



KERALA AGRICULTURAL UNIVERSITY
B.Tech.(Agrl. Engg.) 2021 Admission
III Semester Final Examination - February 2023

Fpme.2105

Electrical Machines and Power Utilization (2+1)

Marks: 50
Time: 2 hours

- I Fill in the blanks (10x1=10)**
1. A 500kVA, 3-phase transformer has iron losses of 300W and full load copper losses of 600W. The percentage load at which the transformer is expected to have maximum efficiency is.....
 2. The EMF induced in a conductor rotating in a bipolar field is only.
 3. The hysteresis loop of a magnetic material has an area of 5m^2 with the scales given as $1\text{cm}=2\text{AT}$ and $1\text{cm}=50\text{mWb}$. At 50 Hz, total hysteresis loss is.....
 4. A benchtop DC power supply acts as an ideal 4A current source as long as its terminal voltage is below 10V. Beyond this point, it begins to behave as an ideal 10V voltage source for all load currents going down to 0A. When connected to an ideal rheostat, value of load resistance is required at which maximum power is transferred.
 5. In DC machines, the air gap flux distribution in space at no load is
 6. In a DC motor, the windage loss is proportional to..... of armature speed
 7. A decrease in the number of poles of a 3-phase induction motor, results in of maximum power factor.
 8. In a squirrel cage induction motor, high starting torque is achieved by using rotor.
 9. The maximum possible speed of a 3-phase squirrel cage induction motor running at a slip of 4% is.....
 10. In a L-C parallel circuit, the current drawn will be minimum at frequency
- II Write short notes on ANY FIVE of the following (5x2=10)**
1. What is power factor? Why power factor improvement is necessary in an installation?
 2. A 1 kVA, 400 Hz transformer is desired to be used at a frequency of 60Hz. What will be the kVA rating of the transformer at this reduced frequency?
 3. Derive the EMF equation of DC generator.
 4. Derive a condition for maximum efficiency of a DC generator.
 5. A commutator with a diameter of 50cm rotates at 1000 rpm. For a brush width of 1.5cm, calculate the time of commutation.
 6. Compare squirrel cage and wound type induction motors.
 7. What happens when in a 3-phase induction motor, the connections of any two phases are interchanged?
- III Answer ANY FIVE of the following. (5x4=20)**
1. Explain the on load phasor diagram through inductive load by drawing phasor diagram.
 2. Explain open circuit and short circuit tests of a single phase transformer giving circuit diagram for each test.
 3. Explain the various types of DC motors with circuit diagrams and equations.
 4. Define O.C.C. (no-load characteristics) of a DC generator. Explain how it is obtained for a given generator.
 5. A 3 phase, 20kW, 400V, 1470 rpm, 50Hz, squirrel cage induction motor, develops a torque of 100N-m at a speed of 1400 rpm. If the motor is connected to a 30Hz supply, for keeping the same air gap flux. Calculate the supply voltage and the speed for the same load torque would respectively

6. Three similar coils each having a resistance of 8Ω and an inductance of 0.0191H in series in each phase is connected across a 400V , three phase, 50Hz supply. Calculate the line current, power input, kVA , and kVAR taken by the load.
7. A coil of resistance of 8Ω and inductance of 0.12H is connected in series with a condenser of capacitance 140 microfarad across a 230V , 50Hz , supply. Determine:
 - (i) Impedance of the entire circuit
 - (ii) Current flowing through the condenser
 - (iii) Power factor of the circuit
 - (iv) Voltage across the condenser

IV

Write an essay on ANY ONE of the following

(1x10=10)

1. A single phase, 4 kVA , $200\text{V}/100\text{V}$, 50Hz , transformer with laminated CRGO steel core has rated no-load loss of 450W . When the high voltage winding is excited with 160V , 40 Hz , sinusoidal AC supply, the no-load losses are found to be 320W . When the high voltage winding of the same transformer is supplied from 100V , 25 Hz sinusoidal AC source, calculate the no-load losses.
2. Write short notes on
 - (a) Double field revolving theory
 - (b) Shaded pole motors
