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EE 1818 PE 71

Roll No. of candidate | | | | | | | | | | |

2023

B.Tech. 8th Semester End-Term Examination

Electrical Engineering

UTILIZATION AND CONSERVATION OF ELECTRICAL ENERGY

New Regulation (w.e.f. 2017 – 18) & New Syllabus (w.e.f. 2018 – 19)

Full Marks – 70 Time – Three hours

Numbers in margin indicate full marks for the questions

Attempt Q. No. 1 and any *four* from the rest

1. (A) Select the most appropriate option from the given options $(6 \times 1 = 6)$

(i) Tractive effort is required to

(a) Overcome the gravity component of train mass.

(b) Overcome friction, windage, curve resistance

(c) Accelerate train mass

(d) All of these

(ii) It is desirable to operate arc furnaces at power factor of

(a) Zero (b) 0.707 lagging

(c) Unity (d) 0.707 leading

(iii) Resistance variation method of temperature control is done connecting resistance elements in

(a) series (b) parallel

(c) series–parallel (d) star–delta

(e) All of these

(iv) Due to which of the following reasons aluminium is difficult to weld?

(a) It has an oxide coating (b) It conducts away heat very rapidly

(c) Both (a) and (b) (d) None of these

[Turn over

(v) The specific energy consumption of a train depends on which of the following?

(a) Acceleration and retardation

(b) Gradient

(c) Distance covered

(d) All of these

(vi) The material of the beating element for a furnace should have

(a) Lower melting point (b) Higher temperature coefficient

(c) High specific resistance (d) All of these

(B) Attempt any two $(2 \times 2 = 4)$

(i) Why trapezoidal speed time curve is suitable for main line service?

(ii) What factors affect specific energy consumption?

(iii) What are the advantages of improved power factor?

(iv) List the properties of a good heating element.

(v) What is pulsation welding?

2. (a) Explain why energy storage devices are required in power system. Draw relevant graphs etc.

(b) Discuss how energy can be stored in fly wheel. Derive necessary mathematical, expression.

(c) Discuss the role of storage batteries in power system.

It is desired to discharge a storage battery consisting of 115 cells, each having an emf of 2.1 V and internal resistance of 0.001 ohm , into 220 V bus bars so that the battery delivers 100 A. Determine the value of resistance to which the series resistor must be adjusted. (5+5+5=15)

3. (a) Distinguish between dielectric heating and induction heating.

(b) A piece of an insulating material is to be heated by dielectric heating. The size is 12 cm × 12 cm × 3 cm. 20 MHz is used and the power absorbed is 450 W. If the material has a relative permittivity of 5 and power factor of 0.05, calculate the voltage necessary for heating and the current that flows in the material.

(c) A 27 kW, 3 phase, 400 V resistance oven is to employ nickel chrome strip 0.25 mm thick for the star connected heating elements. If the temperature of the strip is to be 1000° C and that of the charge be 600° C, estimate a suitable width for the strip. Assume emissivity as 0.9, radiating efficiency to be 0.5 and resistivity of the strip material as 101.6×10^{-8} ohm–meter.

(2+6+7 = 15)

4. (a) With the help of various circuits, describe how a variable AC supply can be obtained for AC arc welding.

(b) How do you prevent electrode in spot welding from sticking to work piece? What are the qualities of a good weld?

(c) A train is required to run between two stations 2 km apart at a scheduled speed of 36 km/hr, the duration of stops being 20 seconds. The braking retardation is 2.7 kmphps. Assuming a trapezoidal speed time curve, calculate the acceleration if the ratio of maximum speed to average speed is 1.2. (5+3+7 = 15)

5. (a) List the motivations for energy conservation

(b) Explain the various steps of energy conservation planning. Discuss the uses of Energy Quality Index and Energy Quantity Index.

(c) Describe how energy conservation can be achieved in generation-transmission-distribution network of a power system. (2+5+8 = 15)

6. (a) Distinguish between topping cycle and bottoming cycle in regard to cogeneration.

(b) Discuss the working of a very efficient co-generation technology with the help of suitable diagram.

(c) An electric train has quadrilateral speed time curve as follows:

* Uniform acceleration from rest at 1.95 kmphps for 30 seconds.
* Coasting for 50 seconds.
* Duration of braking 20 seconds.

If train is moving a uniform upgradient of 10%, tractive resistance is 40 N/ tonne, rotational inertia effect 9.5% of dead weight, duration of, station stop 14 seconds and overall efficiency of transmission gear and motor is 74%, estimate the schedule speed and specific energy consumption of the run. (2+5+8 = 15)

7. (a) Distinguish between the following:

(i) Tractive effort and draw bar pull.

(ii) Preliminary energy audit and detailed energy audit

(b) Discuss with a flow chart how detailed energy audit can be carried out for an industry.

(c) Justify use of DC series motor as traction motor in the light of some characteristics. (3+7+5 = 15)
