

UNIT - III

- 5 a. Explain :
- i) Direct steam engine system 10
 - ii) Direct internal combustion engine system of traction with merits and demerits.
- b. Explain any two system of track electrification for traction purpose. 10
- 6 a. What are the requirements of an ideal traction system? 6
- b. Explain the Battery-Electric drive system of traction with merits and demerits. 7
 - c. What is meant by composite system of track electrification? Briefly explain. 7

UNIT - IV

- 7 a. Draw and explain typical speed time-curve for an electric train and also explain, 12
- i) Crest speed
 - ii) Scheduled speed.
- b. An electric train has an average speed of 48 kmph on a level track between stops 1.6 km apart. If the acceleration and retardation are 1.8 km phps and 3.2 km phps. Draw the speed time curve for the run. Determine the energy consumption at the axles of the train per tonne km. Take tractive resistance constant at 50 NW per tonne and allow 10% for the effect of rotational inertia. 8
- 8 a. Explain in detail Quadrilateral speed time curve. 8
- b. Write a note on co-efficient of adhesion. 6
 - c. A train has a scheduled speed of 65 km/hr between the stops which are 6 km apart. Determine the maximum speed over the run, if the duration of the stop is of 30 secs. The values of acceleration and retardation are 2 km/hr/sec and 3 km/hr/sec respectively. Assume simplified trapesoidal speed time curve. 6

UNIT - V

- 9 a. Explain the desirable properties of traction motors. 6
- b. Explain how energy saving is achieved by series parallel control? 8
 - c. Write a note on train tightening system. 6
- 10 a. With the help of phasor diagrams, explain characteristics of AC series motor. 8
- b. Explain the following :
 - i) Plugging 12
 - ii) Rheostatic braking
 - iii) Regenerative braking applied to DC shunt motor.