

B.Tech. 6th Semester Exam., 2014**UTILIZATION OF ELECTRICAL POWER**

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct alternative for any seven of the following : 2×7=14

(a) Trapezoidal speed-time curve is a better approximation to the actual conditions for

- (i) sub-urban services
- (ii) urban services
- ~~(iii) mainline services~~
- (iv) urban and sub-urban services

(b) — is used for heating non-conducting material.

- (i) Eddy current heating
- ~~(ii) Dielectric heating~~
- (iii) Induction heating
- (iv) Arc heating

(c) The unit of illumination is

- (i) lumen
- ~~(ii) lumen/m²~~
- (iii) candela/m²
- (iv) steradian

(d) The method that can bring a locomotive to standstill is

- (i) rheostatic braking
- ~~(ii) plugging~~
- (iii) regenerative braking
- (iv) None of the above

(e) The solid angle subtended at the centre of the spherical surface is

- (i) 360°
- (ii) 2π
- ~~(iii) 4π~~
- (iv) None of the above

(f) Choke is provided in fluorescent lamp to

- (i) avoid radio interference
- (ii) improve power factor
- ~~(iii) produce high starting voltage~~
- (iv) All of the above

(g) The normal value of coefficient of adhesion for clean, dry rail is

- (i) 0.35
- ~~(ii) 0.25~~
- (iii) 1.25
- (iv) 0.50

(h) Dielectric loss is proportional to

- ~~(i) frequency~~
- (ii) (frequency)²
- (iii) (frequency)^{0.5}
- (iv) (frequency)³

(i) The value of coefficient of adhesion will be high when rails are

- (i) wet
- (ii) greased
- ~~(iii) dry~~
- (iv) sprayed with oil

(j) The welding transformer should have

- ~~(i) drooping V-I characteristics~~
- (ii) rising V-I characteristics
- (iii) flat V-I characteristics
- (iv) None of the above

2. (a) What are the special features (both mechanical and electrical) required for a traction motor?
 (b) Discuss the suitability of DC series motor for traction service.
 (c) What are the advantages and disadvantages of 3- ϕ induction motor in traction?
 5+5+4=14

3. (a) Distinguish between rheostatic and regenerative braking in electric traction system.
 (b) What is plugging?
 (c) Describe plugging for DC shunt motor with necessary diagrams.
 (d) Why the current flowing through armature circuit during plugging is very high?
 (e) How is armature protected against this heavy current?
 4+2+4+3+1=14

4. (a) A locomotive exerts a tractive effort of 33800 N to pull a train at 48.3 km/hr on level surface. It has to pull the same train on same speed on a gradient and tractive effort required is 53400 N. Find the HP delivered by the locomotive when the motors used are DC series motor or induction motor.

- (b) Define the term 'adhesive weight'.
 (c) Draw simplified speed-time curve for mainline services and sub-urban services. Show all necessary periods.
 7+1+6=14

5. (a) Define (i) average speed, (ii) schedule speed and (iii) train resistance.
 (b) A train has a scheduled speed of 25 km/hr between 800 m apart stations. The duration of stop at the station is 20 sec. Maximum speed is 20% higher than average running speed and retardation is 3 kmphrps. Calculate the acceleration required to operate this service.
 (c) What is crest speed?
 6+6+2=14

6. (a) A factory space 33 m \times 13 m is to be illuminated with an average illumination of 72 lumen/m² by 200 W lamps. The coefficient of utilization is 0.4 and the depreciation factor is 0.71. Calculate the number of lamps required, the output of 200 W lamp is 2730 lumen.
 (b) State the inverse square law and cosine law as applied to illumination.
 (c) Define candle power, depreciation factor and coefficient of utilization.
 4+4+6=14

7. (a) What are the ranges of voltage and frequency used in dielectric heating? Explain why these ranges are used.

(b) Is dielectric heating used to heat conducting material or non-conducting material? Explain.

~~(c)~~ What is induction heating?

(d) A piece of insulating material is to be heated by dielectric heating. The size of the piece is $10 \times 10 \times 3 \text{ cm}^3$. A frequency of 30 MHz is used and the power absorbed is 400 W. Determine the voltage necessary for heating and the current that flows in the material. Permittivity is 5 and power factor is 0.05.
4+3+2+5=14

8. Write short notes on the following : $3\frac{1}{2} \times 4 = 14$

(a) Cooling classes of transformer

(b) Electric welding

(c) Advantage of electric braking over mechanical braking

(d) Tractive effort

9. (a) What are the requirements of braking system?

(b) Classify braking system.

(c) A train runs between two stations 2 km apart at an average speed of 40 km/hr. The train accelerates at 2 km/hr. sec. and retards at 3 km/hr. sec. Assume trapezoidal speed-time curve. Calculate maximum speed and distance travelled by the train before brakes are applied.

5+3+6=14
