13 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEL	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Utilization of Electrical Energy *(EE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) What are the advantages of electrical energy over other forms of energy? Also discuss different types of electrical consumer on basis application and end use. [8]

   b) What are the factors which limit the choice of high frequency in induction and dielectric heating? Calculate KVA and KW drawn from supply, its p.f. and electrical efficiency with the following data pertaining to an electric arc furnace three phase. Current drawn = 4500 A, arc voltage = 50 V, resistance of transformer referred to secondary = 0.002 ohms and reactance of transformer referred to secondary = 0.004 ohms. [4+4]

2. a) Explain 4-quadrant operation of a dc motor with help of loaded and unloaded cage. [8]

   b) A 550 V, 45kW, 600 rpm dc shunt motor has a full load efficiency of 90%. The field resistance is 200 Ω and armature resistance is 0.2 Ω. Find the speed under each of the following conditions at which will develop an electromagnetic torque equal to the related value: [8]

      i) Regenerative braking with no limiting resistance
      ii) Plugging with external limiting resistance of 5.5 Ω inserted.
      iii) Dynamic braking with external limiting resistance of 2.6 Ω inserted. The field current is maintained constant and armature reaction and brush drop may be neglected.

3. a) A 500 V, 1500 rpm, 100 A separately excited motor is fed from a 350 V, 3-phase supply through a 3-phase. Semi-controlled bridge converter. Armature resistance is 1.1 ohm. If firing angle is 45° find rms source current, rms thyristor current, and average thyristor current and power factor at input terminals. Assume constant armature current and speed of 1200 rpm. [8]

   b) What do you mean by slip power recovery system? Explain in detail the different methods of slip power recovery. [8]

4. a) Why tramways are losing ground to other system of traction? And what is the scope of application of battery drive? [4]

   b) A train runs between two stations 2 KM apart at an average speed of 40km/hr. The run is to be made according to simplified quadrilateral speed-time curve. If the maximum speed to be limited to 80 km/hr, acceleration to 2 km/hr/s, coasting retardation to 0.15 km/hr/s and braking retardation 3 km/hr/s. Determine the duration of acceleration, coasting and branking periods. [8]

   c) Explain how actual speed-time curve for an electric train service can be replaced by a curve having a simple geometric shape. What type of train services corresponds to trapezoidal and quadrilateral speed time curves? [2+2]

5. a) What are the importance of demand side management? Explain its objectives for effective demand side management. [4]

b) What is two part tariff? Compare it with power factor tariff. [4]

c) A 35 kW induction motor has p.f.0.9 and efficiency 0.9 at full load, power factor 0.6 and efficiency 0.7 at half load. At no-load the current is 25% of full-load current and power factor 0.1. Capacitor are supplied to make the line power factor 0.8 at half full-load. With these capacitor in the circuit, find the power factor at (i) full load and (ii) no load. [8]

***

13 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEL	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Utilization of Electrical Energy *(EE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ ***All** questions carry equal marks.*
- ✓ *Assume suitable data if necessary.*

1. a) Classify and explain different types of electrical consumers on the basis of voltage level.

   b) What are the factors to be considered for electric heating in building design?

2. a) What do you mean by electric drive? Compare between individual, group and multi-motor drives with applications.

   b) A horizontal conveyer belt moving at uniform speed of 2.2 m/s transports material at the rate of 200 tones/hour. Belt is 100m long and driven by a motor at 1500 rpm.

   (i) Determine load inertia referred to motor shaft.
   (ii) Calculate torque that motor should develop to accelerate the belt from standstill to full speed in 8 sec. Moment of Inertia of motor is 0.1 kg-m^2.

3. a) Explain Ward-Leonard type variable speed drives enlisting its major benefits and dis benefits.

   b) A 8-pole 25 Hz 3 phase induction motor is running at 4% slip when delivering full load torque. It has standstill rotor resistance of 0.1 Ω and reactance 0.6 / phase. Calculate the speed of motor if additional resistance of 0.5 Ω / phase is used.

4. a) What do you mean by electric traction? Draw the speed-time curve for urban, sub-urban and main line services explaining the following terms: Free run period, Coasting Period.

   b) A train runs between 2 stations 2 km apart at an average speed of 40 km/hr. The run is to be made according to simplified quadrilateral speed-time curve. If the maximum speed is to be limited to 60 km/hour, acceleration to 2 km/h/sec, coasting retardation to 0.15 km/h/sec and braking retardation 3 km/h/sec, determine the duration of acceleration, coasting and braking periods.

5. a) What are the causes and disadvantages of low power factor? Briefly describe the differences between static capacitors and synchronous capacitors used for improving power factor of a machine.

   b) The load on an installation is 600 kW, 0.8 lagging which works for 2000 hours per annum. The tariff is Rs 80 per kVA plus 20 paisa per kWh. If the power factor is to be improved to 0.9 lagging by the means of capacitors costing Rs.50 per kVAR, find the annual saving. Allow 10% per annum for interest and depreciation on capacitors.

***

15 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Utilization of Electrical Energy *(EE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ ***All** questions carry equal marks.*
- ✓ *Assume suitable data if necessary.*

1. a) What do you mean by electrical energy? Explain the different class of electrical consumers and their demand.

   b) A low frequency induction furnace operating at 10V in the secondary circuit takes 500kW at 0.5 p.f when the hearth is full. If the secondary voltage be maintained at 10V, estimate the power absorbed and the p.f when the hearth is half full. Assume the resistance of the secondary circuit to be thereby halved and the reactance to remain the same.

2. a) A 30 kW, 220V, dc shunt motor with a full load speed of 535 rev/min is to be braked by plugging. Estimate the value of resistance which should be placed in series with it to limit the initial braking current to 200A. What would be the initial value of the electric braking torque and the value when the speed has fallen to half its full load value? (Given: armature resistance of motor = 0.086 Ω, Full load armature current = 150A)

   b) For the selection of various types of motor, what are the classes of duties to be performed by the motor on the basis of load variations? List out some examples of driver/machine applicable to various classes of duties.

3. a) How three phase induction motor has controlled by variable frequency method? Explain with necessary mathematical relation and figures.

   b) A separately excited dc motor is fed from a three phase six pulse fully controlled bridge converter. The motor develops its full load torque at a rated speed of 1800 rpm taking a current of 60 A from a 400 V supply. Determine the rms value of supply voltage if the motor runs at its rated conditions for $\alpha = 0$. What is the range of firing angles for a speed control of 1800 rpm to 900 rpm. The armature resistance is 0.5 ohm. The supply and thyristors are ideal.

4. a) An electric train is to have accleration and braking retardation of 1.2 km/h/s and 3.8km/h/s respectively. If the ratio of maximum to average speed is 1.6 and time for stop 45 seconds, find the schedule speed from a run of 2.5 km. Assume simplified trapezoidal speed time curve.

   b) What is self-contained electric vehicle? What are transmission system employed in these types of electric vehicle? Explain.

5. a) What is demand side management? Explain the effective techniques for effective demand side management.

   b) A 50 Hz HP induction motor has power factor 0.9 and efficiency 90% at full load, power factor 0.6 and efficiency 70% at half load. At no-load the current is 25% of the full-load current and power factor 0.1. Capacitors are supplied to make the line power factor 0.8 at half load. With these capacitors in circuit, find the line power factor at (i) full-load and (ii) no-load

***