B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2010.

Fourth Semester

Electrical and Electronics Engineering

EE2251 — ELECTRICAL MACHINES – I

(Regulation 2008)

Time: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A — (10 × 2 = 20 Marks)

1. Define Torque.

2. How is emf induced dynamically?

3. Give the principle of transformers.

4. What are the conditions for parallel operation of transformers?

5. In a linear system prove that field energy and co-energy are equal.

6. Write an expression for the stored energy in the magnetic field.

7. What are the basic magnetic field effects that result in the production of mechanical forces?

8. What are the assumptions made to determine the distribution of coil mmf?

9. What is armature reaction?

10. What are the methods

PART B — (5 × 16 = 80 Marks)

11. (a) Discuss in detail the following:

(i) B-H relationship

(ii) Leakage flux

(iii) Fringing

(iv) Stacking factor. (4 × 4 = 16)

Or

(b) (i) Derive an expression for energy density in the magnetic field. (6)

8

(ii) Explain in detail ''Eddy – current loss''. (5)

(iii) The total core loss of a specimen of silicon steel is found to be 1500 W at 50 Hz. Keeping the flux density constant the loss becomes 3000 W when the frequency is raised to 75 Hz. Calculate separately the hysteresis and eddy current loss at each of there frequencies. (5)

12. (a) (i) Draw the equivalent circuit of single phase transformer and draw the necessary phasor diagram under load (8)

(1) Resistive

(2) Inductive

(3) Capacitive.

(ii) Explain in detail the tests required to obtain the equivalent circuit parameters of transformer. (8)

Or

(b) (i) Explain in detail the various types of three phase transformer connection. (10)

(ii) Prove that amount of copper saved in auto transformer is (1 – K) times that of ordinary transformer. (6)

13. (a) (i) Derive an expression for mechanical force in terms of field energy. (8)

(ii) Discuss the flow of energy in electromechanical devices in detail. (8)

Or

(b) (i) Derive an expression for torque in case of a multiply excited magnetic field system. (8)

(ii) Two coupled coils have self and mutual inductance of

xL21 2 11 + = ; xL21 1 22 + = ; xL L21 21 12 = =

over a certain range of linear

displacement x. The first coil is excited by a constant current of 20A

and the second by a constant current of –10A. Find:

(1) Mechanical work done if x changes from 0.5 to 1 m.

(2) Energy supplied by each electrical source in part (a).

(3) Change in field energy. (8)

14. (a) Explain in detail the basic concept of a synchronous generator with a

neat diagram and the necessary space wave form. (16)

Or

(b) (i) Discuss the basic concept of emf generation in a DC machine in

detail. (8)

(ii) What is MMF space wave of a single coil and in a distributed

winding? (8)

15. (a) (i) Explain armature reaction and commutation in detail. (8)

(ii) Draw the

(1) OCC characteristics of DC generator and (4)

(2) External characteristics of DC generator. (4)

Or

(b) (i) Explain in detail the various methods of speed control in DC motor.

(8)

(ii) What are the various starting methods of DC motor? Explain any

one method. (8)

Reg. No. : | | | | | | | | | | | |

Question Paper Code : 53136

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2010

Fourth Semester

Electrical and Electronics Engineering

EE 2251 — ELECTRICAL MACHINES – I

(Regulation 2008)

Time : Three hours Maximum : 100 Marks

Answer ALL questions

PART A — (10 × 2 = 20 Marks)

1. Give the analogy between electric circuit and magnetic circuit.

2. Distinguish between statically and dynamically induced electromotive force.

3. What are the no load losses in a two winding transformer and state the reasons for such losses.

4. Mention the conditions to be satisfied for parallel operation of two winding transformers.

5. Draw the power low diagram for motor and generator operation.

6. In a magnetic circuit with a small air gap, in which part the maximum energy is stored and why?

7. Explain the concept of electrical degree. How is the electrical angle of the voltage in a rotor conductor related to the mechanical angle of the machines shaft?

8. Why does curving the pole faces in a D.C. machine contribute to a smoother D.C. output voltage from it?

9. State the conditions under which a D.C. shunt generator fails to excite.

10. What is the precaution to be taken during starting of a D.C. series motor? Why?

PART B — (5 × 16 = 80 Marks)

11. (a) (i) Define inductance of a coil. (4)

(ii) For the magnetic circuit shown in Fig. 11.a (ii) determine the current required to establish a flux density of 0.5 T in the air gap. (12)

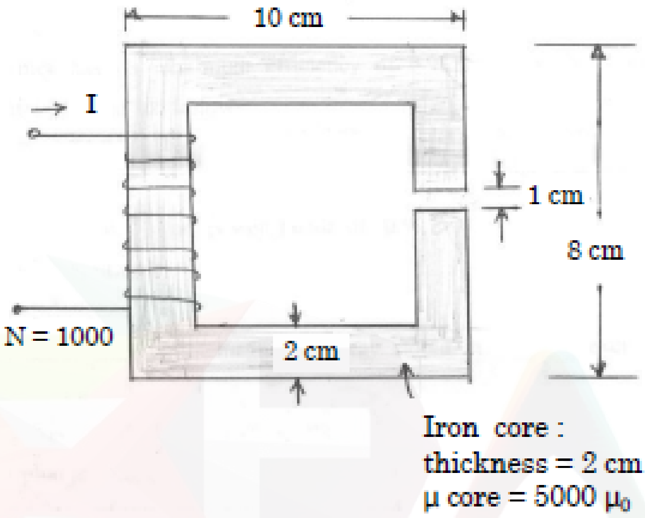

Fig. 11 (a) (ii)

Or

(b) (i) c material and the factors on which it depends. (4)

(ii) Explain the operation of a magnetic circuit when A.C. current is applied to the coil wound on iron core. Draw the B-H curve and obtain an expression for hysteresis loss. (12)

12. (a) (i) Define "Voltage Regulation" of a two winding transformer and explain its significance. (4)

(ii) A 100 kVA, 6600 V/ 330 V, 50 Hz single phase transformer took 10 A and 436 W at 100 V in a short circuit test, the figures referring to the high voltage side. Calculate the voltage to be applied to the high voltage side on full load at power factor 0.8 lagging when the secondary terminal voltage is 330 V. (12)

Or

(b) (i) Explain the reasons for 'tap changing' in transformers. State on which winding the taps are provided and why? (4)

(ii) A transformer has its maximum efficiency of 0.98 at 15 kVA at unity power factor. During the day it is loaded as follows :

12 Hours	2 kW	at power factor of 0.5
6 Hours	12 kW	at power factor of 0.8
4 Hours	18 kW	at power factor of 0.9
2 Hours	No load	

Find the 'All Day Efficiency'? (12)

13. (a) (i) Derive an expression for the magnetic energy stored in a singly excited electromagnetic relay. (8)

(ii) The relay shown in Fig. Q.13.a (ii) is made from infinitely permeable magnetic material with a movable plunger also of infinitely permeable material. The height of the plunger is much greater than the air gap length (h >> g). Calculate the magnetic energy stored as a function of plunger position (0 < x < d) for N=1000 turns, g = 2.0 mm, d=0. 5 m, l = 0.1 m and I = 10 A. (8)

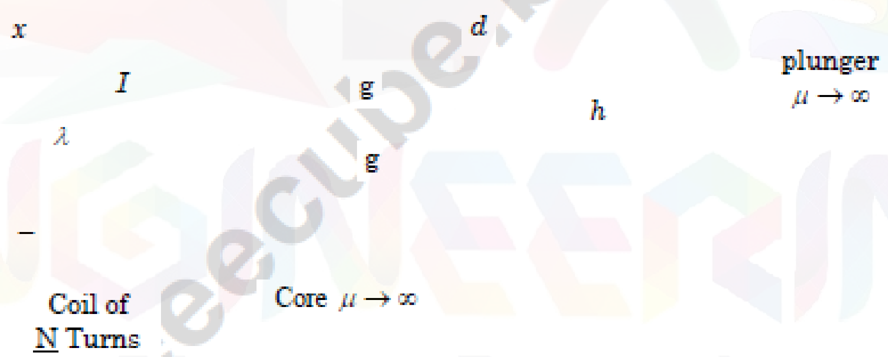

Fig. Q. 13. (a) (ii)

Or

(b) Two windings one mounted on the stator and the other mounted on a rotor have self and mutual ind[illegible] $L_{22} = 2.5$ H and $L_{12} = 2.8 \cos \theta$ H, where [illegible] axes of the windings. The resistances of the windings may be neglected. Winding 2 is short circuited and the current in Winding 1 as a function of time is $i_1 = 10 \sin \omega t$ A. Derive an expression for the numerical value of the instantaneous torque on the rotor in N-m in terms of the angle θ. (16)

(ii) Prove that a three phase set of currents, each of equal magnitude and differing in space by 120° applied to a three phase winding spaced 120 electrical degrees apart around the surface of the machine will produce a rotating magnetic field of constant magnitude. (10)

Or

(b) (i) A D.C. machine has 'P' number of poles with curved pole faces having 'Z' number of conductors around the rotor armature of radius 'r' and the flux per pole is given as, φ . The rotor rotates at a speed of 'n' rpm. Obtain the induced e.m.f. of the D.C. machine assuming a number of parallel paths. (8)

(ii) A 12 pole D.C. generator has a simplex wave wound armature containing 144 coils of 10 turns each. The resistance of each turn is $0.011\,\Omega$. Its flux per pole is 0.05 Wb and it is running at a speed of 200 rpm. Obtain the induced armature voltage and the effective armature resistance. (8)

15. (a) (i) Draw the load characteristics of D.C. shunt and compound (cumulative and differential) generators and explain. (6)

(ii) In a 110 V, compound generator the resistances of the armature shunt and series field windings are $0.06\,\Omega$, $25\,\Omega$ and $0.04\,\Omega$ respectively. The [illegible] [illegible]ted at 55 W, 110 V. Find the [illegible]ture current when the machine is connected long shunt and short shunt. (10)

Or

(b) (i) Give the reasons for using 'starters' to start D.C. motors. (3)

(ii) Draw the circuit of any one type of starter and explain its operation. (5)

(iii) A series motor of resistance $1\,\Omega$ between terminals runs at 800 rpm at 200 V with a current of 15 A. Find the speed at which it will run when connected in series with a $5\,\Omega$ resistance and taking the same current at the same supply voltage. (8)

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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2011.

Fourth Semester

Electrical and Electronics Engineering

EE 2251 — ELECTRICAL MACHINES — I

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define statically and dynamically induced EMF.
2. What is Hysteresis loss and how can this loss be minimized?
3. Why is transformer rated in KVA?
4. Compare two winding transformer and auto transformer.
5. What are the advantages of analyzing energy conversion devises by field energy concept?
6. Draw the general block diagram of electromechanical energy conversion device.
7. What is back EMF in a D.C. motor?
8. Define winding factor.
9. What is armature reaction in DC machines?
10. Explain why Swinburne's test cannot be performed on DC series motor.

PART B — ($5 \times 16 = 80$ marks)

11. (a) Compare electric and magnetic circuit by their similarities and dissimilarities. (16)

Or

(b) A ring composed of three sections. The cross section area is 0.001 m^2 for each section. The mean arc length are l_a = 0.3 m, l_b = 0.2 m, l_c = 0.1 m. an air gap length of 0.1 mm is cut in the ring. μ_r for sections a, b and c are 5000, 1000 and 10000 respectively. Flux in the air gap is 7.5×10^{-4} Wb. Find (i) mmf (ii) exciting current if the coil has 100 turns (iii) reluctance of the sections.

12. (a) (i) Explain clearly the causes of voltage drop in a power transformer on load and develop the equivalent circuit for a single phase transformer. (10)

(ii) Derive an expression for saving of copper when an auto transformer is used. (6)

Or

(b) A 3-phase step down transformer is connected to 6.6 KV mains and takes 10 Amps. Calculate the secondary line voltage and line current for the (i) Δ/Δ (ii) Y/Y (iii) Δ/Y and (iv) Y/Δ connections. The ratio of turns per phase is 12 and neglect no load losses. (16)

13. (a) Obtain an expression for the mechanical force of field origin in a typical attracted armature relay. (16)

Or

(b) Find an expression for the magnetic force developed in a doubly excited magnetic systems. (16)

14. (a) Derive an expression for emf generated in

(i) Synchronous machine (8)

(ii) D.C machine. (8)

Or

(b) A 3Φ, 50 Hz, star connected alternator with two layer winding is running at 600 rpm. It has 12 turns/ coil, 4 slots/pole/phase and a coil pitch of 10 slots. If the flux per pole is 0.035 Wb sinusoidally distributed, Find the phase and line emf induced. Assume that the total turns/phase are series connected.

15. (a) Explain the different methods of excitation and characteristics of a DC motors with suitable diagrams. (16)

Or

(b) Explain the Ward-Leonard system of controlling the speed of a DC shunt motor with help of neat diagram. (16)

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Third Semester

Electronics and Communication Engineering

EE 1211 — ELECTRICAL MACHINES

(Common to Electronics and Instrumentation Engineering and Instrumentation and Control Engineering)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is a self excited d.c. machine?

2. State the advantages of Swinburne's test.

3. What is a step up transformer?

4. Draw the no load phasor diagram of single phase transformer.

5. Define slip of an induction motor.

6. List out four applications of single phase induction motor.

7. State any two applications of stepper motor.

8. Define voltage regulation of alternator.

9. What is the need of a sub-station in the power system?

10. What are the different types of cables generally used for 3-phase service?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss how a d.c. generator builds up e.m.f. (8)

(ii) A 4 pole generator with wave wound armature has 51 slots each having 24 conductors. The flux per pole is 0.01 weber. At what speed must the armature rotate to give an induced e.m.f. of 250 V. What will be the voltage developed, if the winding is lap connected and the armature rotates at the same speed? (8)

Or

(b) (i) Draw and explain the characteristics of D.C. shunt and series motors. (8)

(ii) A 400 V d.c. shunt motor takes 5 A at no load. Its armature resistance (including brushes) is 0.5 Ω and shunt field resistance is 200 Ω. Estimate the efficiency when the motor takes 50 A on full load. (8)

12. (a) Explain how the efficiency of a transformer may be found from the open circuit and short circuit tests.

Or

(b) (i) Describe the constructional features of any one type of single phase transformer. (8)

(ii) A 600 kVA single phase transformer has an efficiency of 94 % both at full load and half load at unity power factor. Determine the efficiency at 75% of full load at 0.9 power factor. (8)

13. (a) (i) Explain the principle of operation of 3 phase induction motor. (8)

(ii) Explain any one method of speed control technique adopted for speed control of a 3 phase induction motor. (8)

Or

(b) Write a brief note on :

(i) Shaded pole induction motor

(ii) Capacitor starts and Run induction motor. (8 + 8)

14. (a) Describe the method of determining the regulation of an alternator by synchronous impedance method.

Or

(b) Explain using a diagram the construction and working of reluctance motor.

15. (a) Explain the working of Nuclear power generation plant with schematic arrangement.

Or

(b) Explain in detail about different types of insulators.

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Third Semester

(Regulation 2004)

Electrical and Electronics Engineering

EE 1202 — ELECTRICAL MACHINES – I

(Common to B.E. (Part Time) Second Semester Regulation – 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Why do all practical energy conversion devices make use of the magnetic field as a coupling medium rather than an electric field?

2. State the necessary conditions for production of steady torque by the interaction of stator and rotor fields in an electric machine.

3. The series field winding has low resistance while the shunt field winding has high resistance. Why?

4. What are the arrangements to be done for satisfactory parallel operation of DC series generators?

5. Draw the mechanical characteristics of all types of DC motors in the same diagram.

6. How does 4-point starter differ from 3-point starter?

7. Under what value of power factor a Transformer gives zero voltage regulation?

8. Why is the Auto-Transformer not used as Distribution Transformer?

9. At what load does the efficiency is maximum in DC shunt machines?

10. Why is the short-circuit test on a Transformer performed on HV (High voltage) side?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Explain why distributed field winding is employed in cylindrical rotor synchronous machine. (6)

(ii) With neat sketch, explain the multiple-excited magnetic field systems in electromechanical energy conversion system. Also obtain the expression for field energy in the system. (10)

OR

(b) (i) Explain clearly how a rotating magnetic field is setup around the 3-phase AC winding having 120° (electrical) phase displacement each when 3-phase balanced supply is given to it. (8)

(ii) Obtain the torque equation for round rotor machine having p number of poles. State the assumptions made. (8)

12. (a) (i) Briefly explain the load characteristics of different types of compound generators. (8)

(ii) A 4-pole, lap connected DC machine has 540 armature conductors. If the flux per pole is 0.03 Wb and runs at 1500 rpm, determine the emf generated. If this machine is driven as a shunt generator with the same field flux and speed, calculate the terminal voltage when it supplies a load resistance of $40\,\Omega$. Given armature resistance as $2\,\Omega$ and shunt field circuit resistance as $450\,\Omega$. Also find the load current. (8)

Or

(b) (i) Two separately excited dc generators are connected in parallel. Discuss in detail how they share a load. (8)

(ii) The brushes of a 400 kW, 500 V, 6-pole DC generator are given a lead of 12° electrical. Calculate (1) the demagnetising ampere-turns, (2) the cross-magnetizing ampere-turns and (3) series turns required to balance the demagnetising component. The machine has 1000 conductors and the leakage co-efficient is 1.4. (8)

13. (a) (i) Derive from the first principle an expression for the torque developed in a DC motor. (8)

(ii) A 220 V DC shunt motor takes 5 A on no-load and runs at 750 rpm. The resistances of the armature and shunt field windings are 0.2 Ω and 110 Ω respectively. Calculate the speed when motor is loaded and taking a current of 50 A. Assume that armature reaction weakens the field by 3%. (8)

Or

(b) A 220 V, DC shunt motor with an armature resistance of 0.4 Ω and a field resistance of 110 Ω drives a load, the torque of which remains constant. The motor draws from the supply, a line current of 32 A when the speed is 450 rpm. If the speed is to be raised to 700 rpm what change must be effected in the value of the shunt field circuit resistance? Assume that the magnetization characteristic of the motor is a straight line. (16)

14. (a) (i) A 100 kVA, 6.6 kV/415 V single-phase Transformer has an effective impedance of (3+j8) Ω referred to HV side. Estimate the full-load voltage regulation at 0.8 pf lagging and 0.8 pf leading. (10)

(ii) Explain the need for parallel operation of single-phase Transformers Give the conditions to be satisfied for their successful operation. (6)

Or

(b) (i) The emf per turn of a single-phase, 6.6 kV, 440 V 50 Hz transformer is approximately 12 V. Calculate number of turns in the HV and LV windings and the net cross-sectional area of the core for a maximum flux density of 1.5 T. (6)

(ii) Explain the Open Delta connection to carry out 3-phase operation with the help of two transformers. State the disadvantage also. (10)

15. (a) The Hopkinson's test on two identical shunt machines gave the following results. Line voltage 230 V; line current excluding field current is 50 A; motor armature current is 380 A; generator and motor field currents are 5 A and 4.2 A respectively; armature resistance of each machine is 0.025 Ω. Calculate the efficiency of each machine at this load condition. (16)

Or

(b) (i) Show that the maximum efficiency in a transformer occurs when its variable loss is equal to constant loss. (6)

(ii) Find the all-day efficiency of a 500 kVA distribution Transformer whose iron loss and full–load copper loss are 1.5 kW and 6 kW respectively. In a day, it is loaded as follows. (10)

Duration (H_i)	Output (P_{oi}) in kW	Power factor ($\cos\phi_2$)
6	400	0.8
10	300	0.75
4	100	0.8
4	0	–