

B.TECH SEM – V (2007 COURSE) (ELECTRICAL ENGG.) :
WINTER - 2017

SUBJECT: INDUCTION MACHINES THEORY & DESIGN

Day: Saturday
Date: 20/01/2018

W-2017-2463

Time: 02.30 PM TO 05.30 PM
Max. Marks: 80

N.B.:

- 1) **Q. No. 1 and Q. No. 5** are compulsory. Out of the remaining attempt any **TWO** questions from each Section.
- 2) Both the section should be written in **SEPARATE** answer books.
- 3) Figures to the right indicate **FULL** marks.
- 4) Assume suitable data, if **NECESSARY**.
- 5) Draw neat labeled diagrams **WHEREVER** necessary.

SECTION – I

- Q.1** a) Write explanation about power flow diagram of 3 phase induction motor. [05]
- b) Explain the phenomenon of cogging and crawling in 3 phase induction motor. [04]
- c) Explain why single phase induction motor is not self starting. [05]
- Q.2** a) Power input to a 440V, 50Hz, 6 pole, 3 phase cage induction motor running at 970 rpm is 30 kW. Stator losses are 1kW, friction and windage losses are 1kW. Calculate: [06]
i) Slip ii) Rotor Cu loss iii) Efficiency
- b) Draw and explain the equivalent circuit of 3 phase induction motor under normal running conditions. [07]
- Q.3** a) Discuss three types of commonly used starters for 3 phase squirrel cage induction motor with neat diagram. [06]
- b) Elaborate the steps to be performed to draw the circle diagram of 3 phase induction motor along with performance computation. [07]
- Q.4** a) Explain with diagram following fractional kilowatt single phase motors: [06]
i) Capacitor start capacitor run induction motor.
ii) Shaded pole induction motor.
iii) Resistance split phase induction motor.
- b) A 230V, 50Hz, 400W, single phase induction motor gives the following test results: [07]
No load test : 230V, 85W, 3A
Blocked motor test: 110V, 6.2A, 450W
Stator winding has 4.5Ω resistance.
Determine equivalent circuit parameters.

SECTION – II

- Q.5 a)** Derive output equation of 3 phase induction motor. [05]
- b)** Discuss in brief the design procedure of wound type 3 phase induction motor. [05]
- c)** Discuss the choice of specific loadings in the design of single phase induction motor. [04]
- Q.6 a)** Find the main dimensions and turns per phase of a 5HP, 400V, 3 phase, 4 pole, 50Hz induction motor with below given parameters. [07]
 $B_{av} = 0.45 \text{ Wb/m}^2$
Power factor = 0.8 lag, efficiency = 0.80, ampere conductors = 23000 A/m
Find dimensions for low cost design.
Assume suitable design consideration data as needed.
- b)** Discuss various consideration that should be taken into account for: [06]
i) Average flux density in air gap
ii) Suitable combinations of stator and rotor slots.
- Q.7 a)** Explain in detail the considerations made while estimating length of air gap. Derive equation for length of air gap. [05]
- b)** Estimate the stator core dimensions, number of stator slots, number of stator conductor per slot for a 100kW, 3300V, 50Hz, 12 pole, star connected slip ring induction motor. [08]
 $B_{av} = 0.4 \text{ Wb/m}^2$, Electric loading = 23000A/m,
Efficiency = 86%, power factor = 0.9
Estimate main dimensions to give best power factor. Make necessary assumptions as needed.
- Q.8 a)** Determine main dimensions of 2HP, 230V, 50Hz, 4 pole, single phase induction motor. Full load efficiency and power factor should not be less than 0.65 and 0.75 respectively. [08]
- b)** Write note on relative size of single phase and 3 phase induction motors for same power output. [05]

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