

5. (a) Explain systematically the setting out of a culvert. 10
 (b) A tacheometer is set up at an intermediate point on a traverse course PQ and following observations were made on a vertically held staff. 5

Staff Station	Vertical angle	Staff intercept	Axial hair reading
P	+9°30	2.250	2.105
Q	+6°00	2.055	1.875

Compute the length of PQ and RL of Q If the RL of P is 350.5 m.

6. (a) Derive an expression for horizontal distance and elevation equation for tangential method when both vertical angles are of opposite sign. 5
 (b) Enlist modern surveying instruments and explain working principle of EDM. 10
 (c) Explain reverse curve and comment on their suitability in highway and railways. 5
7. (a) What is total station? Explain its various use with sketches. 10
 (b) Two straights on the centre line of a proposed railway curve intersect at 2610 m. The deflection angle being 46° . A circular curve with 400 m radius and transition curve of length 90 m are to be introduced. Calculate the necessary data to set out the curve by tangential angles (Calculate these values for first transition curve and circular curve only). 10