# APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY

## 08 PALAKKAD CLUSTER
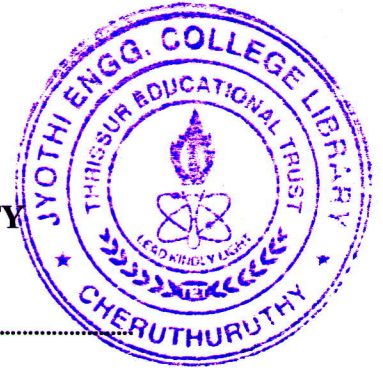
Q. P. Code: TE0820105-I                (Pages: 5)

### FIRST SEMESTER M.TECH. DEGREE EXAMINATION MARCH 2021

**Branch: Civil Engineering**                **Specialization: Transportation Engineering**

### 08CE6205 Urban Transportation

(Common to TE)

Time: 2 hour 15 minutes                                        Max. Marks: 60

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

| Q.no. | Module 1 | Marks |
|---|---|---|
| 1.a | Define objectives and constraints with respect to transportation planning. | 3 |

**Answer b or c**

| | | |
|---|---|---|
| b | What is travel demand? How will you forecast travel demand? | 6 |
| c | Elaborate on the aspects of transportation problems. | 6 |

| Q.no. | Module 2 | Marks |
|---|---|---|
| 2.a | Explain the term 'trip generation rates'. | 3 |

**Answer b or c**

b   A small study area represented by 10 traffic analysis zones (TAZ) has the    **6**
following characteristics:

| Zone | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Trips Productions | 600 | 630 | 900 | 850 | 750 | 290 | 570 | 600 | 450 | 450 |
| Car ownership | 500 | 320 | 710 | 615 | 280 | 130 | 400 | 470 | 250 | 200 |

Use the method of least squares to develop the regression model for predicting trip productions as a function of car ownership in a TAZ. Calculate the $R^2$ discuss on the reliability of the model.

1

**c**   Develop trip generation model for the following data.                    6

| Household No. | Trips per day | Annual income (in 1000 Rs.) | Number of Autos |
|---|---|---|---|
| 1 | 2 | 40 | 0 |
| 2 | 4 | 50 | 0 |
| 3 | 10 | 170 | 2 |
| 4 | 5 | 110 | 0 |
| 5 | 5 | 60 | 1 |
| 6 | 15 | 180 | 3 |
| 7 | 7 | 95 | 1 |
| 8 | 4 | 90 | 0 |
| 9 | 6 | 70 | 1 |
| 10 | 13 | 200 | 3 |

**Q.no.**                        **Module 3**                        **Marks**

**3.a**   Differentiate between trip end and trip interchange models.              3

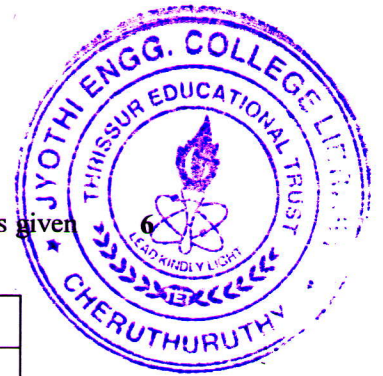**Answer b or c**

**b**   Estimate the future distribution by Furness Method (up to 2 iterations) from the following trips table (trips in 10s).              6

| O/D | 1 | 2 | 3 | 4 | Future Trips |
|---|---|---|---|---|---|
| 1 | - | 5 | 6 | 3 | 28 |
| 2 | 4 | - | 7 | 2 | 39 |
| 3 | 2 | 6 | - | 4 | 30 |
| 4 | 5 | 7 | 3 | - | 22 |
| Future trips | 20 | 50 | 34 | 15 | |

**c** Trip production, trip attraction and travel time for a 3-zone study area as given below.    **6**

| Zone | 1 | 2 | 3 |
|---|---|---|---|
| Trip Production | 210 | 320 | 240 |
| Trip Attraction | 290 | 270 | 210 |

Travel time versus friction factor values as obtained from the calibration process is summarized below.

| Time(min) | Friction factor | Time(min) | Friction factor |
|---|---|---|---|
| 1 | 82 | 5 | 39 |
| 2 | 52 | 6 | 26 |
| 3 | 50 | 7 | 20 |
| 4 | 41 | 8 | 13 |

Determine the number of trips between each zone using a gravity model. Socio economic adjustment factors may be assumed as unity. Show only 2 iterations.

| Q.no. | Module 4 | Marks |
|---|---|---|

**4.a** Explain (any two) diversion curves for the estimation of mode split.    **3**

**Answer b or c**

**b** Given the utility equation $U_k = a_k - 0.003X_1 - 0.04 X_2$ where $X_1$ is the travel cost in cents and $X_2$ is the travel time in minutes.    **6**

   (i)   Calculate the market shares of the following travel modes by logit model formulation.

| Mode k | $a_k$ | $X_1$ | $X_2$ |
|---|---|---|---|
| Automobile | -0.20 | 120 | 30 |
| Express Bus | -0.40 | 60 | 45 |
| Regular Bus | -0.60 | 30 | 55 |

   (ii)  Estimate the effect that a 50% increase in the cost of all three modes will have on mode split.

c    A calibrated utility function for travel in a medium sized city by automobiles, bus and light rail is $U = a - 0.002 X1 - 0.05 X2$ where $X1 = $ cost of travel in cents and $X2 = $ travel time in cents.    **6**

Calculate the modal split for the given values.

| Mode | A | X1 | X2 |
|---|---|---|---|
| Automobile | -0.30 | 130 | 25 |
| Bus | -0.35 | 75 | 35 |
| LRT | -0.40 | 90 | 40 |

Suppose a new mode, a Rapid Transit (RT) is introduced in the city. Service attributes for the new mode are X1= 50, X2 = 30; Find the market shares of four modes. The constant for new mode is -0.6.

| Q.no. | Module 5 | Marks |
|---|---|---|

5.a    Explain Capacity Restraint Assignment.    **4**

**Answer b or c**

b    The description of a network (2-way links) is given below. Find minimum path from node A to B, C and D using minimum path algorithm.    **8**

| Links | Travel Time(min) | Links | Travel Time(min) |
|---|---|---|---|
| 1 to 2 | 13 | 4 to 7 | 17 |
| 1 to A | 14 | 5 to 6 | 17 |
| 1 to 4 | 13 | 5 to 8 | 18 |
| 2 to 3 | 14 | 6 to 9 | 19 |
| 2 to 5 | 14 | 7 to 8 | 20 |
| 3 to B | 13 | 7 to C | 15 |
| 3 to 6 | 22 | 8 to 9 | 22 |
| 4 to 5 | 15 | 9 to D | 14 |

c   Assign the vehicle trips shown in the following O-D trip table to the network (link data - travel times on links given in table), using the all-or-nothing assignment technique.

| From/to | 1 | 2 | 3 | 4 |
|---------|-----|-----|-----|-----|
| 1 | - | 500 | 75 | 350 |
| 2 | 75 | - | 105 | 75 |
| 3 | 50 | 70 | - | 90 |
| 4 | 250 | 350 | 50 | - |

| Links | Travel Time(min) | Links | Travel Time(min) |
|-------|------------------|-------|------------------|
| 1 to 2 | 9 | 2 to 3 | 10 |
| 2 to 1 | 6 | 3 to 2 | 5 |
| 4 to 1 | 4 | 3 to 4 | 6 |
| 1 to 4 | 1 | 4 to 3 | 5 |

| Q.no. | Module 6 | Marks |
|-------|----------|-------|

6.a   Explain any two-transportation planning softwares.          4

**Answer b or c**

b   Elaborate on various indicators used to assess the performance of a transport corridor.          8

c   Elaborate on various applications of Geographical Information Systems in transport sector.          8