PURWANCHAL UNIVERSITY
IV SEMESTER FINAL EXAMINATION- 2002
LEVEL : B. E. (Computer/Electronics & communication)
SUBJECT: BEG224EL, Electric Machine & Drives.

Full Marks: 80

TIME: 03:00 hrs   **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.
All question carry equal marks.

Attempt any FIVE questions.

Q. **[1]** **[a]** Describe operating principle of an ideal transformer and develop its emf equation.

[b] The following data is obtained from an open circuit and short circuit test of an 1 ø , 200/400 V, 50Hz, transformer. Develop the equivalent circuit reference to low voltage side of a transformer:
O.C Test: 200V 0.7A, 70W,   On L.V side.
S.C Test: 15V, 10A, 85W,   On H.V side.

Q. **[2]** **[a]** How the dc voltage is genearated in dc generator? What are the types of generators? Describe with circuit diagram and terminal voltage relation.

[b] A 230V dc series motor has an armature circuit resistance of 0.2 Ω and field resistance of 0.1 Ω. At rated voltage, the motor draws a line current of 40A and runs at a speed of 1200 rpm. Find the speed of the motor for a line current of 20A at 230V. Assume that the flux at 20A line current is 70% of the flux at 40A line current.

Q. **[3]** **[a]** Why the starting of dc motor is necessary? Describe the operation of a 3-point starter with neat sketch.

[b] What do you mean by servomotor? Why the high armature resistance is preferred in the design of servomotor?

Q. **[4]** **[a]** Describe the effect of excitation in synchronous machine with V-curves and inverted V-curve.

[b] A 550V, 55KVA, 1- ø alternator has an effective resistance of 0.2 Ω. A field current of 10A produces armature current of 200A on short circuit and an emf of 400V on open circuit.

Calculate:
(i) the synchronous reactance.
(ii) The full

Q. **[5]** **[a]** How the speed of dc motor can be controlled by controlled rectifiers? Describe with circuits and characteristics.

[b] Explain the operating principle of Schrage variable speed motor with necessary diagram.

Q. **[6]** **Write short notes on (any FOUR):**
[a] Eddy current and Hysteresis loss.
[b] Instrument transformers.
[c] Armature reaction in dc machines.
[d] Stepper motor.

Candidates are required to give their answers in their own words as far as practicable.
All question carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any FIVE questions.

Q. [1] [a] "The flux in the transformer core remains constant irrespective of loading condition". Justify this statement. [5]

[b] What do you mean by an ideal transformer? [3]

[c] A single phase transformer has a primary winding of 800 turns and secondary winding of 200 turns. When the load current on the secondary is 80A at 0.5 p.f lagging, the primary current is 25A at 0.707 p.f lagging. Determine the no-load current of the transformer and its phase w.r.t the voltage. [8]

Q. [2] [a] How the arrangement of carbon brush and commutator segement changes the ac emf induced in the armature winding into dc in a dc generator? Explain with necessary diagrams. [5]

[b] Prove that the torque developed by the dc motor is proportional to the flux and armature current. [3]

[c] A 220V dc shunt motor running at 1000 rpm takes an armature current of 17.5A It is required to reduce the speed to 600 rpm. What must be the value of resistance to be inserted in the armature circuit if the original armature resistance is 0.4 Ω ? Assume that the load torque remains constant during this process. [8]

Q. [3] [a] What are the conditions to be fulfilled while tow alternators are to be connected in parallel? Describe the process of synchronizing two alternators with necessary diagram. [8]

[b] A 3-phase , star connected alternator is rated at 1600 kVA, 13500V. The armature resistance and synchronous reactance are 1.5 Ω and 30 Ω respectively per phase. Calculate athe percentage regulation for a load of 1280 KW at 0.8 leading power factor. [8]

Q. [4] [a] What are synchronous? How they can be used for the transmission of torque between shafts located at different places? Explain with neat circuit diagram. [8]

[b] Why single phase induction motor is not self starting? Explain. [8]

Q. [5] [a] Describe the working principle of Schrage motor with necessary diagram. [8]

[b] Describe the two-quadrant operation of dc motor drive with controlled rectifier circuit. [8]

Q. [6] Write short notes on (any FOUR): [4×4=16]
[a] Core loss in magnetic circuit.
[b] Armature reaction in dc machine.
[c] V-curves and inverted V-curves of synchronous motor.
[d] PMCD motor.

PURWANCHAL UNIVERSITY
IV SEMESTER FINAL EXAMINATION- 2004
LEVEL : B. E. (Computer/Electronics & communication)
SUBJECT: BEG224EL, Electric Machine & Drives.

Full Marks: 80

TIME: 03:00 hrs   **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.

All question carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any FIVE questions.

Q. **[1]** **[a]** Define ideal transformer. Explain the loaded operation of transformer. [5]

[b] Define hysteresis and eddy current loss. How these losses can be reduced? [4]

[c] In a 25KVA, 2000/220V, 50Hz transformer, the iron and copper losses are 350 and 400 watts respectively. Calculate the efficiency at half load and full load at 0.8 power factor lagging. [7]

Q. **[2]** **[a]** What are the roles of back emf in dc motor? [4]

[b] Describe the load characteristics for dc shunt and series generator. [6]

[c] A 220V dc shunt motor running at 700rpm has an armature resistance of 0.45 Ω and takes armature current of 22A. What resistance should be connected in series with the armature to reduce the speed to 500rpm?

Q. **[3]** **[a]** Why 3-ø synchronous motor are not self starting? Explain any one method of starting synchronous motor. [7]

[b] A 6-pole 50Hz, 3-ø induction motor runs at 3% slip at certain load. Determine synchronous speed, rotor speed and frequency of rotor current? [5]

[c] Explain the operation of capacitor start 1-ø induction motor with circuit and characteristics graph. [4]

Q. **[4]** **[a]** How does a controlled rectifier control the speed of dc motor explain with necessary circuit diagram? [6]

[b] Explain the operation of single stack variable reluctance stepper motor with necessary circuit diagram. [4]

[c] Explain the unipolar drive circuit operation for a 3ø variable reluctance stepper motor with necessary circuit diagram. [6]

Q. **[5]** **[a]** How does a Scharage motor operate for speed control? Explain with necessary circuit. [8]

[b] Explain the operation of synchro for torque transmission between shafts located at different places. [8]

Q. **[6]** **Write short notes on (any FOUR):**

[a] Hard and Soft Magnetic materials.
[b] Open Circuit Test of Transformer.
[c] Armature reaction in DC motor.
[d] Voltage Regulation of Alternator
[e] V-curves and Inverted V-curves.

PURWANCHAL UNIVERSITY
IV SEMESTER FINAL EXAMINATION- 2005
LEVEL : B. E. (Computer/Electronics & communication)
SUBJECT: BEG224EL, Electric Machine & Drives.
Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.
All question carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any FIVE questions.

Q. [1] [a] Define idea transformer. Derive an emf equation of a transformer. [2+4]
[b] Define hysteresis & eddy current loss in transformer and write down the practical methods which are used to reduce such losses. [2+2]
[c] A 25Kva 1-ø, 2200/220 V transformer has primary and secondary winding resistance 1.5 Ω and 0.075 Ω respectively. Iron loss for this transformer is 210 watts. Calculate the efficiency of transformer at half load, full load and 25% overload at unity power factor. [6]

Q. [2] [a] Explain the voltage build up process of dc shunt generator with necessary diagrams. [4]
[b] Describe the load characteristics for dc shunt and series generator. [6]
[c] A 220V dc shunt motor runs at 700 rpm at no load and draws a no load current of 5A. When the motor is loaded the motor draws a current of 35A. Armature winding resistance of motor is 0.045 Ω and field winding resistance 220 Ω. Calculate the speed of motor at loaded condition. [6]

Q. [3] [a] Explain with necessary circuit diagrams and terminal relations the different types of dc generator. [6]
[b] Describe with simple block diagram that how the voltage of dc generator can be made automatically regulated. [4]

[c] Draw the equivalent circuit diagram of a power transformer and explain the logic behind the connection of parameter in their respective locations. [6]

Q. [4] [a] Explain the simple constructions and operation of a synchronous generator. [6]
[b] What do you mean by synchronization of alternators. Write down the conditions to fulfilled for successful synchronized operation. [6]
[c] A 6-pole 3- ø induction motor runs at 3% slip at certain load. Determine synchronous speed, rotor speed & frequency of rotor current?

Q. [5] [a] Explain the operation of capacitor start induction motor with circuit & characteristics graph. [6]
[b] How the speed control of dc motor is possible with the use of controlled rectifier circuit? Explain with necessary circuit diagram. [4]
[c] How does a Scharge motor operate explain with its construction arrangement. [6]

Q. [6] **Write short notes on (any FOUR):** [4×4=16]
[a] Ampere's Circuital law.
[b] Hard and soft magnetic materials.
[c] Armature reaction in dc motor.
[d] V- and Inverted – V curves.
[e] Open circuit test of transformer.

PURWANCHAL UNIVERSITY
IV SEMESTER BACK –PAPER EXAMINATION- 2005
LEVEL : B. E. (Computer/Electronics & communication)
SUBJECT: BEG224EL, Electric Machine & Drives.

Full Marks: 80

TIME: 03:00 hrs   **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.

All question carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any FIVE questions.

Q. [1] [a] Write the expression for efficiency of a transformer and hence establish the condition for the maximum efficiency. [8]

[b] A 50 KVA 6360/240V transformer gave the following test results:
Open circuit test: $V_{pirmary}$ = 6360 volts; $I_{primary}$ = 1A, P_{input}= 2KW . Short circuit test: $V_{primary}$ = 1325 volts, $I_{secondary}$ = 175A; P_{input} = 2KW.
Calculate the efficiency of the transformer when supplying full-load current at unity power factor. [8]

Q. [2] [a] A 220 volts shunt motor on no-load runs at 1000 rmp and draws 5A form the lines. The armature is 0.2 Ω and the field circuit resistance is 220 Ω. Calculate the speed of the motor when it is loaded and draws a current of 40A. Assume the constant flux. [8]

[b] A 10KW dc short shunt generator delivers a current of 50A to the load at 250 volts. The armature winding resistance is 0.4 Ω ; series and shunt field resistances are 0.02 Ω and 100 Ω respectively. If, the voltage drop per brush is 1 volt. Calculate the emf generated by the armature. [8]

Q. [3] [a] What are the necessary conditions for parallel operation of two alternators? [3]

[b] Explain the effect of excitation of a synchronous motor on its armature current and power factor with characteristics curve. [8]

[c] A 6-pole induction motor is supplied form a 400V; 3-phase , 50Hz supply system. The frequency of the rotor induced emf is 2Hz. Calculate [a] the percentage slip, [b] the rotor speed. [4+4]

Q. [4] [a] Explain the working principle of single-phase induction motor with the help of double revolving field theory. [8]

[b] Describe the construction of Schrage variable speed motor with neat sketch. [8]

Q. [5] [a] Deduce the equation for speed of a dc motor and hence suggest various methods of speed control. [8]

[b] Explain the working principle of two-quadrant converter with connection diagram. [8]

Q. [6] [a] Calculate the flux produced by the solenoid coil wound on a iron ring of cross-sectional area 4cm² and diameter of 8cm. Provided that ampere-turn solenoid is 500 and relative permeability of iron is 3500. [8]

[b] Write short notes on (any FOUR): [4×2=8]
   [i] Magnetic saturation.
   [ii] Auto- transformer
   [iii] Servo-type motor
   [iv] Synchronous impedance of alternator.
   [v] Armature reaction in dc machine.

Candidates are required to give their answers in their own words as far as practicable.
All question carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any FIVE questions.

Q. [1] [a] What do you mean by no load and load loss in transformer? Explain how short circuit and open circuit test of transformers measure the load loss and no load loss in transformer. [6]

[b] "Secondary of current transformer should not be left open". Explain. [4]

[c] A 50KVA, 2400/240V, transformer has a core loss 200watt at rated voltage and copper loss 500 watt at full load. It has the following load cycle.

%load	0.0%	50%	75%	100%	110%
Cosø		1	0.8log	0.9log	1
Hours	6	6	6	3	3

Determine the all day efficiency of a transformer. [6]

Q. [2] [a] What is armature reaction in D.C machines? How it is minimized? [4]

[b] Define the short time and continuous rating of DC machine what are the different methods of cooling in DC machine? [4]

[c] A separately excited DC generator when running at 1000 rpm suppliers 200A at 125 volt. What will be the load current when the speed drops to 800 rpm if the field current is unchanged, given that armature resistance = 0.04 Ω and brush drop = 2V. [8]

Q. [3] [a] Explain how the speed control above the below he rated speed is done in DC motor. [5]

[b] How the duration of rotation of DC motor can be changed in DC motor. [3]

[c] A 250V DC shunt motor has armature resistance of 0.2 Ω. On load it takes an armature current of 50A. and runs at 750rpm. If the flux of that motor is reduced by 10% without changing the load torque, find the new speed of motor. [8]

Q. [4] [a] Explain the torque-slip characteristics of induction motor. [4]

[b] What is voltage regulation in synchronous generator? Draw the neat phasor diagram for synchronous generator for the load of unity power factor, lagging power factor and lading power factor. [4]

[c] A 3ø Y-connected , 50HZ, 1600KVA, 13500 Volt synchronous reactance are 1.5 Ω and 30 Ω respectively per phase. Calculate the percentage regulation for a load of (i) 1280KW at 0.8 power factor lagging (ii) 1280 KW at 0.8 power factor leading. [8]

Q. [5] [a] Explain how the two quadrant operation is achieved in DC drive using diodes and controlled rectifier? [5]

[b] Why single phase induction motor is not self starting? Explain the double field revolving theory of single phase induction motor. [6]

[c] Why is soft starting is required with induction motor? Explain the various types of soft starter in Induction motor. [5]

Q. [6] **Write short notes on (any FOUR):** [4×4=16]
[a] Hysteresis and eddy current loss.
[b] Back emf of DC motor.
[c] Capacitor start motor.
[d] Cycloconverter.
[e] Series-parallel speed control of DC motor.
[f] V-curves of synchronous motor.

PURWANCHAL UNIVERSITY
IV SEMESTER BACK-PAPER EXAMINATION- 2006
LEVEL : B. E. (Computer/Electronics & communication)
SUBJECT: BEG224EL, Electric Machine & Drives.

Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.
All question carry equal marks. The marks allotted for each sub-questions is specified along its side.

Attempt any FIVE questions.

Q. [1] **[a]** Explain the operation of transformer on load and justify that the flux in the core remains constant irrespective of load. [5]

[b] For the magnetic circuit of fig 1 where
N=400 turns .
Mean core length l_c = 100 cm
Air gap length l_a = 2mm
Cross sectional area, A_c = 15 cm^2
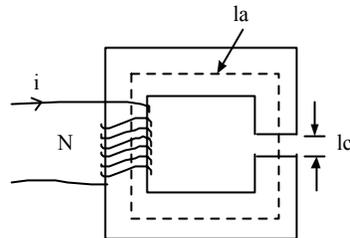Relative permeability of the core = 4000
And current i = 3A
Calculate,
i) Flux in the air gap.
ii) Inductance of the coil.

Q. [2] **[a]** A 1ø , 20KVA, 2000/400 V, 50 Hz transformer gave the following results.

Test	Volt	Ampere	Watts
OC test	400	5	150
SC test	100	10	300

i) Calculate and draw the equivalent circuit of the transformer referred to the HV side.
ii) Calculate efficiency and voltage regulation of the transformer for 50% overload.

Q. [2] **[a]** Derive expression for torque production in demotor and prove that the armature torque is proportional to the armature current. [5]

[b] A 30KW short shunt generator delivers a current of 100A to a load at 400V. The armature winding resistance is 0.1Ω, the series field winding is 0.05 Ω and the shunt field winding is 200Ω. If the voltage drop per brush is 2V, calculate the emf generated by the armature. [5]

[c] A 400V dc series motor draws a current of 80A when running at 1000rpm. Calculate the speed at which the motor will run and the current taken from the supply if the field winding is shunted by a resistance double the field resistance and load torque is increased by 50%. Given Ra = 0.2 Ω and R_{se} = 0.1 Ω [6]

Q. [3] **[a]** What do mean by armature reaction? Explain the armature reaction in synchronous generator for resistive, inductive and capacitive and capacitive loads. [8]

[b] A six pole 50Hz. 3 phase induction motor develops a starting torque of 80N-m. The rotor winding has impedance of (0.8+j4) ohm per phase. [8]
Calculate:
[i] Synchronous speed.
[ii] Speed at which motor develops maximum torque.
[iii] Value of max torque.

Q. [4] **[a]** Explain why a single phase motor is not self starting with reference to double revolving field theory. [7]

[b] What is synchro and what are its types? Explain with neat sketch how synchros can be used for the transmission of torque between shifts located at different places. [7]

[c] Why should a dc series generator always started with load? **[2]**

Q. [5] **[a]** Describe with neat sketches the construction and working of a scharge variable speed motor. [8]

[b] Explain the working of two quadrant converter with connection diagram. [8]

Q. **[6]** **Write short notes on (any FOUR):** [4×4=16]

[a] Autotransformer

[b] Commutation.

[c] Critical resistance and critical speed of dc generator.

[d] V curves and inverted V curves of synchronous motor.

[e] Working principle of three induction motor

[f] Cycloconverter.