



PART B — (5 × 16 = 80 marks)

11. (a) Design a flat belt drive to transmit 110 kW for a system consisting of two pulleys of diameters 0.9 m and 1.2 m for a center distance of 3.6 m, belt speed of 20 m/s and coefficient of friction is 0.3. There is a slip of 1.2% at each pulley and 5% friction loss at each shaft with 20% overload.

Or

- (b) A bucket elevator is to be driven by a geared motor and a roller chain drive with the information given below :

Motor output – 3 kW

Speed of motor shaft – 100 rpm

Elevator drive shaft speed – 42 rpm

Load – even

Distance between centres of sprockets approximately – 1.2 m

Period of operation – 16 hours/day

Geared motor is mounted on an auxiliary bed for centre distance adjustments. Design the Chain drive.

12. (a) Design a pair of straight spur gear drive for a stone crusher, the pinion and wheel are made of C15 steel and cast iron grade 30 respectively. The pinion is to transmit 22 kW power at 900 rpm. The gear ratio is 2.5. Take pressure angle of  $20^\circ$  and working life of gears as 10,000 hours.

Or

- (b) Design a pair of helical gear to transmit 10 kW at 1000 rpm of the pinion. Reduction ratio of 5 is required. Pressure angle is  $20^\circ$  and the helix angle is  $15^\circ$ . The material for both the gears is 40 Ni2Cr1Mo28. Give the details of the drive in a tabular form.

13. (a) Design a bevel gear drive to transmit 3.5 kW with driving shaft speed is 200 rpm. Speed ratio required is 4. The drive is non-reversible. Pinion is made of steel and wheel made of CI. Assume a life of 25000 hrs.

Or

- (b) A hardened steel worm rotates at 1440 rpm and transmits 12 kW to a phosphor bronze gear. The speed of the worm gear should be 60 rpm. Design the worm gear drive if an efficiency of at least 82% is desired.

14. (a) Design the layout of a 12 speed gear box for a milling machine having an output of speeds ranging from 25 to 600 rpm. Power is applied to the gear box from a 2.25 kW induction motor at 1440 rpm. Construct the speed diagram using standard speed ratio. Calculate the number of teeth on each gear and sketch the arrangement of the gear box.

Or



(b) Sketch the arrangement of a six speed gear box for a minimum speed of 460 rpm and a maximum speed of 1400 rpm. Draw the speed diagram and kinetic arrangement showing number of teeth in all gears. Check whether all the speeds obtained through the selected gears are within  $\pm 2\%$  of standard speeds. The drive is from an electric motor giving 2.25 kW at 1440 rpm.

15. (a) A multiplate clutch, steel on bronze is to transmit 6 kW power at 750 rpm. The inner radius of contact surface is 4 cm and outer radius is 7 cm. The clutch plates operate in oil, so the co-efficient of friction is 0.1. The average pressure is 0.35 N/mm<sup>2</sup>. Determine (i) the total number of steel and bronze friction discs (ii) actual axial force required (iii) actual average pressure (iv) actual maximum pressure.

Or

- (b) A single shoe brake is shown in fig. The diameter of drum is 250 mm and angle of contact is 90°. If the operating force of 750 N is applied at the end of the lever and  $\mu = 0.35$ , determine the torque that may be transmitted by the brake.

