

Enrollment No: \_\_\_\_\_

Exam Seat No: \_\_\_\_\_

# C. U. SHAH UNIVERSITY

## Summer Examination-2022

Subject Name : Electrical Machine-II

Subject Code : 4TE04EMC1

Branch: B.Tech (Electrical)

Semester: 4

Date: 09/05/2022

Time: 11:00 To 02:00

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

Q-1

Attempt the following questions:

(14)

- a) A three phase transformer has primary connected in delta and secondary in star. The ratio of secondary to primary turns in each phase is 5. If the primary is supplied from a source of 3-phase, 400 V a.c., the secondary line voltage would be,
  - (i) 2000 V
  - (ii) 80 V
  - (iii) 3464 V
  - (iv) 138.6 V
- b) If two transformers are to be operated in parallel, their kVA ratings must be same.
  - (i) True
  - (ii) False
- c) The load which can be carried by an Open  $\Delta$  or V-V transformer bank is \_\_\_\_\_ percent as compared to  $\Delta$ -  $\Delta$  bank is,
  - (i) 50
  - (ii) 75
  - (iii) 57.7
  - (iv) 73.2
- d) Three single phase transformers, each rated 100 MVA, 127/66 kV are connected in Y/  $\Delta$  to form a three phase transformer bank. The overall rating of the three phase bank will be:
  - (i) 100 MVA, 127/66 kV
  - (ii) 100 MVA, 220/66 kV
  - (iii) 300 MVA, 220/66 kV
  - (iv) 300 MVA, 381/198 kV
- e) A 3-phase, 50 Hz, 4-pole, wound rotor induction motor is running at 4 % slip. What will be the frequency of rotor currents?
- f) In the circle diagram drawn for an induction motor, the diameter of the circle represents,
  - (i) slip



- (ii) rotor current
- (iii) running torque
- (iv) line voltage
- g) A 3-phase slip ring induction motor has rotor resistance and reactance of 0.5 ohm and 3 ohm respectively. At what value of slip will the torque become maximum?
- h) What will be the synchronous speed of a 3-phase, 50 Hz, 6-pole induction machine?
- i) Name a single phase induction motor which will not have a winding on its rotor.
- j) Power factor of an alternator driven by constant prime mover input can be changed by changing its
  - (i) Speed
  - (ii) Load
  - (iii) Field current
  - (iv) Phase sequence.
- k) A coil spans from slot 1 to slot 8 in a 36-slot, 4-pole synchronous generator. What is the value of pitch factor?
  - (i)  $\cos ( 30^\circ )$
  - (ii)  $\cos ( 20^\circ )$
  - (iii)  $\cos ( 70^\circ )$
  - (iv)  $\cos ( 40^\circ )$
- l) A generator used with a hydraulic turbine as prime mover will usually be of,
  - (i) Cylindrical rotor type synchronous generator
  - (ii) Salient pole type synchronous generator
  - (iii) Induction generator
  - (iv) None of these
- m) The value of load angle for a synchronous motor depends mainly upon its
  - (i) Excitation
  - (ii) Load
  - (iii) Speed
  - (iv) Supply voltage
- n) A synchronous motor operating at no load in an over excited condition will behave as:
  - (i) Inductor
  - (ii) Resistor
  - (iii) Capacitor
  - (iv) Rectifier
  - (v)

**Attempt any four questions from Q-2 to Q-8**

**Q-2 Attempt all questions**

**(14)**

- (a) Draw and explain all the 3-phase transformer connections which may give:
  - (1) 0 degree phase shift
  - (2) 180 degree phase shift
 between primary and secondary voltages.
- (b) Explain Scott Connection for transformation from three phase to two phase.



- Q-3 Attempt all questions (14)**
- (a) Briefly discuss different methods of speed control of a three phase induction motor.
- (b) A 3-phase induction motor runs at 1000 rpm at no load and 950 rpm at full load, when supplied from a 3-phase, 50 Hz line. Determine:
- Number of poles of motor
  - percentage slip at full load
  - frequency of rotor currents
  - relative speed between rotor magnetic field and rotor
  - relative speed between rotor magnetic field and stator
- Q-4 Attempt all questions (14)**
- (a) A 50 kW, 6-pole, 50 Hz, 3-phase, 450 V slip ring induction motor gave the following test data:
- No load test: 450 V, 20 A, p.f. = 0.15  
Blocked Rotor test : 200 V, 150 A, p.f. = 0.3
- The ratio of stator copper loss to rotor copper loss during short circuit was 5 : 4.
- Draw circle diagram and determine from it
- Full load current and power factor
  - maximum torque and maximum power output
  - slip at full load
  - efficiency at full load
- (b) Write equation of torque under running condition for a 3-phase induction motor and derive the condition for maximum running torque.
- Q-5 Attempt all questions (14)**
- (a) Briefly discuss the concepts of (i) Cogging and (ii) Crawling in 3-phase induction motors.
- (b) A three phase, 50 Hz, 4-pole, , star connected alternator has flux per pole of 0.12 Wb. It has 4 slots per pole per phase and the number of conductors per slot is 4. If the winding coil span is  $150^\circ$ , determine the line value of emf induced.
- Q-6 Attempt all questions (14)**
- (a) Derive e.m.f. equation for a 3-phase alternator.
- (b) Explain synchronous impedance method for finding voltage regulation of a three phase alternator.
- Q-7 Attempt all questions (14)**
- (a) List the types of single phase induction motors. Describe construction and working principle of any one of them.
- (b) Explain the “Double Revolving Field Theory” for a single phase induction motor.
- Q-8 Attempt all questions (14)**
- (a) Explain the effect of change in excitation of a synchronous motor giving constant mechanical power output.
- (b) Give comparison between synchronous motor and induction motor.

