exciting current when the flux in the air gap is 0.5 X $10^{-3}$wb.(Given $\mu_r$ of iron=600 and leakage factor is 1.2) Assume areas of air gap and iron are same. **[7M]**

2. (a) State and explain i)Faraday's Laws of Electromagnetic induction ii)Lenz Law iii)Self Inductance iv)Mutual inductance **[7M]**

   (b) A steel ring having a mean circumference of 50cm and $10cm^2$ cross-section area has a coil of 300 turns wound uniformly around it. Determine the reluctance of the ring and current required to produce a flux of 1 mWb in the ring. Given $\mu_r$=300. **[7M]**

### UNIT – II

3. (a) Obtain the emf equation of DC generator and outline the parameters that affect the emf generation. **[7M]**

   (b) The brushes of a certain lap connected 400 KW, 6 pole generator is given a lead of 18 degrees (electrical). calculate

   i) The demagnetizing ampere turns

   ii) The cross magnetizing ampere turns

   iii) Series turns required to balance the demagnetizing component The full load current is 750 A, total numbers of conductors are 900 and the leakage coefficient is 1.4. **[7M]**

4. (a) Draw and explain the OCC and load characteristics of DC shunt generator. **[7M]**

   (b) Two DC generators are connected in parallel to supply a load of 1500 A. One generator has an armature resistance of 0.5 Ω and an emf of 400 V while the other has an armature resistance of 0.04 Ω and an emf of 440 V. The resistances of shunt fields are 100 Ω and 80 Ω respectively. Calculate the currents supplied by the individual generators and the terminal voltage. **[7M]**

## UNIT – III

5. (a) Explain in detail about field control method of DC series motor. **[7M]**

   (b) A 240 V DC shunt motor has a field resistance of 400 Ω and an armature resistance of 0.1 Ω. The armature current is 50 A and the speed is 1000 rpm. Calculate the additional resistance in the field to increase the speed to 1200 rpm. Assume that armature current remains the same and the magnetisation curve to be a straight line. **[7M]**

6. (a) With neat sketch explain the function of no volt coil (NVC) and overload release (OLR) in three-point starter. **[7M]**

   (b) A 250 V shunt motor takes 4 A at no-load and resistance of armature is 0.4 Ω and that of shunt field is 125 Ω.Calculate:

   i) Output in kW ii) Efficiency of motor when motor current is 102A. **[7M]**

## UNIT – IV

7. (a) Develop an equation for induced emf in a transformer winding in terms of flux and frequency. **[7M]**

   (b) A 20 kVA, 2500/500 V, single phase transformer has the following parameters:

   | H.V. winding | L.V. winding |
   |---|---|
   | $R_1 = 8\ \Omega$ | $R_2 = 0.3\ \Omega$ |
   | $X_1 = 17\ \Omega$ | $X_2 = 0.7\ \Omega$ |

   Find the voltage regulation and secondary terminal voltage at full load for a power factor of

   i) 0.8 lagging ii) 0.8 leading. The primary voltage is held constant at 2500 V. **[7M]**

8. (a) State the various losses which take place in a transformer. On what factors do they depend? Explain the steps taken to minimize these losses. **[7M]**

   (b) A 15 KVA, 2300/230V, 50Hz single phase transformer gave the following test data open circuit test $V_o$=2300V, $I_o$=0.21A, $W_o$=50W (H.V side) short circuit test $V_{sc}$=47V, $I_{sc}$=6.0A, $W_{sc}$=160w (H.V side)

   i)Find the equivalent circuit parameters refer to high voltage side

   ii)Calculate the full load voltage regulation at 0.8 power factor lagging when the load voltage is held at 220V

   iii)What is the efficiency at half the rated load at unity power factor

   iv)Find the maximum efficiency and corresponding output power **[7M]**

## UNIT – V

9. (a) Draw the circuit and explain the principle of an autotransformer. **[7M]**

   (b) A three-phase step down transformer is connected to 6600 V mains and takes a current of 24 A. Calculate the secondary line voltage, line current and output for the following connections

   i) Delta-Delta ii) Delta-Star. The ratio of turns of per phase is 12. Neglect losses. **[7M]**

10. (a) Explain the effect of harmonic currents in three phase transformer? **[7M]**

    (b) An auto transformer supplies a load of 5KW at 125V and at unity power factor. If the primary voltage is 250V. Determine

    i)Transformation ratio ii)Secondary current iii)Primary current iv)Number of turns across secondary if the total number turns is 250 v)Power transformed vi)Power conducted directly from the supply main to load. **[7M]**