

B.E. DEGREE EXAMINATIONS: NOVEMBER 2009

Third Semester

ELECTRONICS AND INSTRUMENTATION ENGINEERING

U07EI302: Electrical Machines

Time: Three Hours**Maximum Marks: 100****Answer ALL the Questions:-****PART A (10 × 1 = 10 Marks)**

1. The purpose of providing dummy coils in DC machine armature is to
A) reduce eddy currents B) increase voltage induced
C) decrease armature resistance D) provide mechanical balance for the rotor
2. A DC motor operating on 230 V DC supply has armature resistance of 0.5Ω and back emf of 220 V. Its armature current is
A) 5 A B) 10 A C) 20 A D) 225 A
3. A Transformer having 50 turns in the primary winding is connected to a 220 V, AC supply. For obtaining 440- V at the secondary terminal, the number of turns in the secondary should be
A) 25 B) 50 C) 100 D) 200
4. Open-circuit test at rated voltage on Transformers is conducted to determine
A) copper loss B) eddy current loss
C) hysteresis loss D) iron losses
5. If the stator winding is wound for 8 poles in a 3-phase slip-ring induction motor, its rotor winding should be wound for
A) 2 poles B) 4 poles C) 8 poles D) 10 poles
6. The type of the single-phase induction motor used in ceiling fans is
A) capacitor start motor B) capacitor start and run motor
C) split-phase motor D) shaded pole motor
7. The speed at which a 6-pole Alternator is to be driven to obtain the frequency of emf induced to be 50 Hz is
A) 300 rpm B) 600 rpm C) 1000 rpm D) 3000 rpm
8. The hysteresis motor rotates always at
A) synchronous speed B) speed according to load torque
C) speed less than synchronous speed D) speed more than synchronous speed

9. Generation, in India, is mostly at ----- kV.
A) 11 kV B) 33 kV C) 66 kV D) 132 kV
10. The most commonly used insulation in high voltage cable is
A) impregnated cloth B) insulated oil
C) impregnated paper D) mica strips

PART B (10 x 2 = 20)

11. Under what circumstances does a DC shunt generator fail to build up?
12. By what methods can the speed of a DC shunt motor be controlled?
13. Draw the equivalent circuit of single phase two winding transformer referred to LV side with its parameters filled.
14. Define voltage regulation of a Transformer.
15. What are the different methods of starting 3-phase Induction motors?
16. Name any four types of single phase Induction motor.
17. Why almost all large size synchronous machines are constructed with rotating field system type?
18. What are the advantages of Brushless alternators over brushed type?
19. State any two advantages and disadvantages of DC transmission over a.c transmission.
20. What are general necessary requirements that a underground electrical cable must fulfill for the given working and service conditions?

PART C (5 x 14 = 70)

- 21a) i) Derived from first principles, an expression for the emf generated in the armature winding of a DC machine. (6)
- ii) Draw and explain the load characteristics of DC shunt generator. How does it get modified if the machine is compounded a) cumulatively and b) differentially? (8)

(OR)

- b) i) Explain why a DC shunt motor cannot normally be switched straight on to the supply and requires a starter. (6)
- ii) A 400 V DC shunt motor takes 5 A on no-load at its rated speed. The armature resistance including that of brushes is 0.2Ω and the normal field current is 2 A. Determine the efficiency of the machine as a generator delivering load current of 30 A. (8)

22 a) i) Explain the principle of operation of a Transformer on no-load with the help of phasor diagram. (6)

ii) A 220/440 V single-phase Transformer has the following test results:

OC Test : 220 V, 1 A, 70 W on LV side

SC Test : 20 V, 12 A, 100 W on HV side.

Draw the equivalent circuit of the Transformer referred to LV side. (8)

(OR)

b) The primary and secondary windings of a 30 kVA, 6.6 kV/240 V Transformer have resistances of 10Ω and 0.013Ω respectively. The leakage reactance of the windings are 17Ω and 0.022Ω . Estimate the percentage voltage regulation of the Transformer when it is delivering full-load at 0.8 pf lagging at the rated voltage.

23 a) A 415 V, 3-phase, delta connected Induction motor has an equivalent circuit parameters referred to stator: $R_1 = 0.54 \Omega$; $R_2' = 0.71 \Omega$; $X_1 = X_2' = 3.24 \Omega$; $R_m = 138 \Omega$; $X_m = 75 \Omega$. Calculate a) input current and b) power factor when motor operates with a slip of 4%.

(OR)

b) i) State the different methods of speed control of 3-phase Induction motors and discuss in detail any one. (6)

ii) 'A single phase Induction motor is not self starting' – Explain this statement using the double revolving field theory. (8)

24 a) A 3.3 kV Alternator gave the following test results:

Field current (A)	16	25	37.5	50	70
OC Voltage (kV)	1.55	2.45	3.3	3.75	4.15

A field current of 18 A is found to cause the full-load current to flow through the winding during short-circuit test. Predetermine the full-load voltage regulation at 0.8 pf lagging by MMF method.

(OR)

b) Explain briefly 4-phase permanent magnet stepper motor with suitable sketches. Also compare Variable reluctance and permanent magnet stepper motor.

25 a) i) Draw the layout of electric power system and explain its various components. (6)

ii) What are various types of insulators used in overhead transmission system? Explain briefly any two. (8)

(OR)

b) i) Discuss briefly the advantages and limitation of high transmission voltages. (6)

ii) Draw the key diagram of a typical 66 kV/11 V substation. (8)
