

B. Tech. 8th Semester Mid term Exam
 Transportation Systems and Planning
 Subject Code: 011X42

2) Utility of:

$$i) \text{ Car} = -0.005 - 0.05 \times 0 - 0.04 \times 5 - 0.02 \times 30 - 100 = -100.805$$

$$ii) \text{ Transit} = -0.05 - 0.05 \times 10 - 0.04 \times 10 - 0.02 \times 50 - 50 = -51.95$$

$$iii) \text{ Express} = -0.05 - 0.05 \times 12 - 0.04 \times 10 - 0.02 \times 39 - 75 = -76.05$$

Mode share

$$\text{Car} = \frac{e^{u_{\text{car}}}}{e^{u_{\text{car}}} + e^{u_{\text{transit}}} + e^{u_{\text{express}}}} \approx 0$$

$$\text{Transit} = \frac{e^{u_{\text{transit}}}}{e^{u_{\text{car}}} + e^{u_{\text{transit}}} + e^{u_{\text{express}}}} \approx 1$$

$$\text{Express} = \frac{e^{u_{\text{express}}}}{e^{u_{\text{car}}} + e^{u_{\text{transit}}} + e^{u_{\text{express}}}} \approx 0$$

When 12% cost increases and 4% riding time reduced for transit, new cost of travel for transit = $50 + .12 \times 50 = 56$
 new riding time for transit = $50 - 0.04 \times 50 = 48$

Only change will occur in utility of transit

$$\text{New utility of transit} = -0.05 - 0.05 \times 10 - 0.04 \times 10 - 0.02 \times 48 - 56 = 57.91$$

$$\text{New Mode share for Car} = 2.34 \times 10^{-19}$$

$$\text{Transit} = 0.9999$$

$$\text{Express} = 1.32 \times 10^{-08}$$

Modal split ~~is~~ does not show much difference. Previously, it was 100% for transit, now, it has dropped down to 99.999% share of modal split.

4.

Using the formula

$$T_{i-j} = \frac{K \cdot P_i \cdot A_j}{t^n}$$

$$T_{B-C} = \frac{K \cdot P_B \cdot A_C}{t^2}$$

$$600 = \frac{K \times 3000 \times 2000}{20 \times 20}$$

$$K = \frac{1}{2.5}$$

$$T_{A-B} = \frac{1}{2.5} \times \frac{2000 \times 4000}{20 \times 20} = 800$$

$$T_{A-C} = \frac{1}{2.5} \times \frac{2000 \times 2000}{20 \times 20} = 400$$

$$T_{B-A} = \frac{1}{2.5} \times \frac{3000 \times 3000}{20 \times 20} = 900$$

$$T_{C-B} = \frac{1}{2.5} \times \frac{4000 \times 4000}{20 \times 20} = 1600$$

5.

$$\text{Cost of Operation on improved road} = \text{Rs } (365 \times 50 \times 2500 \times 1.00) \\ = \text{Rs } 455 \text{ lakhs}$$

$$\text{Cost of Operation on existing road} = \text{Rs } (365 \times 50 \times 2500 \times 1.2) \\ = \text{Rs } 545 \text{ Lakhs}$$

Capital Recovery Factor for $n=20$ and $r=10$

$$CRF = \frac{r(1+r)^n}{r(1+r)^n - 1} = 0.117$$

$$\text{Total cost of improvement} = \text{Rs } 50 \times 12 \text{ lakhs} = \text{Rs } 600 \text{ lakhs}$$

$$\text{Present annual cost of improvement} = \text{Rs } 600 \times 0.117 = \text{Rs } 70.2 \text{ lakhs}$$

$$\text{Maintenance cost difference} = \text{Rs } (10000 - 6000) \times 50 = \text{Rs } 2 \text{ lakhs}$$

$$\text{Benefit-Cost Ratio} = \frac{(545 - 455)}{(70.2 + 2)} = 1.246$$

Since, the ratio is more than 1.0, the project is worthwhile