Tutorial - 1

1. A vehicle travelling at a speed of 50 kmph was stopped within 2.5 secs after the full application of brakes. Calculate the skid resistance.
2. A braking test was done in a dumper travelling at the speed of 90 kmph. The dumper was moving downwards on the road of 3^o slope to horizontal and the braking efficiency is 85 %. After the application of the brakes, the skid marks were seen as 40.2 m in length. Determine the average skid resistance of the pavement.
3. After application of the brakes fully, a car was stopped in 1.9 secs and skid marks were measured as 7.5 m in length. Determine the average skid resistance.
4. A truck moving at a speed of 45 kmph was stopped after the application of the brakes fully. The length of skid marks was 14 m. If the average skid resistance of the pavement is 80 %, determine the braking efficiency of the truck.
5. A vehicle hits a bridge abutment at a speed estimated by an investigator as 15 kmph. Skid marks of 30 m on the pavement (f = 0.35) followed by skid marks of 60 m on the gravel shoulder (f = 0.50) approaching to the abutment are observed. If the speed limit is 60 kmph, is the driver speeding?
6. A lady driver of car applied brakes and barely avoided hitting the truck parked due to technical problem on the roadway. The vehicle left skid marks of 25 m. Assuming f = 0.6 and the braking efficiency of 95 %, determine whether the driver was in violation of the 45 kmph speed limit at that location if she was travelling a) uphill on 3^o slope, b) downhill on 2.3^o slope and c) on the level roadway.
7. A deer is running across the level road and a driver did his best to avoid hitting the deer by attempting to stop his car. However, during the braking, his car slide from the concrete pavement to graveled shoulder but finally came to halt safely. If the travelling speed of this car is 60 kmph and the coefficient of friction on the concrete pavement and graveled shoulder are 0.4 and 0.5 respectively, what would be the length of skid mark on the graveled shoulder. The length of the skid mark resulted from braking the vehicle on concrete pavement is 15.5 m and the road is level.
8. Speed observations from a radar speed meter have been taken, giving the speeds of the subsidiary streams composing the flow along with the volume of traffic of each subsidiary stream. The readings are as under:

Speed (kmph)	2-5	6-9	10-13	14-17	18-21	22-25	26-29	30-33	34-37	38-41	42-45	46-49	50-53	54-57	58-61
Volume of subsidiary stream (veh/hr)	1	4	0	7	20	44	80	82	79	49	36	26	9	10	3

   Calculate: i) Time mean speed
   ii) Space mean speed
   iii) Variance about space mean speed
9. Twenty-five spot speed observations were taken in kmph and were as under:
   50, 40, 60, 54, 45, 31, 72, 58, 43, 52, 46, 56, 43, 65, 33, 69, 34, 51, 47, 41, 62, 43, 55, 40, 49
   Calculate: i) Time mean speed
   ii) Space mean speed
   iii) Verify the relation between them
10. Spot speed studies were carried out at a certain stretch of a highway and the consolidated data collected are given below:

Speed (kmph)	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of vehicles	12	18	68	89	204	255	119	43	33	9

Determine: i) Upper speed limit for regulation
ii) Lowe speed limit for regulation
iii) Speed to check design elements
iv) Modal speed

11. A truck travelling at 40 kmph is approaching a stop sign. At time t_o and at a distance of 20 m, the truck begins to slow down by decelerating at 4 m/s^2. Will the truck be able to stop in time?
12. The following speed data were collected during a two-minute segment of a spot speed study (speed in kmph)
    92, 82, 78, 86, 100, 91, 63, 75, 86, 90, 88, 79, 95, 84
    a) Estimate the time mean speed and the space mean speed.
    b) What will be the average density of the above traffic stream if the mean headway is 8.6 secs?
13. Estimate the theoretical capacity of a traffic lane with one-way traffic flow at stream speed of 40 kmph. Assume the average space gap between vehicles to follow the relation $S_g = 0.278\ V\ t$, where V is stream speed in kmph, t is the average reaction time = 0.7 sec; assuming average length of vehicles = 5.0 m.
14. What is the theoretical capacity of a traffic lane with one-way traffic flow at a stream speed of 50 kmph if the average reaction time is 0.9 secs and average length of vehicles is 7.0 m.
15. Calculate the theoretical maximum traffic capacity for a traffic lane at the speed of 80 kmph. Assume the coefficient of friction (f) as 0.4, total reaction time (t) as 0.75 secs and average length of the vehicle is 6.0 m. Assume the average space gap between vehicles to follow the relation, $S_g = 0.278\ V\ t + (V^2 / 254\ f)$.
16. The free mean speed on a roadway is found to be 80 kmph. Under the stopped condition the average spacing between vehicle is 6.9 m. Determine the capacity of flow.
17. In the road at Tripureshwor, it is found that the free mean speed is only 75 kmph. Under the stopped condition the average spacing between the vehicle is only 6.3 m. What is the maximum capacity of flow in that road?
18. The data collected after speed and delay studies by floating car method on as stretch of urban road of length 3.5 km are given below. Determine the average values of volume, journey speed and running speed of the traffic stream along either direction.

Trip No.	Direction of Trip	Journey Time (Min-secs)	Total Stopped Delay (Min-secs)	No. of vehicles overtaking	No. of vehicles overtaken	No. of vehicles form opposite direction
1	A-B	6-32	1-40	4	7	268
2	B-A	7-14	1-50	5	3	186
3	A-B	6-50	1-30	5	3	280
4	B-A	7-40	2-00	2	1	200
5	A-B	6-10	1-10	3	5	250
6	B-A	8-00	2-22	2	2	170
7	A-B	6-28	1-40	2	5	290
8	B-A	7-30	1-40	3	2	160

19. ABCD is a street running north to south comprising of three adjacent sections. The table below gives the length of each section:

Section	AB	B	BC	C	CD
Length (km)	500	Intersection	600	Intersection	450

Again, the following table gives the details of observations (Average of test runs) by the moving observer team:

Moving Observer Travelling South				
Sections	Time take to travel (secs)	Vehicle met with in opposing direction	Vehicle in the same direction	
			Overtaking	Overtaken
AB	152	25	4	3
B	15	-	-	-
BC	172	31	2	2
C	10	-	-	-
CD	138	28	3	4
Moving Observer Travelling North				
Sections	Time take to travel (secs)	Vehicle met with in opposing direction	Vehicle in the same direction	
			Overtaking	Overtaken
DC	132	50	2	1
C	12	-	-	-
CB	160	55	3	4
B	18	-	-	-
BA	145	45	1	1

Calculate the flows and running speeds in each section in both directions and the overall journey speeds in each direction.