BALANCING
PART-A

1. What is meant by balancing of rotating masses?
2. Why rotating masses are to be dynamically balanced?
3. Define static balancing.
4. Define dynamic balancing.
5. State the conditions for static and dynamic balancing.
6. State the conditions for complete balance of several masses revolving in different planes of a shaft.
7. Why complete balancing is not possible in reciprocating engine?
8. Can a single cylinder engine be fully balanced? Why?
9. Differentiate between the unbalanced force caused due to rotating and reciprocating masses.
10. Why are the cranks of a locomotive, with two cylinders, placed at 90° to each other?
11. List the effects of partial balancing of locomotives.
12. Define swaying couple.
13. Define hammer blow with respect to locomotives.
14. What are the effects of hammer blow and swaying couple?
15. Define direct and reverse cranks.
16. What for the balancing machines are used?
17. What are different types of balancing machines?

PART-B

1. A shaft is rotating at a uniform angular speed. Four masses M1, M2, and M3and M4 of magnitudes 300kg, 450kg, 360kg, 390kg respectively are attached rigidly to the shaft. The masses are rotating in the same plane. The corresponding radii of rotation are 200mm, 150mm, 250mm and 300mm respectively. The angle made by these masses with horizontal are 0°.45°, 120°and 255°respectively. Find,
    (i) The magnitude of balancing mass
    (ii) The position of balancing mass if its radius of rotation is 200mm.
2. Four masses M1, M2, M3, and M4 are 200kg, 300kg, 240kg and 260kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3m respectively and the angle between successive masses45°, 75°, and135°.Find the position and magnitude of balance mass required if its radius of rotation is 0.25m.
3. A, B, C and D are four masses carried by a rotating shaft at radii 100mm,125mm,200mm and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the masses of B,C and D are 10kg,5kg and 4kgrespectively.Find the required mass A and relative angular setting of the four masses so that the shaft be in complete balance.
4. A four cylinder vertical engine has cranks 300mm long. The plane of rotation of the first, third and fourth cranks are 750mm, 1050mm and 1650mm respectively from

that of the second crank and their reciprocating masses are 10kg,400kg and 250kg respectively. Find the mass of the reciprocating parts for the second cylinder and relative angular position of the cranks in order that the engine may be in complete balance.

5. The data for three rotating masses are given below:
   M1=4kg r1=75mm Θ1=45
   M2=3kg r2=85mm Θ2=135
   M3=2.5kg r3=50mm Θ3=240
   Determine the amount of counter mass at a radial distance of 65mm required for their static balance.
6. Four masses A, B, C and D revolves at equal radii and equally spaced along a shaft. The mass B is 7kg and the radii of C and D make angle s of 90° and 240 °respectively with the radius of B. Find the magnitude of masses A,C and D and angular position of A . So that the system may be completely balanced.
7. Four masses A, B, C, and D are completely balanced masses C and D makes angles of 90° and 195° respectively with B in the same sense. The rotating masses have the following properties:
   mA=25kg rA=150mm
   mB=40kg rB=200mm
   mC=35kg rC=100mm
   rD=180mm
   Planes B and C are 250mm apart. Determine
   (i) The mass A and its angular position
   (ii) The position of planes A and D.
8. A four cylinder vertical engine has cranks 150mm long. The plane of rotation of the first, second and fourth cranks are 400mm,200mm and 200mm respectively from that of the third crank and their reciprocating masses are 50kg,60kg and 50kg respectively. Find the mass of the reciprocating parts for the third cylinder and relative angular position of the cranks in order that the engine may be in complete balance.
9. Derive the following expression of effects of partial balancing in two cylinder locomotive engine
   (i) Variation of tractive force
   (ii) Swaying couple
   (iii) Hammer blow
10. Shaft caries four rotating masses A, B, C and D which are completely balanced. The masses B, C and Dare 50kg, 80kg and 70kg respectively. The masses C and D make angles of 90° and 195° respectively with mass B in the same sense. The masses A,B,C and D are concentrated at radius 75mm,100mm,50mm and 90mmrespectively.The plane of rotation of masses B and C are 250mm apart. Determine
    a. The magnitude of mass A and its angular position
    b. The position of planes A and D.