

CS/B.Tech/EE/Odd/Sem-7th/EE-702/2015-16



**MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY,
WEST BENGAL**

EE-702

UTILIZATION OF ELECTRIC POWER

Time Allotted: 3 Hours

Full Marks: 70

The questions are of equal value.

The figures in the margin indicate full marks.

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

All symbols are of usual significance.

GROUP A

(Multiple Choice Type Questions)

1. Answer any ten questions. 10×1 = 10
 - (i) The Specific energy consumption of a train depends on

(A) acceleration and retardation	(B) gradient
(C) distance covered	(D) all of these
 - (ii) Distance between two stations is 1 km and schedule speed 30 kmph. Station stop time 20 seconds. Average speed is

(A) 25.7 kmph	(B) 36 kmph	(C) 45 kmph	(D) 54 kmph
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 - (iii) In suburban services as compared with urban services

(A) coasting period is longer
(B) coasting period is shorter
(C) the coasting and free running periods are smaller
(D) none of these

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- (iv) The filament of a GLS is made of

(A) tungsten	(B) copper
(C) carbon	(D) aluminium
- (v) In lighting installations using filament lamps, 1% voltage drop results into

(A) no loss of light	(B) 1.5% loss in light output
(C) 3.5% loss in light output	(D) 15% loss in light output
- (vi) The unit of illumination is

(A) lumen	(B) lambert
(C) lux	(D) steradians
- (vii) Non conducting materials are heated by

(A) eddy current heating	(B) arc heating
(C) induction heating	(D) dielectric heating
- (viii) Ajax Wyatt furnace is started when

(A) it is filled below core level	(B) it is filled above core level
(C) it is fully empty	(D) none of these
- (ix) In the direct resistance heating method, maximum heat transfer takes place by

(A) radiation	(B) convection
(C) conduction	(D) all of these
- (x) Steel rails are welded by

(A) argon arc welding	(B) thermit welding
(C) gas welding	(D) resistance welding
- (xi) Aluminium is difficult to weld because

(A) it has an oxide coating	(B) it conducts away heat very rapidly
(C) both of (A) and (B)	(D) none of these
- (xii) The value of current efficiency in electrolytic process lies between

(A) 90-98%	(B) 75-80%	(C) 10-20%	(D) 30-35%
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GROUP B
(Short Answer Type Questions)

Answer any three questions.

3×5 = 15

2. What is the system voltage of power supply in Indian Railway traction? What is the voltage rating of traction motors used in locomotives? Give a schematic layout of power transmission in electric locomotive.
3. How unbalancing is avoided in railway traction?
4. Define plain angle and solid angle. Mention the units by which these angles are measured. Establish a relation between plain angle and solid angle.
5. Calculate the efficiency of a high frequency induction furnace which takes 10 minutes to melt 1.8 kg of aluminium. The input to the furnace being 4.8 kW and initial temperature 15°C. Specific heat of aluminium = 0.88 kJ/kg°C; melting point of aluminium = 660°C; latent heat of fusion of aluminium = 32 kJ/kg; 1kJ = 2.78×10⁴ kWh.
6. What is ultrasonic welding? Describe the principle of ultrasonic welding for joining of plastic materials.

GROUP C
(Long Answer Type Questions)

Answer any three questions.

3×15 = 45

7. (a) Why regenerative braking can not be applied to D.C. series motors? How then in railway traction regenerative braking is applied to D.C. series motors to stop the trains?
- (b) A train weighing 400 tonnes is going down a gradient of 20 in 1000. It is desired to maintain speed at 40 kmph by regenerative braking. If the tractive resistance is 40 N/t, rotational inertia 10 percent and efficiency of conversion 75 percent, calculate the power fed into the line.

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Turn Over

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8. (a) Define adhesive weight and coefficient of adhesion in connection with train movement. 3+3+4+5

- (b) Whether coefficient of adhesion of electric-traction will be greater or that of steam traction will be greater? Explain with reasons. Also mention the respective limiting values.
- (c) Explain the factors on which coefficient of adhesion depends.
- (d) A goods train weighting 450 tones is to be hauled by a locomotive up an ascending gradient 2.2 percent with an acceleration of 0.8 kmphs. If the coefficient of adhesion is 0.24, train resistance 42 N/t and the effect of rotational inertia 10 percent, find the weight of the locomotive and the number of axles, if the load is not to increase beyond 18 tonnes per axle.

9. (a) State and explain the laws of illumination. 5+5+5

- (b) Prove that in a filament lamp working at a temperature, the diameter of the filament is proportional to $I^{2/3}$, I being the working current. How much input energy is radiated as light by filament lamps?
- (c) A 110 Volt lamp develops 16 cp, and a lamp of same material and worked at same efficiency develops 25 cp on 220 Volt. Compare the diameter and length of filaments.

10. (a) What is dielectric heating? Explain the factors on which the dielectric loss in a dielectric material depends. 4+4+7

- (b) What are the factors which decide the frequency and voltage of the dielectric heating?
- (c) A Copper refining plant employing 400 electrolytic cells carries current of 6000 amperes, voltage per cell being 0.25 Volts. If plant is working for 45 hours/week, determine the energy consumption per metric ton, assuming ECE of Copper as 0.3281 mgm/Coulomb of electricity.

11. Write short notes on any three of the following: 3×5

- (a) Over-load capacity of Traction transformer
- (b) Micro-wave heater
- (c) Stroboscopic effect and its remedy
- (d) Third-Rail system or conductor Rail System
- (e) Anodizing and its application.

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