(a) Write a note on estimation of no-load current and constant losses in a 3 phase transformer?

(b) A 250 KVA, 6600/400 V three phase core type transformer has a total loss of 4800 watts at full load. The transformer tank is 125 cm in height and 100 × 50 cm in plan. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35°c. The diameter of tubes is 5 cm and is spaced 7.5 cm for each other. The average height of tubes is 105 cm.

III/IV B.E. DEGREE EXAMINATION.

First Semester

Electrical and Electronics Engineering

PERFORMANCE AND DESIGN OF ELECTRICAL MACHINES — II

(With Effective from the admitted batch of 2004–2005 and after batches)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining questions.

All questions carry equal marks.

1. (a) What is an ideal transformer?

   (b) What are reasons for humming noise in transformers?

   (c) Why circular coils are always preferred over rectangular coils for windings of transformer?

   (d) Why an induction motor cannot run at synchronous speed?

(e) Why the power factor of induction motor low at starting?

(f) How the speed control can be achieved slip ring induction motor?

(g) Write the applications of AC series motor.

2. (a) Explain the operation of single phase transformer and sketch the phasor on No- load?

(b) Obtain the equivalent circuit of single phase, 4kVA, 200/400V, 50Hz transformer from the following test results

OC test: 200V 0.7A 70W on LV side

SC test: 15V 10A 80W on HV side

3. (a) Draw the connection diagrams for OC & SC tests of single phase transformer and describe briefly how would you performance the above tests.

(b) A single phase 5:1 step down transformer takes no-load current of 0.8 A at p.f of 0.25 lagging with LV winding as open. The secondary is connected to a load, taking a current of 100A at 0.8 pf lagging. Find the primary current and power factor.

4. (a) Discuss essential and desirable conditions to be fulfilled for operating two single phase transformer in parallel.

(b) A 3-phase transformer has 400 turns on the primary and 80 turns on secondary. The supply voltage is 6.6kv. Find the secondary voltage on No-load when the winding are connected in (i) Star/Delta, (ii) Delta/Star.

5. (a) Derive the expression for developed torque 3-phase induction motor and find the condition for maximum torque.

(b) What are the various losses in an inductance motor? On what factors do they depend?

6. Draw the circle diagram of a 20 hp, 400 V, 50 Hz, 3-phase star-connected induction motor from the following test data (line value)

No. load	400 V	9 A	pf 0.2
Blocked rotor	200 V	50 A	pf 0.4

From the circle diagram find (a) line current and power factor at full-load. (b) Maximum power output.

7. (a) Discuss the operation of single phase induction motor based on double revolving field theory.

(b) Explain different speed control methods of Induction Motors.

6. (a) Describe the construction, principle of operation and applications of capacitor start induction motor. (7)

(b) The following data pertains a 230 V, 50 Hz, $1-\phi$, capacitor start induction motor at stand still.

Main winding	:	100 V; 2 A; 40 W
Auxillary winding	:	80 V; 1 A, 50 W

Determine the value of capacitance for obtaining maximum starting torque. (7)

7. (a) Explain why single phase induction motor is not self starting. Also explain various methods of starting. (7)

(b) Explain with neat schematic diagram the principle of operation and construction of AC series motor. (7)

8. (a) Derive an expression for output in KVA in terms of its main dimensions for a 3-phase transformer. (7)

(b) Explain how heat generated in a transformer can be managed. Give a detailed scheme. (7)

III/IV B.E. DEGREE EXAMINATION.

First Semester

Electrical and Electronics Engineering

Elective II – PERFORMANCE AND DESIGN OF ELECTRICAL MACHINES – II

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

First question is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

$(7 \times 2 = 14)$

1. (a) Draw the phasor diagram of a transformer connected with leading load.

(b) What is the function of conservator tank near the transformer?

(c) Write the power stages of 3-phase induction motor and list out the losses.

(d) What are the advantages of two phase motors?

(e) List out the cooling methods of a transformer.

(f) Draw the torque speed characteristics of shaded pole motor.

(g) Write the applications of universal and hysterisis motors.

2. (a) Derive the condition for maximum efficiency of a single phase transformer. (7)

(b) Two transformers A and B are connected in parallel to supply a load having an impedance of $(2 + j1.5\Omega)$. The equivalent impedances referred to the secondary windings are $0.15 + j\ 0.5\Omega$ and $0.1 + j\ 0.6\ \Omega$ respectively. The open-circuit emf of A is 207V and B is 205 V.

Calculate:

(i) the voltage at the load

(ii) the power supplied to the load

(iii) the power output of each transformer

(iv) KVA input to each transformer. (7)

3. (a) Explain the principle of operation of single phase auto transformer. Derive an expression for the saving of copper in auto-transformer as compared with an equivalent two winding transformer. (7)

(b) In a 25 KVA, 2000 / 200 V transformer, iron and copper losses are 350 W and 450 W required

Calculate the efficiency at UPF at

(i) Half full load

(ii) 3/4 full load.

Determine the load for maximum efficiency. (7)

4. (a) Derive the relation between rotor power input, mechanical power developed and rotor copper loss of a 3-phase induction motor. (7)

(b) A 110V, 3-phase, star connected induction motor takes 25 A at a line voltage of 30 V with rotor blocked. With this line voltage power input to the motor is 440 W and core loss is 40 W. The d.c. resistance between a pair of stator terminals is 0.15 Ω. If the ratio of a.c. to d.c resistance is 1.6, find the equivalent leakage reactance per phase of the motor and the stator and the rotor resistance per phase. (7)

5. (a) Explain the construction, principle of operation and speed control of a Schrage motor. (7)

(b) A 400 volts, 50 Hz, delta connected, 3-phase induction motor gave the following test results. No load test; 400 V, 8.6 A, 1120 W (line value). Blocked rotor test; 130 V, 17.9 A, 1640 W (line values). Stator resistance per phase = 2.45 Ω. Draw the circle diagram and find the parameters; full load current, torque and slip. (7)

7. (a) Sketch and explain the nature of the torque-slip characteristics of single phase induction motor based on double revolving field theory.

(b) Briefly explain the working of repulsion type motor with relevant diagrams.

8. (a) Develop the output equation for a single phase transformer.

(b) A 1000 kVA, 6600/440 V, 50 Hz 3-phase delta/star, core type oil inversed natural cooled transformer the design data as follows :

Distance between adjacent limbs = 0.47 m

Outer diameter of high voltage winding = 0.44m

Height of the frame = 1.24 m

Core losses = 3.7 kW and copper loss = 10.5 kW

Design a suitable tank for the transformer. The average raise of oil temperature should not exceed 35°C. Specific heat dissipation from tank wall is 6W/m^2 -°C and 6.5 W/m^2 - °C due to radiation and convection respectively. Assume that the convection is improved by 35% due to convector.

[06 – 3113]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Electrical and Electronics Engineering

PERFORMANCE AND DESIGN OF ELECTRICAL MACHINES – II

(Common with Dual Degree E.EE)

(with effective from admitted batch of 2004–2005 and after batches)

Time : Three hours Maximum : 70 marks

Question No.1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) What is an ideal transformer?

(b) Why core of transformer is laminated? What is magneto friction phenomena?

(c) Why welding transformer are made to hard a relatively large reactance?

(d) Why usually transformer tapping are provided on the high voltage side?

(e) Why 3-phase induction motors usually connected to supply through starter?

(f) Why the power factor of a lightly loaded induction motor is quite low?

(g) How can the direction of a capaciter-ram motor be reversed?

2. (a) Explain the operation of transformer and sketch phasor diagram on load. How it effects the power factor of the loaded transformer?

(b) Consider 4 kVA, 200/400 V single phase transformer supplying full load current at 0.8 lagging power factor. The OC/SC test results are :

OC Test : 200V 0-.8A 70W

SC Test : 20V '10A 60W

Calculate efficiency, secondary voltage and current into primary at the above load. Calculate the load at unity power factor corresponding to maximum efficiency.

(a) Describe back to back test for separation of losses in two identical transformers.

(b) A load of 100 kVA is to be supplied at 460 volts from 2,300 V supply mains by an auto transformer. Determine the current and voltage rating for each of the two windings. What would be the kVA of the transformer, if it were used as a two winding transformer?

4. (a) Why transformers are operated in parallel? What are the necessary and sufficient conditions to operate two transformers in parallel?

(b) Explain different cooling methods that are used in transformer?

5. (a) Explain the construction and working of a 3-phase induction motor.

(b) A delta-connector, 6 pole, 50 Hz, 3-phase Induction motor has a rotor resistance of 0.15Ω per phase and exerts maximum torque at 880 rpm. Calculate the percentage maximum torque that would be exerted

(i) at stand still and

(ii) at 940 rpm.

6. (a) List out various methods of speed control of Induction motor and explain any one method.

(b) The rotor of 4-pole, 50Hz slip way induction motor has a resistance of 0.25Ω per phase and maximum at 1,440 rpm. at full-load. Calculate the external resistance per phase which must be added to lower the speed to 1200 rpm, the torque being the same as before.

[06 – 3221]

III/IV B.E. DEGREE EXAMINATION.

Second Semester

Electrical and Electronics Engineering

PERFORMANCE AND DESIGN OF ELECTRICAL MACHINES — III

(Effective from the admitted batch of 2006–2007)

Time : Three hours   Maximum : 70 marks

Question No.1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) Write the advantages of stationary armature and rotating field in an alternator.

   (b) Deduce the relation between the number of poles, the frequency and the speed of the alternator.

   (c) Derive from first principles the emf equation of 3-phase synchronous machine.

   (d) Why 3-phase synchronous motor will not run at other than synchronous speed.

(e) Derive the output equation of poly phase induction motor.

(f) Write some differences between salient pole and non-salient pole machines.

(g) What is the significance of air gap length in synchronous machines?

2. (a) Write a note on two reaction model of salient pole synchronous machine.

(b) Explain the determination of Xd and Xq by slip test.

3. (a) The data obtained on 100 kva, 1100 V, 3-phase alternator is :

DC resistance test, E between line = 6V dc, I in lines = 10 A dc.

Open circuit test, field current = 12.5 A dc, Line voltage = 420 V ac.

Short-circuit test, field current = 12.5 A, line current = rated value. Calculate the voltage regulation of alternator at 0.8 pf lagging.

(b) Explain potier triangle method of voltage regulation.

4. (a) Explain how open circuit test and short circuit test are conducted for an alternator.

(b) Explain the effect of increasing the driving torque of one of the alternators in parallel operation.

5. (a) Explain the power flow in a synchronous motor with diagram.

(b) A 500V, 1-phase synchronous motor gives a net output mechanical power of 7.46 kw and operates at 0.9 pf lagging. Its effective resistance is 0.8 ohm. If the iron and mechanical losses are 500 W and excitation losses are 800 W, estimate the armature current. Calculate the commercial efficiency.

6. (a) What is the necessity of damper windings in synchronous motor?

(b) Explain about V and inverted V curves.

7. (a) Write note on design of windings of an induction motor.

(b) Explain in detail the main dimensions of in the design of an induction motor.

8. (a) Explain the design of rotor for salient pol alternator.

(b) Derive the output equation of a synchronou machine.

(3)

APRIL-17

[06 – 3221] 3131771114003

III/IV B.E. DEGREE EXAMINATION.

Second Semester

Electrical and Electronics Engineering

PERFORMANCE AND DESIGN OF ELECTRICAL MACHINES — III

(Effective from the Admitted Batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) What conditions are required to be fulfilled for the successful parallel operation of alternators?

   (b) What are the advantages of short pitching?

   (c) What is synchronous impedance? What is the significance of conducting slip test?

   (d) What is hunting of synchronous motor? How will it be minimized?

   (e) Write the differences between squirrel cage and wound rotor induction motors.

(f) What are the major components in the construction of a synchronous machine?

(g) What are the advantages of distributed winding of a synchronous machine?

2. (a) Derive the expressions for (i) Pitch factor (ii) Distribution factor.

(b) Explain armature reaction subject to synchronous generator at (i) lagging zero power factor (ii) leading zero power factor.

3. (a) A 3-phase star-connected alternator is rated at 1,600 kVa, 13,500 V. The armature resistance and synchronous reactance are 1.5 ohm and 30 ohm respectively per phase. Calculate the percentage regulation for a load of 1,280 kW at 0.8 leading power factor.

(b) Explain ampere turn or MMF method of voltage regulation.

4. (a) Describe any one method of synchronizing of alternators.

(b) Explain the effect of increasing the excitation of one of the alternators in parallel operation.

5. (a) Explain armature reaction in synchronous motors.

(b) Discuss with circuit diagram any one method of starting a synchronous motor.

6. (a) A 2.3 kV, 3-phase, star connected synchronous motor has $Z_s = (0.2 + j2.2)$ ohms per phase. The motor is operating at 0.5 power factor leading with a line current of 200 A. Determine the generated emf per phase.

(b) Write a brief note on power flow in a synchronous motor.

7. (a) Explain how stator slots are selected in induction motors.

(b) Write about the main dimensions of an induction motor design.

8. (a) Explain any two methods of armature winding of a synchronous machine.

(b) Explain the design of rotor for turbo alternators.

(1) APRIL 2016

8. (a) Explain the types of induction motors based on their construction in detail. (8)

(b) Write a brief note on design of windings of an induction motor. (6)

8

[06 – 3221]

III/IV B.E. DEGREE EXAMINATION.

Second Semester

Electrical and Electronics Engineering

PERFORMANCE AND DESIGN OF ELECTRICAL MACHINES — III

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

$(7 \times 2 = 14)$

1. (a) What is Hunting in synchronous motors?

(b) Justify whether synchronous motors are self starting. List out various methods of starting.

(c) What are the general principles governing windings for a synchronous generator. State various types of armature windings.

(d) What is Short Circuit Ratio (SCR) of a synchronous machine?

(e) Write the differences between squirrel cage rotor and wound rotor of an induction motor.

(f) What is the significance of air gap length in induction machines?

(g) Write the special features of salient pole synchronous machine.

2. (a) Calculate the distribution factor for a single layer 18-slot, 2-pole, three phase stator winding. (6)

(b) A 500 kVA, three-phase, star connected alternator has a rated line-to-line terminal voltage of 3300 V. The resistance and synchronous reactance per phase are 0.3 and 4.0 ohms respectively. Calculate the voltage regulation at full-load, 0.18 power-factor lagging. (8)

3. (a) Explain methods of synchronizing of alternators. (6)

(b) Two alternators A and B operate in parallel and supply a load of 8 MW at 0.8 lagging. The power output of A is adjusted to 5000 kW by changing its steam supply and its pf is adjusted to 0.9 lagging by changing its excitation. Find the pf of alternator B. (8)

4. (a) Explain the effect of change of excitation of a synchronous motor driving a constant load. (8)

(b) Explain the concept of synchronous machine working as a motor. (6)

5. (a) An industrial plant has a load of 800 kW at of power factor of 0.8 lagging. It is desired to install a synchronous motor to deliver a load of 200 kW and also serve as a synchronous condenser to improve the overall power factor of the plant to 0.92. Determine the kVA rating of the synchronous motor and its power factor. Assume that the synchronous motor has an efficiency of 90 percent. (8)

(b) Explain how synchronous condenser is operated. (6)

6. With neat sketches explain the constructional features of a salient pole and non salient pole type synchronous machines. (14)

7. (a) Derive the expressions for pitch factor and distribution factor there by getting the expression for winding factor. (8)

(b) Calculate the distribution factor for a 36-slot, 4-pole, single layer 3-phase winding. (6)