Full Marks: 70. Time: Three (03) Hours

N.B. (i) Answer SIX questions, taking THREE from each Section.
(ii) Figures in the margin indicate full marks.
(iii) Use separated answer script for each section

SECTION- A

Marks

Q.1 (a) State and explain Faraday's law and Lenz's law. $3\frac{2}{3}$

(b) List the reasons why a generator may fail to build up. How can each failure be corrected? 04

(c) The armature of a 2-pole generator is rotating at 3600 rpm. The armature has a simplex lap winding with a total of 1504 coductors. Determine the generated voltage when the flux per pole is $600{,}000\times10^{-8}$ wb. 04

Q.2 (a) What is the significant of critical resistance in a self-excited shunt generator? $2\frac{2}{3}$

(b) Define armature reaction. Describe 2-types of pole tip construction that would provide high reluctance pole tips. P-70 06

(c) A 10KW, 250 V shunt generator generates 257V at a field current of 2A. When delivering rated output, Determine the (i) Armature resistance (ii) Voltage regulation of the generator. 03

Q.3 (a) Why is it important that field circuit of a dc motor never be left open with power applied? $3\frac{1}{2}$

(b) Draw torque versus load current and speed versus load current characteristic curves of different types of dc motor. 8.12 Page 106 $3\frac{1}{2}$

(c) The following information was obtained from the name plate of a shunt motor: 5 hp, 240V dc, full-load current 20.4 A, field resistance 200Ω. If the armature resistance is 0.70Ω, determine (i) Power delivered to motor, (ii) Power dissipation in shunt field, (iii) Power dissipation in armature circuit, (iv) Electrical power converted to mechanical power. $4\frac{2}{3}$

Q.4 (a) Why transformers are rated in KVA? $3\frac{2}{3}$

(b) Briefly explain why a power transformer is judged by its all-day efficiency rather than by its full-load efficiency. 03

(c) The low voltage side of a 20KVA, 2400/240V, 50 Hz transformer is short circuited. The application of 72V on the high voltage side is found sufficient to flow rated current in the low voltage winding. A wattmeter on the high voltage side at this time reads 275 watts. Determine the transformer resistance and inductance referred to the high voltage side. 05

R_T Z_T

SECTION- B

Q.5 (a) Explain the basic principal of induction motor. Why does rotor rotate in the same direction as the stator magnetic field? 04

(b) What is dc motor starter? Why is it essential to start the dc motor? 03

(c) A 3-φ induction motor is wound for 4 poles and is supplied from 50 Hz system. Calculate (i) the synchronous speed (ii) the rotor speed, when slip is 4% and (iii) rotor frequency when rotor runs at 600 rpm. $4\frac{2}{3}$

Q.6 (a) Draw the equivalent circuit of the 3- φ induction motor. $2\frac{2}{3}$

(b) Derive the equation of running torque of 3- φ induction motor and also determine the condition of maximum running torque. 04

(c) A 50 hp, 440V, 50 Hz induction motor with star-connected stator winding gave the following test results 05

No load test	440V	24A	W_1=5150 watt	W_2=3350 watt
Blocked rotor test	33.6V	65A	W_1=2150 watt	W_2=766 watt

Assume stator winding resistance per phase is 0.11Ω. Calculate the parameters of the equivalent circuit.

Q.7 (a) What is meant by alternator? Draw the equivalent circuit of a 3- φ alternator. $3\frac{2}{3}$

(b) What is meant by synchronous speed? 03

(c) The total factory load on a 3- φ 2300V supply line is 1200KW at a lagging pf of 0.60. Find, 05
(i) The KVA ratings of a synchronous condenser required to raise the pf to 0.90 lagging.
(ii) The total KVA supplied by the line at the new pf.

Q.8 (a) Make a comparison between a dc generator and an alternator. $3\frac{2}{3}$

(b) What is stepper motor? Explain the working principle of permanent magnet stepper motor. 04

(c) Write short note on the followings: 04
(i) Universal motor (ii) Hysteresis motor.

***** The End *****

Full marks: 70 Time: Three (03) hours

N.B. Answer six questions, taking three from each section.
The questions are of equal value.
Use separate answer script for each section.

SECTION-A

Q1. (a) Describe the waveform of the induced voltage in a coil rotating in a magnetic field. 4

(b) Draw the thermal voltage, V_t, V_s load current, I_L curves of various types of dc generator in a single graph and compare them. $3\frac{2}{3}$

(c) A 100 KW, 600 V compound generator required an increase of 2.3 A in shunt-field current to raise the terminal voltage to 625 V when supplying current of 135 A. If the shunt field has 400 turns per pole and the series field $7\frac{1}{2}$ turns per pole and the series-field resistance is 0.009 Ω, calculate the resistance of the diverter. 4

Q2. (a) What is meant by a negative speed regulation? $3\frac{2}{3}$

(b) Draw the speed torque characteristics for different type of D.C. motor. 4

(c) A 10-*hP* shunt motor takes a line current of 5A when running light. Calculate the efficiency as motor when delivering full load output, if the armature and field resistance are 0.5 Ω and 250 Ω respectively. At what output power will the efficiency be maximum? P-1024 (T) 4

Q3. (a) Explain the effect of frequency and flux of voltage induced in a single phase transformer. 3

(b) What happens if you connect a dc source of rated voltage to a transformer? Explain. 2

(c) A 50 KVA, 2200/110 V transformer when tested gave the following results: 5
O.C. test (L.V. Side): 400 W, 10A, 110V
S.C. test(H.V. side): 808 W, 20.5A, 90V
Compute all the parameters of the equivalent circuit referred to HV side and draw the resultant circuit.

(d) Why are the transformers rated in KVA not in KW?

Q4. (a) Discuss the looses incurred in a dc motor and derive the mechanical power equation converted from electrical power. $1\frac{2}{3}$

(b) Explain how the speed of a dc motor can be controlled? $3\frac{2}{3}$

(c) A shunt motor connected to a 120 V line draws 24 A from the line. The resistance of the field circuit is 100 Ω and the armature resistance is 0.25 Ω. Calculate (a) Power input to the motor (b) Power lost in the shunt field (c) Power lost in the armature circuit and (d) Electrical power converted to mechanical power. $3\frac{1}{2}$ $4\frac{1}{2}$

SECTION-B

Q5. (a) Explain V curve and inverted V curve for the synchronous motor. $3\frac{2}{3}$

(b) Explain the role of damper winding in a synchronous motor in making its speed constant. 4

(c) A 2000 V, 3-phase star connected synchronous motor has an effective resistance and synchronous resistance of 0.2 Ω and 2.2 Ω respectively. The input is 800 KW at normal voltage and the e.m.f. is 2500 V. Calculate the line current and power factor. 4

Q6. (a) Deduce the equation of starting torque of a 3-phase induction motor and also determine the condition for maximum starting torque. P-1515 (T) 4

(b) How is it possible to represent the mechanical load of a induction motor? What are the advantages of doing this? $3\frac{2}{3}$

(c) A 1100 V, 50 Hz delta connected induction motor has a start-connected slip-ring rotor with a phase transformer ratio of 3.8. The rotor resistance and standstill leakage reactance are 0.012Ω and 0.25 Ω per phase respectively. Neglecting stator impedance and magnetising current determine. 4

(i) The rotor current at start with slip ring shorted.
(ii) The rotor power factor at start with slip-ring shorted.
(iii) The rotor current at 4% slip with slip-rings shorted.

Q7. (a) What is hunting? How hunting effect can be minimized? 4

(b) Explain the effect of load changes on the synchronous motor in terms of armature current, power factor and torque angle. 4

(c) How many turns are required to obtain a voltage of 0.06 V in a coil rating at 2000 r/min if the flux per pole of a six pole generator in 3×10^3 maxwells. $3\frac{2}{3}$

Q8. (a) Explain one method for speed control of DC motor. 4

(b) A 5-*hP*, 240 V shunt motor has a full-load current of 20.4 A. The armature resistance of the motor in 0.71Ω. Design the steps of the series starting resistor so that the motor current will not exceed 200 percent of full-load value. 4

Time: Three Hours Full Marks: 70

Note:
(i) Answer Six questions taking Three from each section
(ii) Figures in the right margin indicate full marks
(iii) Use separate answer script for each section

SECTION-A

Q1. (a) Define critical resistance. Explain the effect of field resistance on the voltage buildup process of a self excited shunt generator. 3

(b) Explain the three reasons why the terminal voltage of a self excited shunt generator will decrease with the application of increased load. 4 2/3

(c) A 600 V, 100kW long shunt compound generator has bush voltage drop of 5V, series field resistance of 0.02Ω, a shunt field circuit resistance of 200Ω, and an armature circuit resistance of 0.04Ω. When the rated current is delivered at rated speed of 1200 rpm, calculate armature current and generated armature voltage. 4

Q2. (a) What is meant by "back emf" in a dc motor? 3

(b) Why is it important that the field circuit of the motor never be opened with power applied? 3

(c) A shunt motor operates at 1400 rmp when connected to a 110 V line. The armature current is 20A and the armature resistance is 0.15Ω. If the flux remains constant, determine the speed of the motor when the armature current is 34 A. 5 2/3

Q3. (a) Give at least three reasons for the widespread use of transformers. 3

(b) Explain how mutual flux remains constant in a single phase transformer. 4

(c) A 7.5 kVA 575/115 volt transformer is tested by means of the short circuit test. With the low side short circuited, rated current flows with an impressed voltage of 22 volts. The copper loss is 212 watts. 4 2/3

(i) Calculate all transformer constants with respect to both high and low voltage sides.
(ii) Calculate the voltage regulation at 0.80 lagging power factor.

Q4. (a) What are the basic differences between induction motor and DC motor? 3

(b) Explain the basic principle of induction motor, why the rotor rotates in the same direction as the stator magnetic field. 4

(c) Calculate the torque exerted by an 8-pole, 50 Hz 3-phase induction motor operating with a 4 percent slip which develops a maximum torque of 150Kg-m at a speed of 660 rpm. The resistance per phase of the rotor is 0.5 Ω. 4 2/3

SECTION-B

Q5. (a) What is a dc motor starter? Why is it essential to start the dc motor? 3

(b) Explain the silicon controlled rectifier scheme to control the speed of a dc motor. 4

(c) A 250 V shunt motor has full load armature current of 40 A and a speed of 1000 rpm. The resistance of the armature is 0.2 Ω. What resistance must be added in series with the armature in order to reduce the speed by 25% for the same load torque? 4 2/3

Q6. (a) Define torque angle of a synchronous generator. Derive the power and torque angle relation of a 1-φ synchronous generator. 3

(b) Define synchronizing current. Explain the role of synchronizing current in keeping two generators in parallel operation process. 3 2/3

(c) A 200kVA, 480 V, 50 Hz, Y connected synchronous generator with a rated field current of 5 Amp was tested and the following data were taken:
(i) V_{TOC} at rated I_F was measured to be 540 volt.
(ii) $I_{L,SC}$ at rated I_F was found to be 300A.
(iii) When a dc voltage of 10 volt was supplied to two terminals, a current of 25 amp was measured. Find the values of the armature resistance and the approximate synchronous reactance in ohms that would be used in the generator model at the rated conditioned.

Q7. (a) At what condition an induction motor produces maximum starting torque? Establish mathematical relationship. 4 2/3

(b) How the speed of the induction motor can be controlled? 3

(c) If the emf in the rotor of an 8-pole induction motor has a frequency of 1.5 Hz and that in the stator is 50Hz, at what speed is the motor running and what is the slip? 4

Q8. (a) Explain the role of Commutator and Brush in obtaining a DC voltage of a DC generator. 4 2/3

(b) Explain the effect of load changes on the synchronous motor in terms of armature current, power factor and torque angle. 4

(c) Explain the role of Dampes winding in a synchronous motor in making its speed constant. 3

Department of Computer Science and Engineering
Course no: EE 403 Course Title: Electrical Machines and Applications
Full marks: 70 Time: Three (03) hours

N.B. Answer six questions, taking three from each section.
The questions are of equal value.
Use separate answer script for each section.

SECTION – A

1. (a) Describe Fleming's right-hand rule.

(b) What are the functions of compensating winding and interpole?

(c) Show that the voltage induced in the armature of a generator is, $E_g = K\phi S$, where $k = \frac{zp}{60a}$.

(d) The following information is known about a generator: number of poles, 4; flux per pole, 20000 lines; turn per coil, 50; speed of rotation, 1800 rpm. How many coils must be connected in series to obtain a voltage of 120V?

2. (a) What do you mean by negative voltage regulation of a DC generator?

(b) Define magnetic saturation. How can magnetic saturation be determined from the magnetization curve?

(c) List the reasons why a generator may fail to build up. How can each failure be corrected?

(d) A 11.0 KW, 220 V separately excited shunt generator has no load terminal voltage of 235 V. The armature circuit resistance is 0.25 ohm. When full load is connected to the generator, determine
i) armature resistance drop
ii) drop due to armature reaction &
iii) voltage regulation

3. (a) Discuss the losses incurred in a d.c. motor and derive the mechanical power equation converted from electrical power.

(b) Why are starters required for DC motors?

(c) Write short note on dynamic breaking and regenerative breaking.

(d) When connected to a source of rated voltage, a 25 hp, 230 V shunt motor draws 6.1 amp at no load and at a speed of 1300 rpm. The field current is 1.0 amp at no load and at a speed of 1300 rpm. The armature circuit resistance is 1.0 ohm. Determine
i) the speed of the motor when the armature current is 80.0 amp (rated value) &
ii) speed regulation

4. (a) Define the term transformer. Show that the secondary induced voltage of a transformer is $E_2 = 4.44 f N_2 \phi_{max}$.

(b) Why transformers are rated in KVA and not in KW?

(c) A 13200/460 V, 25 Hz transformer is to be used on a 50 Hz system. If the flux density is to remain the same, what are the voltage ratings for 50 Hz?

SECTION – B

5. (a) Show that in an induction motor a magnetic flux of constant magnitude, but rotating at synchronous speed is set up when the 3-phase stator windings are fed by a 3-phase supply.

(b) Deduce the equation of starting torque of an induction motor (3 phase) and also determine the condition for maximum starting torque.

(c) Why is starter used to start a 3 phase induction motor?

6. (a) By simply looking at the two motors, how can you distinguish between a wound rotor and a squirrel-cage induction motor?

(b) Explain the Y Δ method of 3 phase induction motor starting.

(c) Describe the "Capacitor Split phase" starting methods of single phase induction motor.

(d) A 6 pole, 60Hz induction motor has a no load speed of 1196 rpm and a full load speed of 1150 rpm. Calculate
i) no load % slip
ii) full load % slip and
iii)% slip at stand still

7. (a) Write the principle of operation of a synchronous motor.

(b) A 6 pole, 50Hz synchronous motor is running at rated load. What is the speed of the motor?

(c) List the method of starting a ploy phase synchronous motor and briefly discuss one of them.

(d) Draw the schematic diagram of two phase servomotor and explain its operation.

(e) Explain the [illegible]

(f) What is stepper motor? Write some applications of stepper motor.

(g) Write short notes on variable reluctance stepper motor.

---------The END---------

Department of Computer Science and Engineering

Course no: EE 203 Course Title: Electrical Machines and Applications

Full marks: 70 Time: Three (03) hours

N.B. Answer six questions, taking three from each section.
The questions are of equal value.
Use separate answer script for each section

SECTION-A

Q1 (a) What factors determine the voltage induced in a conductor?
(b) Describe Fleming's right hand rule.
(c) What is the function of commutator in a dc machine?
(d) A 10KW, 250V, shunt generator generates 257V at a field current of 2A when delivering rated output. Determine the (i) armature resistance and (ii) voltage regulation of the generator.

Q2 (a) What is the significance of critical resistance in a self excited shunt generator?
(b) Define voltage regulation.
(c) Draw the terminal voltage V_t vs load current I_L curves of various types of generator in a single graph and compare them.
(d) A shunt motor connected to a 220V line draws 24A. The resistance of the field circuit is 250Ω and the armature resistance is 0.25Ω. Calculate (i) power input to the motor (ii) total power lost in the motor and (iii) power converted to mechanical power.

Q3 (a) What is meant by "back emf" in a dc motor?
(b) Why is it important that the field circuit of the motor never be opened with power applied?
(c) A shunt motor operates at 1400 rpm when connected to a 110V line. The armature current is 20A and the armature resistance is 0.15Ω. If the flux remains constant, determine the speed of the motor when the armature current is 34A.

Q4 (a) Briefly explain how the change in load current keeps the mutual flux in a transformer constant.
(b) Briefly explain why a power transformer is judged by its all day efficiency rather than by its full-load efficiency.
(c) The low-voltage side of a 20KVA 2400/240V, 50Hz transformer is short circuited. The application of 72V on the high voltage side is found sufficient to flow rated current in the low voltage winding. A wattmeter on the high voltage side at this time reads 275Watts. Determine the transformer resistance and inductance referred to the high voltage side.

SECTION-B

Q5 (a) Define pitch factor, K_p and distribution factor, K_d.
(b) What is the advantage of a fractional pitch winding?
(c) Draw the phasor diagram of a synchronous generator operated at leading power factor and hence determine the equation of the generated voltage.
(d) A 500KVA 1100V 50Hz 3 Φ alternator is Y connected. The effective resistance per phase is 0.10Ω, and the synchronous reactance per phase is 1.20Ω. Determine the voltage regulation of the alternator in percent for 0.90 lagging pf.

Q6 (a) List the power losses that occur in an alternator.
(b) Explain the effect of field current variation on the synchronous motor.
(c) The total factory load on a 3 Φ 2300V supply line is 1200KW at a lagging pf of 0.60. Find (i) the KVA rating of a synchronous condenser required to raise the pf to 0.90 lagging (ii) the total KVA supplied by the line at the new pf.

Q7 (a) Describe the effect of load on a synchronous motor.
(b) Why ac stator resistance of an alternator is much larger than the dc resistance?
(c) A 100hp 440 V 1500 rpm 50Hz 3 Φ synchronous motor has a Y connected stator and is designed to operate at unity pf at full load. The rated line current is 106A. The dc armature resistance is 0.061Ω per phase and the synchronous reactance is 2.25Ω per phase. Determine the generated phase voltage per phase, the torque angle and the hp developed at rated conditions.

Q8 (a) Define slip. At what speed does the stator field of a polyphase induction motor rotate? Explain.
(b) A 3 Φ Y connected 50Hz 2 pole induction motor is operating at its rated voltage and frequency. It develops a starting torque of 1.6 times the full load torque and a maximum torque of 2 times the full load torque. Determine (i) the synchronous speed, (ii) the slip at maximum torque (iii) the speed at maximum torque.
(c) Briefly explain the operating principle of a single phase induction motor.

Department of Computer Science and Engineering

Course no: EE 403 Course Title: Electrical Machines and Applications

Full marks: 70 Time: Three (03) hours

N.B. Answer six questions, taking three from each section.
The questions are of equal value.
Use separate answer script for each section.

SECTION-A

Q1. (a) Define voltage regulation. Can you determine the type of generator if the regulation becomes negative?

(b) Define armature reaction and explain the effect of armature reaction of a dc generator.

(c) A compound generator with rising characteristic has a terminal voltage of 130 V when supplying power to a remote load. The total line drop is 10 V. When load is removed from the generator the terminal voltage drops to 120 V. Determine

(i) Voltage at the load ;

(ii) Terminal voltage of the generator at no-load and

(iii) Voltage regulation.

Q2 (a) Explain Voltage build up process of a self excited dc generator. Why may a generator fail to build up process?

(b) Why is a shunt generator not used for remotely located load?

(c) Why is it required to operate a generator above the knee point of no load-magnetization curve?

(d) Explain the function of commutator and brushes in a dc generator.

Q3 (a) " Series motors are never used unless they are directly connected to the load", Explain.

(b) Compare the torque and speed characteristic curves for different type of dc motors.

(c) A 10 KW, 200 V dc self shunt generator generates 210 V at a field current of 2.0 amp when delivering rated output. Find (i) the armature resistance and (ii) the efficiency of the generator.

control the speed of a dc motor? Explain silicon control rectifier scheme to control the speed of a dc motor.

(c) Determine the resistance of each step of a starter for the following motor: 20 hp, 240 V, armature circuit resistance 0.5 Ω, full load current 45 A, starting current to be 200% of full load current.

SECTION-B

Q5 (a) What happens if you connect a dc source of rated voltage to a transformer? Explain.

(b) What is meant by efficiency of a transformer? Prove that maximum efficiency is obtained when the fixed losses are equal to the variable losses.

(c) Draw the full load phasor diagram of a single phase transformer.

Q6 (a) Explain the reasons Why three phase induction motor is called rotating transformer, asynchronous motor, and single excited motor?

(b) How and at what strength the field flux rotates in a 3 phase induction motor?

(c) The rated voltage starting torque of a poly phase induction motor is 1.75 times the full load torque. The motor is rated for 3 phase, 220 V operation, but a 208 V 3-phase supply is available. Determine the starting torque at this voltage. Express your answer in terms of rated torque.

Q7 (a) What do you mean by synchronous speed?

(b) What do you mean by alternator? Draw the equivalent circuit of a 3 phase alternator?

(c) " A synchronous motor is not inherently self-starting", Explain.

Q8 (a) What do you mean by mechatronics? Write some applications of dc brush less motor.

(b) Generate stator field pulses of a permanent magnet stepping motor by using C++ programming language with the help of computer parallel port for which the motor will rotate 90° for each change of excitation. Explain it's working principle.

--------- THE END ----------

Khulna University of Engineering & Technology (KUET), Khulna

B.Sc. Engineering 2nd Year 4th Semester Examination, 2002

Department of Computer Science and Engineering

Course No: EE 403 Course Title: Electrical Machines and Applications

Full Marks: 210 Time: Three (03) Hours

N.B. Answer six questions, taking three from each section.

The questions are of equal value.

The figures in the right margin indicate full marks.

SECTION - A

(a) Derive the fundamental dc generator equation for average emf between the brushes.

(b) Set reasons why a generator may fail to build up? How can each failure be corrected?

(c) The armature of a 110V dc generator delivers a current of 60A to a load. The armature resistance is 0.25Ω. The generator has 6 poles and 12 paths with a total of 720 conductors. The generator is driven at a speed of 1500 rpm. Calculate:

(i) The generated EMF in the armature.

(ii) The flux per pole.

(a) Give three reasons, why the terminal voltage of a self excited shunt generator decreases with the application of increased load.

(b) For a given value of load current, what is the effect of increasing the prime mover speed on the terminal voltage of a (i) shunt generator (ii) Cumulative compound generator.

(c) A 100V, 100kW long shunt compound generator has a brush voltage drop of 2V, a series resistance of 0.02Ω, a shunt field circuit resistance of 20Ω and an armature circuit resistance of 0.05Ω. When the machine is delivered at rated speed

(i) Armature Current

(ii) Generated armature voltage.

(a) Explain how is the electrical power converted to mechanical power in a dc motor.

(b) Explain why the series motor must be started with a mechanical load coupled to its armature. Also explain why all dc motors are started with maximum resistance in series with armature.

(c) The armature of a 230V shunt motor has a resistance of 0.30Ω and takes 50A at rated load at a speed of 1500 rpm. At what speed will the motor operate if the load is completely removed and the armature current drops to no load value of 5A? Assume a constant flux throughout the operation and the voltage drop at the brush at full load and no load are 2 volts and 1 volts respectively.

(a) Draw the torque – load characteristics curves for shunt, series, cumulative compound and differential compound dc motors in the same scale and explain their shapes.

(b) Explain how the speed of a dc motor can be controlled.

(c) A series motor has a resistance of 1 Ω between its terminals. The motor runs at 800 rpm at 200V taking a current of 15A. Calculate the speed at which the motor will run when connected in series with a 3 Ω resistance and taking the same current at the same supply voltage.

Q 5(a) Draw the equivalent circuit and full load vector diagram of a single phase transformer.

(b) What is excreising current? What are the compoicents of this current?

(c) A 10KVA, 600/240 V, 50 Hz transformer is tested on open and short circuit test, giving the following readings:

Open circuit test: V = 240V; I = 1.85A; P = 65W. (High side open)

Short circuit test: V = 22.5V; I = rated; P = 180W. (Low side shorted)

Calculate the full load efficiency at unity power factor. [illegible]%.

Q 6(a) Write down the conditions that must be met for proper synchronization of alternators.

(b) What is the function of an exciter?

(c) Calculate the open circuit line to line voltage of a 4 pole, 3 phases, 50 Hz, Y connected alternator with 36 slots and 30 conductors per slots. The flux per pole is 0.05 wb sinusoidally distributed. [illegible]V

Q 7(a) Explain how a synchronously rotating magnetic field is generated at the 3 phase stator of an induction motor

(b) Derive the expression of stand still torque of a 3 phase induction motor. Prove that the rotor current of a 3 phase induction motor is directly proportional to the slip under normal operating conditions.

(c) A 2-pole, 50Hz, 3 phases induction motor has a no load speed of 2990 rpm and a full load speed of 2880 rpm. Determine:

(i) The percent slip at no load,

(ii) The percent slip at full load and

(iii) The percent speed regulation

Q 8(a) With proper diagram, derive expression of maximum power developed in a synchronous motor

(b) Explain the double revolving field theory for the operation of single phase induction motor

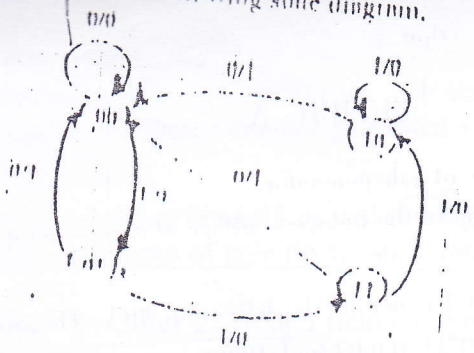
(c) Explain the operation of stepper motor.

..... The End .....

(iii) D flip-flop
(iv) T flip-flop

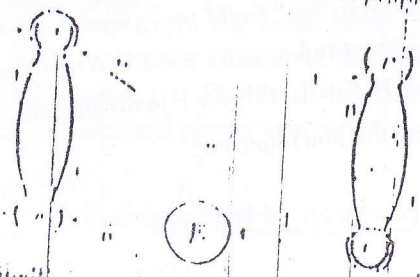
(c) What do you mean by stable and unstable conditions of asynchronous sequential circuit?

Q. Draw the state table from the following state diagram.



(b) How many ways to describe a set of strings? Explain

(c) What are the strings to accept by the following transition graph and why? Is it possible to recognize 111011 string by the following transition graph?

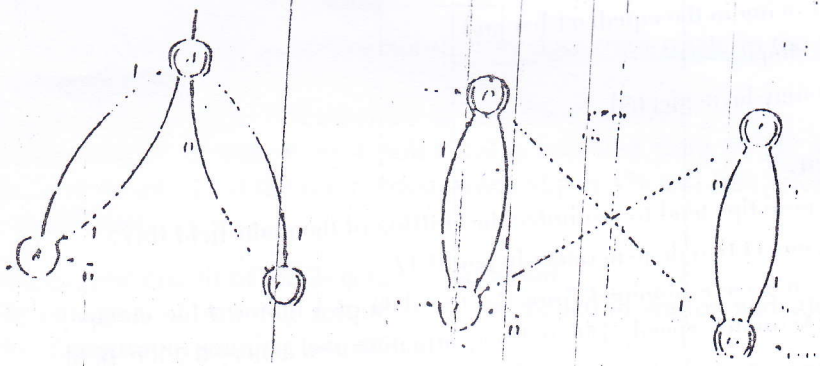


Q. (a) How to recognize by transition graph of the following expressions.

(i) (10^*)

(ii) $(01 + 10)^*11$

(b) Show that the following two graphs are equivalent by converting them to their deterministic forms.



..... The End .....

Department of Computer Science and Engineering

Course no: EE 303 Course Title: Electrical machines and Applications

Full marks: 20 Time: Three (03) hours

N.B. Answer six questions, taking three from each section

All questions are of equal value

Use separate answer script for each section

SECTION – A

1. (a) Describe the working principle of a dc generator.

(b) How to determine the direction of the induced voltage of a dc generator? Explain briefly.

(c) A 4-pole, lap wound shunt generator is delivering 90 A. The armature, series and shunt field resistances are 0.03Ω, 0.04Ω and 100Ω respectively. Calculate the voltage induced allowing a brush drop of 2 volts.

2. (a) Explain the functions of the commutator and brushes.

(b) What is the role of armature reaction in the "build up" process? Explain briefly.

(c) Is the voltage regulation is still important to know for electrical machines? If so, why?

(d) Two compound generators A and B fitted with an equalizing bar, supply a total load current of 500A. The data regarding the machines are:

	A	B
Armature resistance (ohm)	0.01	0.01
Series field resistance (ohm)	0.001	0.005
Generated emf (volt)	...	244

Calculate,

3. (a) (i) Current in each armature

(ii) Current in each series winding

(iii) The current in the equalizer bar and

(iv) The bus bar voltage.

Shunt current may be neglected.

3. (a) Explain armature reaction.

(b) How do high retentive pole tips tend to minimize the shifting of the main-field flux?

(c) What are conditions to be met to connect two dc generators in parallel?

(d) The following information were obtained from the test data of a motor: Line voltage, 120V; Line current, 15A; motor speed, 186 rad/sec; armature resistance, 0.75Ω; field resistance, 90Ω. Determine

(i) Counter emf

(ii) Developed

(iii) Developed

4. (a) Why are the starters used for motors?

(b) How does a four point starter overcome the objections of a three point starter?

(c) How only is the utilization of complete time delay starter?

(d) A 15kW, 250V, dc shunt generator has armature and field resistance of 0.06Ω and 100Ω respectively. Determine

(i) the total armature power developed when working

(ii) as a generator delivering 15kW output and

(iii) as a motor taking 15kW input.