Reg. No._____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2017

EE 202 SYNCHRONOUS AND INDUCTION MACHINES (EE)

Max. Marks: 100 Duration: 3hours

PART A

Answer all questions. 5 marks each.

1. Write any four advantages of short pitched winding in alternators.
2. Explain the ASA method of determining voltage regulation of alternator.
3. Describe how synchronisation can be achieved using a synchroscope.
4. Draw the phasor diagram of a three phase Induction Motor at standstill and when operating at a Full load slip,'s'
5. What is meant by cogging in three phase Induction motor? How can it be eliminated?
6. Design a three step starter for a three phase,400V wound rotor Induction motor. Full Load slip is 3% and maximum starting current is limited to full load value. Rotor resistance per phase is 0.015 Ω.
7. Compare the operation of Induction generator and synchronous generator.
8. Explain the principle of operation of Synchronous Induction motor.

PART B

Answer any two questions.10 marks each.

Graph sheet permitted.

9. Derive from the fundamentals, generalised equation of the EMF generated in a non salient pole synchronous generator, taking into account the effect of 5^{th} and 7^{th} harmonic components. (10)
10. Explain the effect of armature flux on main field flux when an alternator is operating at
    (i) Lagging pf
    (ii) Unity pf.
    State the reason of accounting the effect of armature reaction as a fictitious reactance in calculations. (10)

11. A 3phase, 6000V star connected alternator has the following OCC at normal speed.

Field Ampere (A)	14	18	23	30	43
Terminal voltage (V)	4000	5000	6000	7000	8000

With armature short circuited and full load current flowing, the field current is 17A and

when the machine is supplying full load of 20000kVA at zpf, the field current is 42.5A and terminal voltage is 6000V. Determine the field current required when the machine is supplying full load at 0.8pf lagging. (10)

PART C

Answer any two questions.

12. A salient pole alternator has direct and quadrature axis reactances of 80% and 60% respectively. It is having a resistance of 10%. Determine its regulation if the generator delivers (i) Full load at rated terminal voltage and 0.8 pf lagging (ii) ¾ th Full load and 0.8pf lagging. (10)
13. With the help of a phasor diagram explain the parallel operation of alternators under no load and loaded condition. (10)
14. Derive the expression for the mechanical power developed in a 3 phase Induction motor Draw the approximate equivalent circuit also. (10)

PART D

Answer any two questions.

15. A 2.4 kW, 400V, 50Hz, 3phase, delta connected slip ring Induction motor has a stator resiatnce of 0.36Ω/phase and a rotor resistance of 0.06Ω/phase. Stator to rotor turns ratio is 2.

    No Load test data : 400V, 3.2A, Cos Φ_0=0.17

    Blocked rotor test : 210V, 16A, Cos Φ_s=0.35.

    Draw the circle diagram and find line current, pf, efficiency at Full load and maximum torque. (10)
16. a) With the help of a neat diagram, explain how an Induction motor can be started using a star delta starter. (5)

    b) Determine approximately the starting torque of an Induction motor in terms of full load torque when started by means of (i) Star delta starter (ii) Auto transformer with 50% tapping. Ignore I_μ. The short circuit current of motor at normal voltage is 5 times the full load current and slip at FL is 5%. (5)
17. Explain the following starting methods of a single phase Induction motor.

    (i) Split phase starting

    (ii)Capacitor start- capacitor run starting (10)

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