Seat
No.

Set **P**

T.E. (Civil Engineering) (Part – I) (New-CBCS) Examination, 2018
TRANSPORTATION ENGINEERING – I

Day and Date : Monday, 10-12-2018   Max. Marks : 70
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) *Q. No.* **1** *is* **compulsory**. *It should be solved in* **first**
   30 minutes *in Answer Book Page No.* **3. Each** *question*
   carries **one** *mark.*
2) **Answer MCQ/Objective type questions on Page No. 3
   only. Don't forget to mention, Q.P. Set (P/Q/R/S) on
   Top of Page.**

MCQ/Objective Type Questions

Duration : 30 Minutes   Marks : 14

1. Choose the correct answer :   **14**

   1) Reaction time of a driver
      a) increases with increase in speed
      b) decreases with increase in speed
      c) is same for all speeds
      d) none of the above

   2) Bottom most layer of pavement is known as
      a) wearing course   b) base course
      c) sub-base course   d) subgrade

   3) The terrain may be classified as rolling terrain if the cross slope of land is
      a) upto 10%   b) between 10% and 25%
      c) between 25% and 60%   d) more than 60%

   4) Rapid curing cutback bitumen is produced by blending bitumen with
      a) Kerosene   b) Petrol   c) Diesel   d) Benzene

   5) For highway geometric design purposes the speed used is
      a) 15th percentile   b) 50th percentile
      c) 85th percentile   d) 98th percentile

P.T.O.

6) For the design of super elevation for mixed traffic conditions, the speed is reduced by

   a) 15%   b) 20%   c) 25%   d) 75%

7) Widening of curve on horizontal curve is required for _____ purpose.

   a) Mechanical   b) Psychological

   c) Both a) and b)   d) None of these

8) Spacing of the contraction joint is

   a) 4.0 m to 5.0 m   b) 5.0 m to 6.0 m

   c) 6.0 m to 7.0 m   d) 7.0 m to 8.0 m

9) Equivalent radius of resisting section for 20 cm thick slab, given that the radius of contact area of wheel load is 15 cm is

   a) 15.07 cm   b) 14.07 cm   c) 16.07 cm   d) 17.07 cm

10) Critical combination of stresses at edge in rigid pavement during winter mid-day are

   a) Load stress + Warping stress

   b) Load stress + Warping stress + frictional stress

   c) Load stress + warping stress – frictional stress

   d) Load stress – Warping stress + frictional stress

11) Construction joint in rigid pavement is provided where

   a) Concreting work is started at the start of the day

   b) Temperature of the concrete is more

   c) Concreting work is stopped at the end of the day

   d) Contraction and expansion is required

12) Which one of the following methods is generally considered the best for tunnel ventilation ?

   a) Driving a drift through the tunnel

   b) 'Blowin' method

   c) 'Blowout' method

   d) Combination of 'Blowin' and 'Blowout' methods

13) What is the correct sequence of the following events of construction of a shaft in a rock ?

   1) Drilling and blasting   2) Timbering

   3) Pumping   4) Mucking

   Select the correct answer using the codes given below.

   a) 1, 2, 3, 4   b) 1, 4, 2, 3   c) 2, 1, 4, 3   d) 2, 4, 1, 3

14) PPP stands for

   a) Private Public Partnership   b) Public Private Partnership

   c) Partnership Public Private   d) Public Provident Partnership

_____

Set P

SLR-TX – 50

Seat No.	

T.E. (Civil Engineering) (Part – I) (New-CBCS) Examination, 2018
TRANSPORTATION ENGINEERING – I

Day and Date : Monday, 10-12-2018　　　　　　　　　　　　　　　Marks : 56
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) **All** questions are **compulsory**.
　　　　　　　　2) Figure on r**ight** indicates **full** marks.
　　　　　　　　3) Assume suitable data **wherever** needed and mention it **clearly**.

SECTION – I

2. Solve **any two** (**7 marks each**) :

   a) Calculate the minimum sight distance required to avoid a head-on collision of two cars approaching from the opposite directions at 90 and 60 kmph. Assume a reaction time of 2.5 seconds, coefficient of friction of 0.7 and a brake efficiency of 50 percent, in either case. **7**

   b) A two lane national highway passing through a rolling terrain has a horizontal curve of radius 500 m. Design the length of transition curve and shift of the curve. Assume Design speed = 80 kmph, length of wheel base = 6 m, width of pavement = 7 m. Rate of introduction of super eleveation = 1 in 150. **7**

   c) Write a detailed note on "Volume and Speed Studies". **7**

3. Solve **any two** (**7 marks each**) :

   a) Enlist different tests carried out on Bituminous material. Explain any one in detail with neat sketch and its practical application. **7**

   b) Discuss the importance of Highway Drainage. **7**

   c) Write a detailed note on applications of Geosynthetics in road construction. **7**

Set P

SECTION – II

4. Answer **any two** questions (**7 marks each**) : **(2×7=14)**

   a) Draw a neat sketch of cross section of two lane flexible pavement and show the component parts. Enumerate the functions and importance of each component of the pavement.

   b) Enumerate the construction steps of Cement Concrete pavement.

   c) It is proposed to widen the existing two lane National Highway section to 4-lane divided road. Design the pavement for new carriageway using IRC guidelines.

   Input data :

   1) Initial traffic in each direction on counting year, N = 4000 cv/day

   2) Construction period since last traffic count, x = 3 years

   3) Design life = 15 years

   4) Design CBR of Subgrade soil to be employed, = 8%

   5) Traffic Growth Rate, r = 8%

   6) Vehicle Damage Factor as per axle load survey, F = 4.0

   7) Lane Distribution factor, D = 0.75

   8) Directional Distribution = 1.00

      Use Plate-4 to 6 of IRC-37-2012.

5. Answer **any two** questions (**7 marks each**) : **(2×7=14)**

   a) Calculate the annual cost of a stretch of higway from the following data.

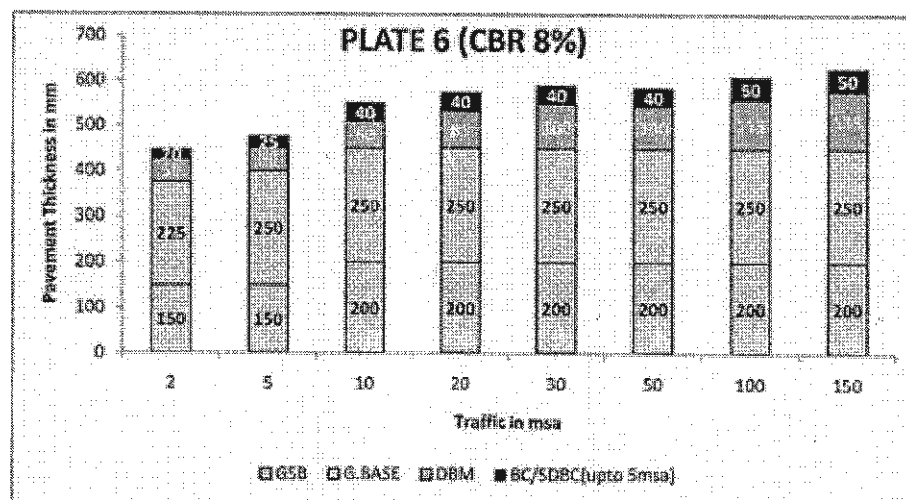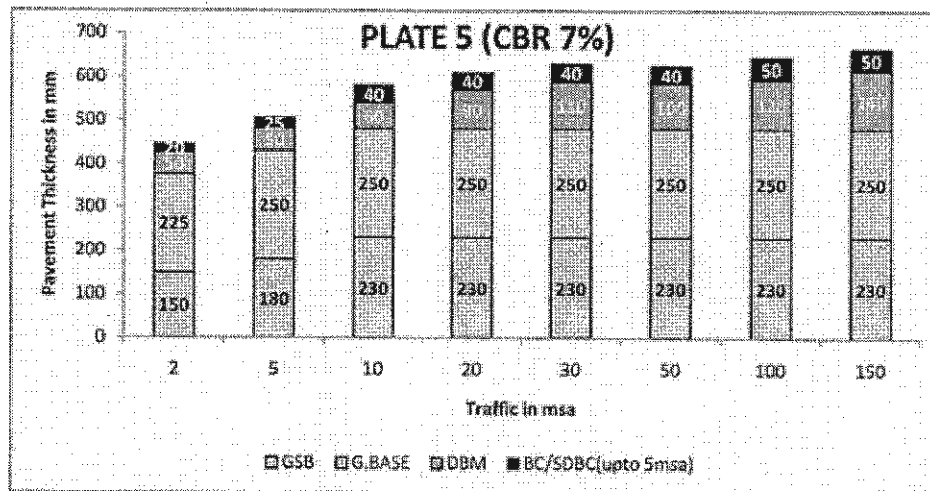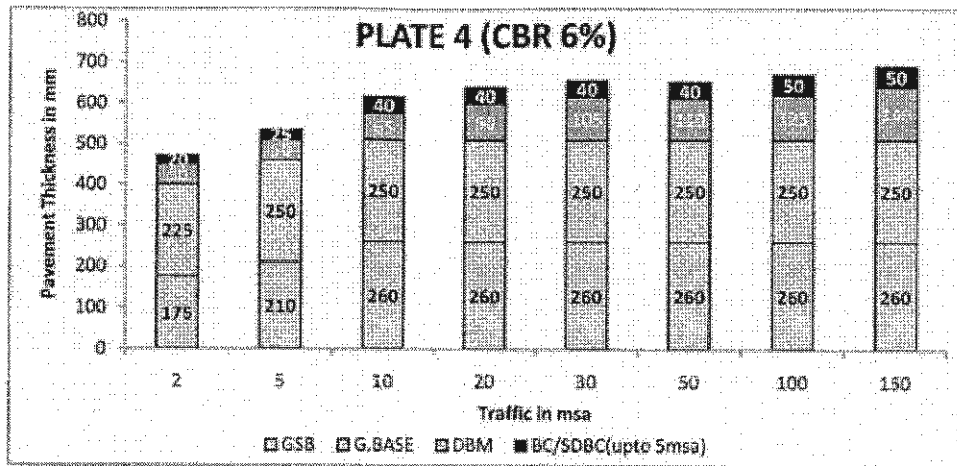| Item	Total Cos, Rs. In Lakhs	Estimated Life, years	Rate of Interest, %
Land	35	100	6
Earth work	40	40	8
Bridges, culverts & Drainage	50	60	8
Pavement	100	15	10
Traffic signs and road appurtenaces	15	5	10

   The average cost of maintenance of the road is Rs. 1.5 lakhs per year.

   b) What are the advantages of implementing PPP projects for highway development in India ?

   c) Describe heading and bench method of tunneling in hard rock with neat sketch.

Set P

PLATE 4 (CBR 6%)

PLATE 5 (CBR 7%)

PLATE 6 (CBR 8%)

Set P

Seat No.

T.E. (Civil Engineering) (Part – I) (New-CBCS) Examination, 2018
TRANSPORTATION ENGINEERING – I

Day and Date : Monday, 10-12-2018   Max. Marks : 70
Time : 2.30 p.m. to 5.30 p.m.

***Instructions** : 1)* Q. No. **1** is **compulsory**. It should be solved in **first 30 minutes** in Answer Book Page No. **3. Each** question carries **one** mark.
     2) **Answer MCQ/Objective type questions on Page No. 3 only. Don't forget to mention, Q.P. Set (P/Q/R/S) on Top of Page.**

MCQ/Objective Type Questions

Duration : 30 Minutes   Marks : 14

1. Choose the correct answer :   **14**

     1) Spacing of the contraction joint is
       a) 4.0 m to 5.0 m   b) 5.0 m to 6.0 m
       c) 6.0 m to 7.0 m   d) 7.0 m to 8.0 m

     2) Equivalent radius of resisting section for 20 cm thick slab, given that the radius of contact area of wheel load is 15 cm is
       a) 15.07 cm   b) 14.07 cm   c) 16.07 cm   d) 17.07 cm

     3) Critical combination of stresses at edge in rigid pavement during winter mid-day are
       a) Load stress + Warping stress
       b) Load stress + Warping stress + frictional stress
       c) Load stress + warping stress – frictional stress
       d) Load stress – Warping stress + frictional stress

     4) Construction joint in rigid pavement is provided where
       a) Concreting work is started at the start of the day
       b) Temperature of the concrete is more
       c) Concreting work is stopped at the end of the day
       d) Contraction and expansion is required

P.T.O.

5) Which one of the following methods is generally considered the best for tunnel ventilation ?

   a) Driving a drift through the tunnel

   b) 'Blowin' method

   c) 'Blowout' method

   d) Combination of 'Blowin' and 'Blowout' methods

6) What is the correct sequence of the following events of construction of a shaft in a rock ?

   1) Drilling and blasting   2) Timbering

   3) Pumping   4) Mucking

   Select the correct answer using the codes given below.

   a) 1, 2, 3, 4   b) 1, 4, 2, 3   c) 2, 1, 4, 3   d) 2, 4, 1, 3

7) PPP stands for

   a) Private Public Partnership   b) Public Private Partnership

   c) Partnership Public Private   d) Public Provident Partnership

8) Reaction time of a driver

   a) increases with increase in speed

   b) decreases with increase in speed

   c) is same for all speeds

   d) none of the above

9) Bottom most layer of pavement is known as

   a) wearing course   b) base course

   c) sub-base course   d) subgrade

10) The terrain may be classified as rolling terrain if the cross slope of land is

   a) upto 10%   b) between 10% and 25%

   c) between 25% and 60%   d) more than 60%

11) Rapid curing cutback bitumen is produced by blending bitumen with

   a) Kerosene   b) Petrol   c) Diesel   d) Benzene

12) For highway geometric design purposes the speed used is

   a) 15th percentile   b) 50th percentile

   c) 85th percentile   d) 98th percentile

13) For the design of super elevation for mixed traffic conditions, the speed is reduced by

   a) 15%   b) 20%   c) 25%   d) 75%

14) Widening of curve on horizontal curve is required for _____ purpose.

   a) Mechanical   b) Psychological

   c) Both a) and b)   d) None of these

_____

Set Q

||||| |||| ||| | ||||| |||| ||| ||||| **SLR-TX – 50**

Seat No.	

T.E. (Civil Engineering) (Part – I) (New-CBCS) Examination, 2018
TRANSPORTATION ENGINEERING – I

Day and Date : Monday, 10-12-2018   Marks : 56
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) **All** questions are **compulsory**.
                       2) Figure on **right** indicates **full** marks.
                       3) Assume suitable data **wherever** needed and mention it **clearly**.

SECTION – I

2. Solve **any two** (**7 marks each**) :

    a) Calculate the minimum sight distance required to avoid a head-on collision of two cars approaching from the opposite directions at 90 and 60 kmph. Assume a reaction time of 2.5 seconds, coefficient of friction of 0.7 and a brake efficiency of 50 percent, in either case.   **7**

    b) A two lane national highway passing through a rolling terrain has a horizontal curve of radius 500 m. Design the length of transition curve and shift of the curve. Assume Design speed = 80 kmph, length of wheel base = 6 m, width of pavement = 7 m. Rate of introduction of super eleveation = 1 in 150.   **7**

    c) Write a detailed note on "Volume and Speed Studies".   **7**

3. Solve **any two** (**7 marks each**) :

    a) Enlist different tests carried out on Bituminous material. Explain any one in detail with neat sketch and its practical application.   **7**

    b) Discuss the importance of Highway Drainage.   **7**

    c) Write a detailed note on applications of Geosynthetics in road construction.   **7**

Set Q

SECTION – II

4. Answer **any two** questions (**7 marks each**) : **(2×7=14)**

   a) Draw a neat sketch of cross section of two lane flexible pavement and show the component parts. Enumerate the functions and importance of each component of the pavement.

   b) Enumerate the construction steps of Cement Concrete pavement.

   c) It is proposed to widen the existing two lane National Highway section to 4-lane divided road. Design the pavement for new carriageway using IRC guidelines.

   Input data :

   1) Initial traffic in each direction on counting year, N = 4000 cv/day

   2) Construction period since last traffic count, x = 3 years

   3) Design life = 15 years

   4) Design CBR of Subgrade soil to be employed, = 8%

   5) Traffic Growth Rate, r = 8%

   6) Vehicle Damage Factor as per axle load survey, F = 4.0

   7) Lane Distribution factor, D = 0.75

   8) Directional Distribution = 1.00

      Use Plate-4 to 6 of IRC-37-2012.

5. Answer **any two** questions (**7 marks each**) : **(2×7=14)**

   a) Calculate the annual cost of a stretch of higway from the following data.

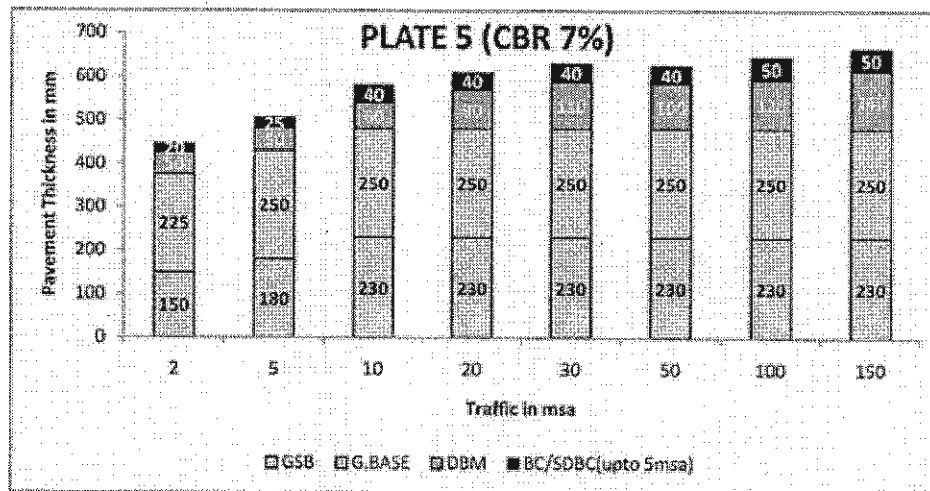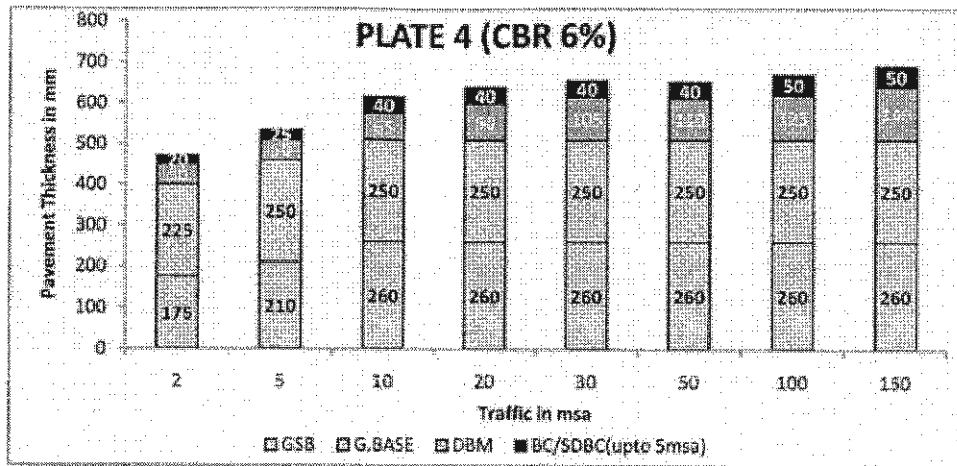| Item	Total Cos, Rs. In Lakhs	Estimated Life, years	Rate of Interest, %
Land	35	100	6
Earth work	40	40	8
Bridges, culverts & Drainage	50	60	8
Pavement	100	15	10
Traffic signs and road appurtenaces	15	5	10

   The average cost of maintenance of the road is Rs. 1.5 lakhs per year.

   b) What are the advantages of implementing PPP projects for highway development in India ?

   c) Describe heading and bench method of tunneling in hard rock with neat sketch.

                                                                    Set Q

IRC: 37-2012

PLATE 4 (CBR 6%)

PLATE 5 (CBR 7%)

PLATE 6 (CBR 8%)

Set Q

SLR-TX – 50

T.E. (Civil Engineering) (Part – I) (New-CBCS) Examination, 2018
TRANSPORTATION ENGINEERING – I

Day and Date : Monday, 10-12-2018　　　　　　　　　　Max. Marks : 70
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) *Q. No.* **1** *is* **compulsory***. It should be solved in* **first** **30 minutes** *in Answer Book Page No.* **3***. Each question carries* **one** *mark.*
　　　　　　　 2) **Answer MCQ/Objective type questions on Page No. 3 only. Don't forget to mention, Q.P. Set (P/Q/R/S) on Top of Page.**

MCQ/Objective Type Questions

Duration : 30 Minutes　　　　　　　　　　　　　　　　Marks : 14

1. Choose the correct answer :　　　　　　　　　　　　　　**14**

　1) For highway geometric design purposes the speed used is
　　a) 15th percentile　　　　　　b) 50th percentile
　　c) 85th percentile　　　　　　d) 98th percentile

　2) For the design of super elevation for mixed traffic conditions, the speed is reduced by
　　a) 15%　　　b) 20%　　　c) 25%　　　d) 75%

　3) Widening of curve on horizontal curve is required for _____ purpose.
　　a) Mechanical　　　　　　b) Psychological
　　c) Both a) and b)　　　　　d) None of these

　4) Spacing of the contraction joint is
　　a) 4.0 m to 5.0 m　　　　b) 5.0 m to 6.0 m
　　c) 6.0 m to 7.0 m　　　　d) 7.0 m to 8.0 m

　5) Equivalent radius of resisting section for 20 cm thick slab, given that the radius of contact area of wheel load is 15 cm is
　　a) 15.07 cm　　　b) 14.07 cm　　　c) 16.07 cm　　　d) 17.07 cm

　6) Critical combination of stresses at edge in rigid pavement during winter mid-day are
　　a) Load stress + Warping stress
　　b) Load stress + Warping stress + frictional stress
　　c) Load stress + warping stress – frictional stress
　　d) Load stress – Warping stress + frictional stress

P.T.O.

7) Construction joint in rigid pavement is provided where
   a) Concreting work is started at the start of the day
   b) Temperature of the concrete is more
   c) Concreting work is stopped at the end of the day
   d) Contraction and expansion is required

8) Which one of the following methods is generally considered the best for tunnel ventilation ?
   a) Driving a drift through the tunnel
   b) 'Blowin' method
   c) 'Blowout' method
   d) Combination of 'Blowin' and 'Blowout' methods

9) What is the correct sequence of the following events of construction of a shaft in a rock ?
   1) Drilling and blasting   2) Timbering
   3) Pumping   4) Mucking
      Select the correct answer using the codes given below.
   a) 1, 2, 3, 4   b) 1, 4, 2, 3   c) 2, 1, 4, 3   d) 2, 4, 1, 3

10) PPP stands for
    a) Private Public Partnership   b) Public Private Partnership
    c) Partnership Public Private   d) Public Provident Partnership

11) Reaction time of a driver
    a) increases with increase in speed
    b) decreases with increase in speed
    c) is same for all speeds
    d) none of the above

12) Bottom most layer of pavement is known as
    a) wearing course   b) base course
    c) sub-base course   d) subgrade

13) The terrain may be classified as rolling terrain if the cross slope of land is
    a) upto 10%   b) between 10% and 25%
    c) between 25% and 60%   d) more than 60%

14) Rapid curing cutback bitumen is produced by blending bitumen with
    a) Kerosene   b) Petrol   c) Diesel   d) Benzene

_____

Set R

Seat No.	

T.E. (Civil Engineering) (Part – I) (New-CBCS) Examination, 2018
TRANSPORTATION ENGINEERING – I

Day and Date : Monday, 10-12-2018   Marks : 56
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) **All** questions are **compulsory**.
               2) Figure on **right** indicates **full** marks.
               3) Assume suitable data **wherever** needed and mention it **clearly**.

SECTION – I

2. Solve **any two** (**7 marks each**) :

   a) Calculate the minimum sight distance required to avoid a head-on collision of two cars approaching from the opposite directions at 90 and 60 kmph. Assume a reaction time of 2.5 seconds, coefficient of friction of 0.7 and a brake efficiency of 50 percent, in either case.   **7**

   b) A two lane national highway passing through a rolling terrain has a horizontal curve of radius 500 m. Design the length of transition curve and shift of the curve. Assume Design speed = 80 kmph, length of wheel base = 6 m, width of pavement = 7 m. Rate of introduction of super eleveation = 1 in 150.   **7**

   c) Write a detailed note on "Volume and Speed Studies".   **7**

3. Solve **any two** (**7 marks each**) :

   a) Enlist different tests carried out on Bituminous material. Explain any one in detail with neat sketch and its practical application.   **7**

   b) Discuss the importance of Highway Drainage.   **7**

   c) Write a detailed note on applications of Geosynthetics in road construction.   **7**

Set R

SECTION – II

4. Answer **any two** questions (**7 marks each**) : **(2×7=14)**

   a) Draw a neat sketch of cross section of two lane flexible pavement and show the component parts. Enumerate the functions and importance of each component of the pavement.

   b) Enumerate the construction steps of Cement Concrete pavement.

   c) It is proposed to widen the existing two lane National Highway section to 4-lane divided road. Design the pavement for new carriageway using IRC guidelines.

   Input data :

   1) Initial traffic in each direction on counting year, N = 4000 cv/day

   2) Construction period since last traffic count, x = 3 years

   3) Design life = 15 years

   4) Design CBR of Subgrade soil to be employed, = 8%

   5) Traffic Growth Rate, r = 8%

   6) Vehicle Damage Factor as per axle load survey, F = 4.0

   7) Lane Distribution factor, D = 0.75

   8) Directional Distribution = 1.00

      Use Plate-4 to 6 of IRC-37-2012.

5. Answer **any two** questions (**7 marks each**) : **(2×7=14)**

   a) Calculate the annual cost of a stretch of higway from the following data.

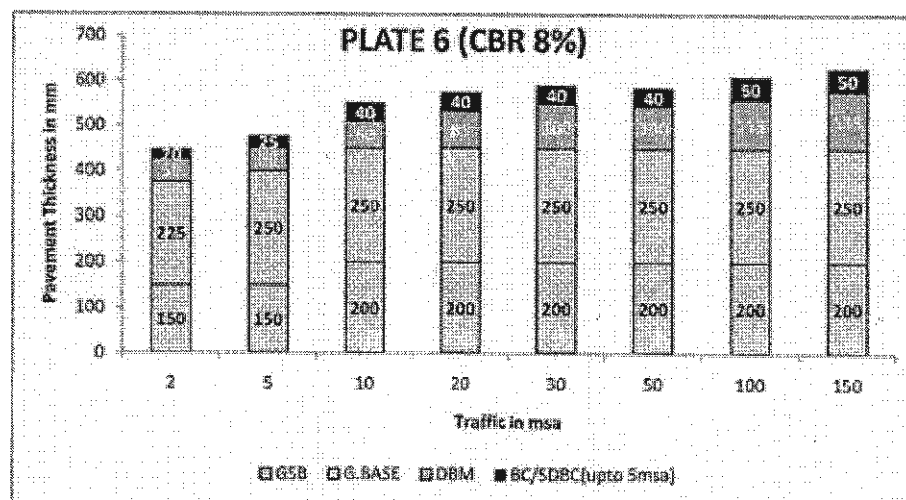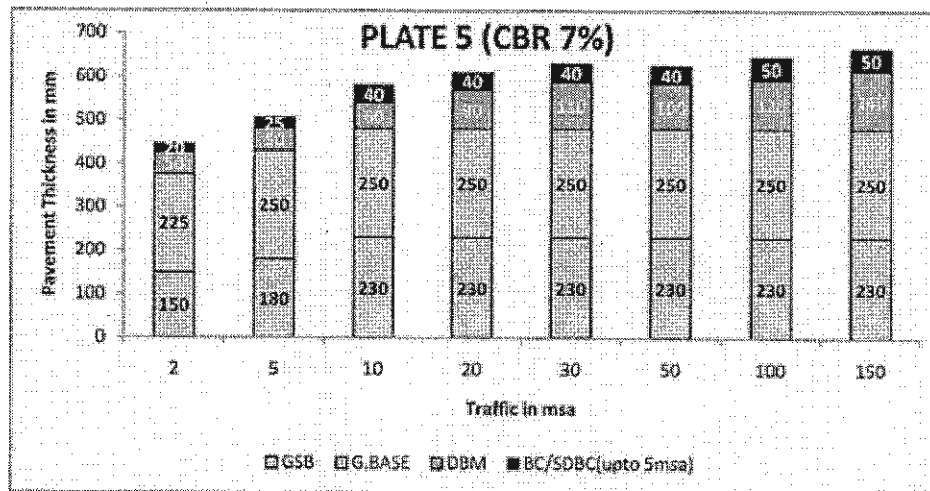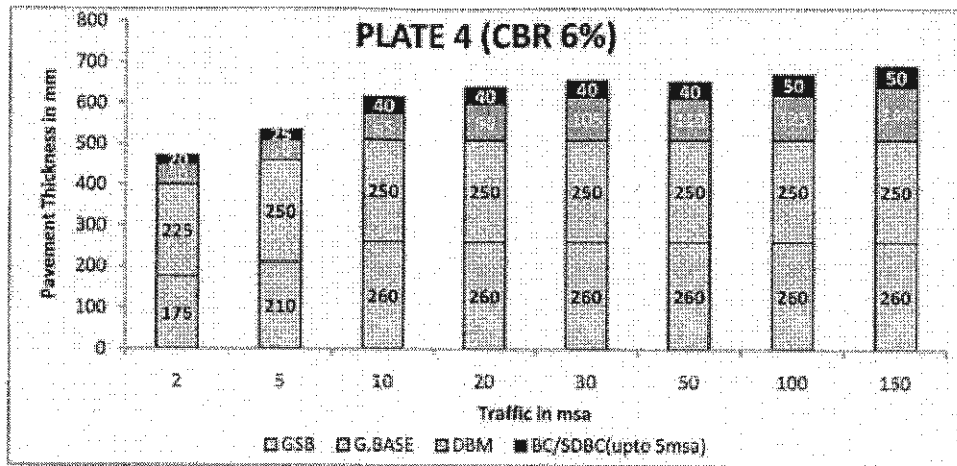| Item	Total Cos, Rs. In Lakhs	Estimated Life, years	Rate of Interest, %
Land	35	100	6
Earth work	40	40	8
Bridges, culverts & Drainage	50	60	8
Pavement	100	15	10
Traffic signs and road appurtenaces	15	5	10

   The average cost of maintenance of the road is Rs. 1.5 lakhs per year.

   b) What are the advantages of implementing PPP projects for highway development in India ?

   c) Describe heading and bench method of tunneling in hard rock with neat sketch.

Set R

PLATE 4 (CBR 6%)

PLATE 5 (CBR 7%)

PLATE 6 (CBR 8%)

Set R

Seat No.	

Set **S**

T.E. (Civil Engineering) (Part – I) (New-CBCS) Examination, 2018
TRANSPORTATION ENGINEERING – I

Day and Date : Monday, 10-12-2018   Max. Marks : 70
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) *Q. No.* **1** *is* **compulsory**. *It should be solved in* **first 30 minutes** *in Answer Book Page No.* **3**. **Each** *question carries* **one** *mark.*
           2) **Answer MCQ/Objective type questions on Page No. 3 only. Don't forget to mention, Q.P. Set (P/Q/R/S) on Top of Page.**

MCQ/Objective Type Questions

Duration : 30 Minutes   Marks : 14

1. Choose the correct answer :   **14**

   1) Critical combination of stresses at edge in rigid pavement during winter mid-day are

     a) Load stress + Warping stress

     b) Load stress + Warping stress + frictional stress

     c) Load stress + warping stress – frictional stress

     d) Load stress – Warping stress + frictional stress

   2) Construction joint in rigid pavement is provided where

     a) Concreting work is started at the start of the day

     b) Temperature of the concrete is more

     c) Concreting work is stopped at the end of the day

     d) Contraction and expansion is required

   3) Which one of the following methods is generally considered the best for tunnel ventilation ?

     a) Driving a drift through the tunnel

     b) 'Blowin' method

     c) 'Blowout' method

     d) Combination of 'Blowin' and 'Blowout' methods

P.T.O.

4) What is the correct sequence of the following events of construction of a shaft in a rock ?
   1) Drilling and blasting 2) Timbering
   3) Pumping 4) Mucking
   Select the correct answer using the codes given below.
   a) 1, 2, 3, 4 b) 1, 4, 2, 3 c) 2, 1, 4, 3 d) 2, 4, 1, 3

5) PPP stands for
   a) Private Public Partnership b) Public Private Partnership
   c) Partnership Public Private d) Public Provident Partnership

6) Reaction time of a driver
   a) increases with increase in speed
   b) decreases with increase in speed
   c) is same for all speeds
   d) none of the above

7) Bottom most layer of pavement is known as
   a) wearing course b) base course
   c) sub-base course d) subgrade

8) The terrain may be classified as rolling terrain if the cross slope of land is
   a) upto 10% b) between 10% and 25%
   c) between 25% and 60% d) more than 60%

9) Rapid curing cutback bitumen is produced by blending bitumen with
   a) Kerosene b) Petrol c) Diesel d) Benzene

10) For highway geometric design purposes the speed used is
    a) 15th percentile b) 50th percentile
    c) 85th percentile d) 98th percentile

11) For the design of super elevation for mixed traffic conditions, the speed is reduced by
    a) 15% b) 20% c) 25% d) 75%

12) Widening of curve on horizontal curve is required for _____ purpose.
    a) Mechanical b) Psychological
    c) Both a) and b) d) None of these

13) Spacing of the contraction joint is
    a) 4.0 m to 5.0 m b) 5.0 m to 6.0 m
    c) 6.0 m to 7.0 m d) 7.0 m to 8.0 m

14) Equivalent radius of resisting section for 20 cm thick slab, given that the radius of contact area of wheel load is 15 cm is
    a) 15.07 cm b) 14.07 cm c) 16.07 cm d) 17.07 cm

_____

Set S

Seat No.	

T.E. (Civil Engineering) (Part – I) (New-CBCS) Examination, 2018
TRANSPORTATION ENGINEERING – I

Day and Date : Monday, 10-12-2018   Marks : 56
Time : 2.30 p.m. to 5.30 p.m.

Instructions : 1) **All** questions are **compulsory**.
              2) Figure on **right** indicates **full** marks.
              3) Assume suitable data **wherever** needed and mention it **clearly**.

SECTION – I

2. Solve **any two** (**7 marks each**) :

    a) Calculate the minimum sight distance required to avoid a head-on collision of two cars approaching from the opposite directions at 90 and 60 kmph. Assume a reaction time of 2.5 seconds, coefficient of friction of 0.7 and a brake efficiency of 50 percent, in either case.   **7**

    b) A two lane national highway passing through a rolling terrain has a horizontal curve of radius 500 m. Design the length of transition curve and shift of the curve. Assume Design speed = 80 kmph, length of wheel base = 6 m, width of pavement = 7 m. Rate of introduction of super eleveation = 1 in 150.   **7**

    c) Write a detailed note on "Volume and Speed Studies".   **7**

3. Solve **any two** (**7 marks each**) :

    a) Enlist different tests carried out on Bituminous material. Explain any one in detail with neat sketch and its practical application.   **7**

    b) Discuss the importance of Highway Drainage.   **7**

    c) Write a detailed note on applications of Geosynthetics in road construction.   **7**

Set S

SECTION – II

4. Answer **any two** questions (**7 marks each**) : **(2×7=14)**

   a) Draw a neat sketch of cross section of two lane flexible pavement and show the component parts. Enumerate the functions and importance of each component of the pavement.

   b) Enumerate the construction steps of Cement Concrete pavement.

   c) It is proposed to widen the existing two lane National Highway section to 4-lane divided road. Design the pavement for new carriageway using IRC guidelines.

   Input data :

   1) Initial traffic in each direction on counting year, N = 4000 cv/day

   2) Construction period since last traffic count, x = 3 years

   3) Design life = 15 years

   4) Design CBR of Subgrade soil to be employed, = 8%

   5) Traffic Growth Rate, r = 8%

   6) Vehicle Damage Factor as per axle load survey, F = 4.0

   7) Lane Distribution factor, D = 0.75

   8) Directional Distribution = 1.00

      Use Plate-4 to 6 of IRC-37-2012.

5. Answer **any two** questions (**7 marks each**) : **(2×7=14)**

   a) Calculate the annual cost of a stretch of higway from the following data.

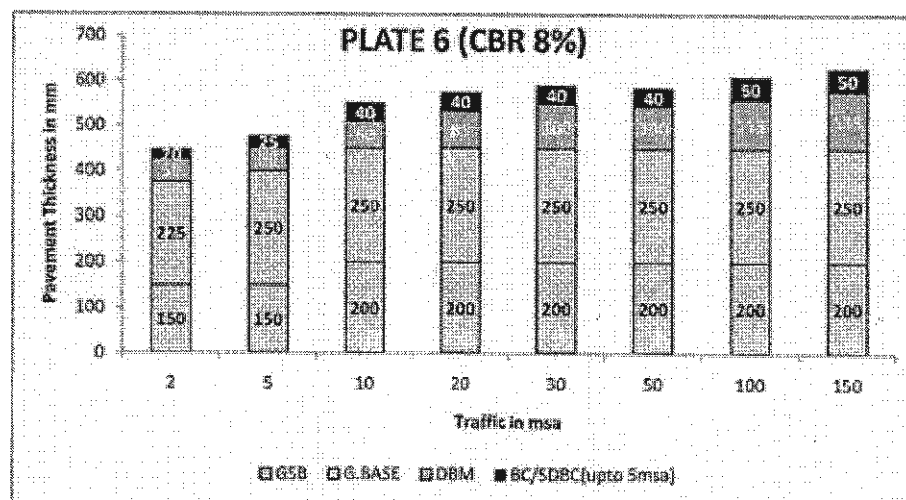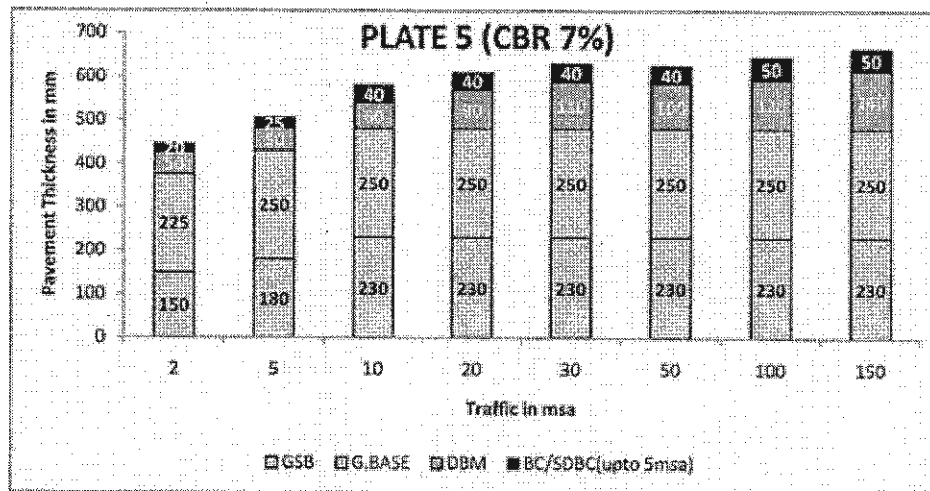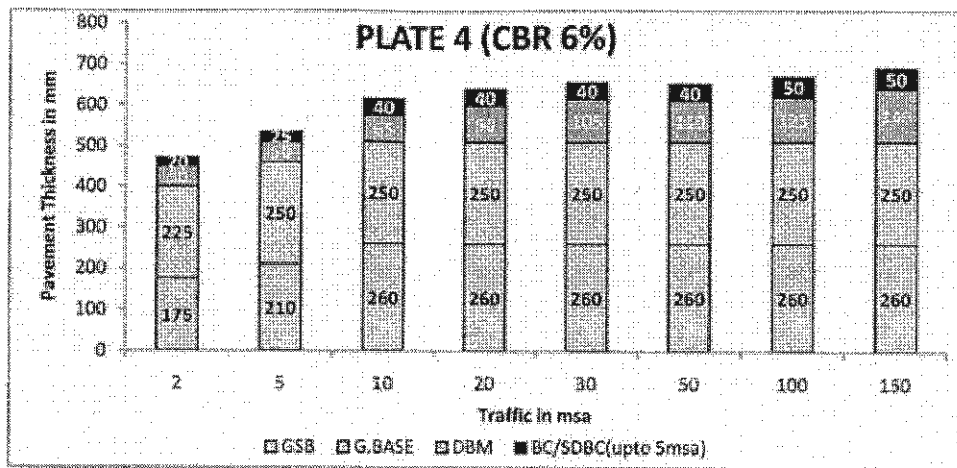| Item	Total Cos, Rs. In Lakhs	Estimated Life, years	Rate of Interest, %
Land	35	100	6
Earth work	40	40	8
Bridges, culverts & Drainage	50	60	8
Pavement	100	15	10
Traffic signs and road appurtenaces	15	5	10

   The average cost of maintenance of the road is Rs. 1.5 lakhs per year.

   b) What are the advantages of implementing PPP projects for highway development in India ?

   c) Describe heading and bench method of tunneling in hard rock with neat sketch.

   Set S

PLATE 4 (CBR 6%)

PLATE 5 (CBR 7%)

PLATE 6 (CBR 8%)

Set S

Set S