
Seat	
No.	

4

## 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

Dur	atio	n : 30 Minutes				Marks : 14
1.	Ch	noose the correct a	answer :			14
	1)	Reaction time of	a driver			
		a) increases with	n increase in spe	ed		
		b) decreases wit	h increase in spe	eed		
		c) is same for all	speeds			
		d) none of the ab	oove			
	2)	Bottom most laye	er of pavement is	known as		
		a) wearing cours	se	b) base cour	se	
		c) sub-base cou	rse	d) subgrade		
	3)	The terrain may b	oe classified as r	olling terrain if the	cross slope of la	and is
		a) upto 10%		b) between 1	0% and 25%	
		c) between 25%	and 60%	d) more than	60%	
	4) Rapid curing cutback bitumen is p		roduced by blend	ling bitumen with	1	
		a) Kerosene	b) Petrol	c) Diesel	d) Benzene	
	5)	5) For highway geometric design purposes			used is	
		a) 15 <sup>th</sup> percentile	)	b) 50 <sup>th</sup> perce	ntile	
		c) 85 <sup>th</sup> percentile	)	d) 98 <sup>th</sup> perce	ntile	



6)	For the design of super elevation reduced by	n for mix	xed traffic c	onditions, the speed	l is
	a) 15% b) 20%	c)	25%	d) 75%	
7)	Widening of curve on horizontal				
	a) Mechanical	b)	Psycholog	ical	
	c) Both a) and b)	d)	None of the	ese	
8)	Spacing of the contraction joint is	S			
	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 se radius of contact area of wheel lo	ection fo bad is 1	or 20 cm thio 5 cm is	ck slab, given that t	he
	a) 15.07 cm b) 14.07 cm	n c)	16.07 cm	d) 17.07 cm	
10)	Critical combination of stresses mid-day are	at edge	e in rigid pa	avement during win	ter
	a) Load stress + Warping stress				
	b) Load stress + Warping stress				
	c) Load stress + warping stress				
	d) Load stress – Warping stress				
11)	Construction joint in rigid paveme	•			
	a) Concreting work is started at		-		
	b) Temperature of the concrete i				
	c) Concreting work is stopped at		-	1	
40\	d) Contraction and expansion is	•			£
12)	Which one of the following meth tunnel ventilation?		generally c	onsidered the best	ior
	a) Driving a drift through the tuni	nel			
	b) 'Blowin' method				
	c) 'Blowout' method	(DI			
4.0\	d) Combination of 'Blowin' and '				<b>.</b> _
13)	What is the correct sequence of shaft in a rock?	the foll	lowing even	its of construction o	та
	Drilling and blasting	2)	Timbering		
	3) Pumping	4)	Mucking		
	Select the correct answer using	•	•		
	• • • • • • • • • • • • • • • • • • • •	c)	2, 1, 4, 3	d) 2, 4, 1, 3	
14)	PPP stands for	_	<b>_</b> =	. <b>.</b>	
	a) Private Public Partnership	b)	Public Priv	ate Partnership	
	c) Partnership Public Private	d)	Public Pro	vident Partnership	
					Set P



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 P



## 4. Answer any two questions (7 marks each):

 $(2 \times 7 = 14)$ 

- 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):

 $(2 \times 7 = 14)$ 

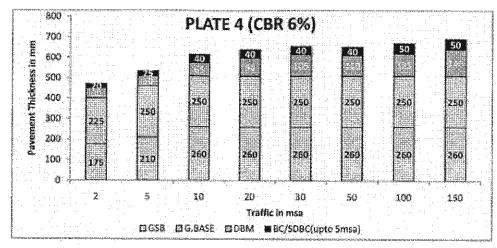
a) Calculate the annual cost of a stretch of higway from the following data.

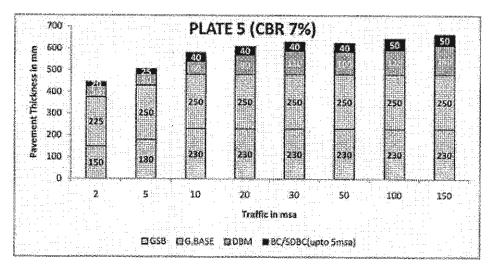
Item	Total Cos, Rs. In	Estimated Life, years	Rate of Interest, %
	Lakhs		<i>,</i> *
Land	35	100	6
Earth work	40	40	8
Bridges, culverts &	50	60	8
Drainage			
Pavement	100	15	10
Traffic signs and road	15	5	10
appurtenaces			

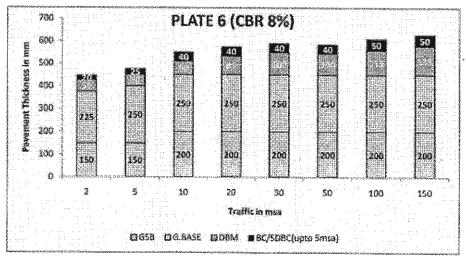
The average cost of maintenance of the road is Rs. 1.5 lakhs per year.

- 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.










Seat	
No.	

Set Q

# 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



			ıt.
	c) Both a) and b)	d) None of these	
	a) Mechanical	b) Psychological	
14)	Widening of curve on horizontal curve		
	•	c) 25% d) 75%	
. 0)	reduced by	mixed traine conditions, the opeca is	
13)	c) 85 <sup>th</sup> percentile For the design of super elevation for	d) 98 <sup>th</sup> percentile mixed traffic conditions, the speed is	
	a) 15 <sup>th</sup> percentile	b) 50 <sup>th</sup> percentile	
12)	For highway geometric design purpos	-	
	a) Kerosene b) Petrol	,	
11)	Rapid curing cutback bitumen is prod	duced by blending bitumen with	
	c) between 25% and 60%	d) more than 60%	
10)	a) upto 10%	b) between 10% and 25%	
10)	<ul><li>c) sub-base course</li><li>The terrain may be classified as rolling</li></ul>	d) subgrade	
	a) wearing course	b) base course	
9)	Bottom most layer of pavement is known		
<b>~</b> \	d) none of the above		
	c) is same for all speeds		
	b) decreases with increase in speed		
	a) increases with increase in speed		
8)	Reaction time of a driver		
	c) Partnership Public Private	d) Public Provident Partnership	
	a) Private Public Partnership	b) Public Private Partnership	
7)	PPP stands for		
	_	c) 2, 1, 4, 3 d) 2, 4, 1, 3	
	Select the correct answer using th	,	
	3) Pumping	4) Mucking	
	Drilling and blasting	2) Timbering	
6)	What is the correct sequence of the shaft in a rock?	tollowing events of construction of a	
<b>6</b> )	d) Combination of 'Blowin' and 'Blow		
	c) 'Blowout' method		
	b) 'Blowin' method		
	a) Driving a drift through the tunnel		
5)	Which one of the following methods tunnel ventilation?	is generally considered the best for	
と/	Which and of the following mathada	is apparally considered the host for	



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# 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.

. .

Set Q



## 4. Answer any two questions (7 marks each):

 $(2 \times 7 = 14)$ 

- 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):

 $(2 \times 7 = 14)$ 

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

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

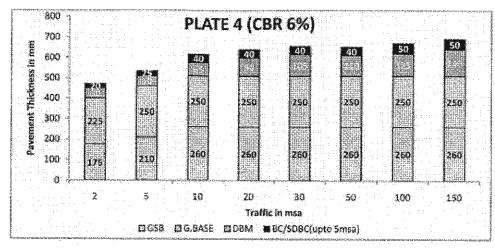
The average cost of maintenance of the road is Rs. 1.5 lakhs per year.

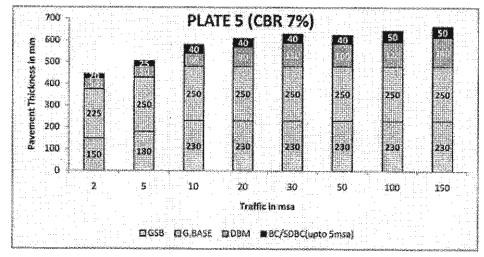
- b) What are the advantages of implementing PPP projects for highway development in India?
- c) Describe heading and bench method of tunneling in hard rock with neat sketch.

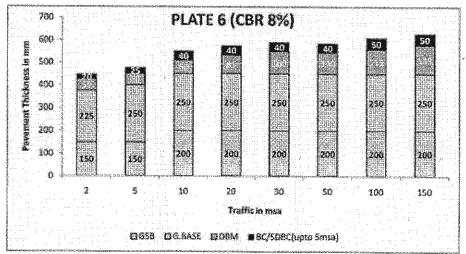
http://www.batuonline.com

Set Q










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		
Dur	atio	n : 30 Minutes				Marks	3:14
1.	Ch	noose the correct a	nswer:				14
	1)	For highway geon	netric design pur	poses	the speed us	ed is	
		a) 15 <sup>th</sup> percentile		b) :	50 <sup>th</sup> percentile	е	
		c) 85 <sup>th</sup> percentile		d) !	98 <sup>th</sup> percentile	е	
	2)	For the design of reduced by	super elevation f	for mixe	ed traffic con	ditions, the speed is	3
		a) 15%	b) 20%	c) :	25%	d) 75%	
	3)	Widening of curve	on horizontal cu	urve is	required for _	purpose.	
		a) Mechanical		b)	Psychologica	ıl	
		c) Both a) and b)		d)	None of these	е	
	4)	Spacing of the cor	ntraction joint is				
		a) 4.0 m to 5.0 m		,	5.0 m to 6.0 r		
		c) 6.0 m to 7.0 m		,	7.0 m to 8.0 r		
	5)	Equivalent radius radius of contact a	of resisting sect area of wheel loa	tion for ad is 15	20 cm thick cm is	slab, given that the	<del>)</del>
		a) 15.07 cm	b) 14.07 cm	c)	16.07 cm	d) 17.07 cm	
	6)	Critical combination mid-day are	on of stresses a	it edge	in rigid pave	ement during winte	r
		a) Load stress + \	Narping stress				
		b) Load stress + \	Narping stress +	<ul> <li>friction</li> </ul>	nal stress		
		c) Load stress + v	warping stress –	friction	al stress		
		d) Load stress - \	Narning stress +	- friction	nal stress		



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	У		
	d) Contraction and expansion is requ				
8)	Which one of the following methods tunnel ventilation?	is generally o	considered the best for		
	a) Driving a drift through the tunnel				
	b) 'Blowin' method				
	c) 'Blowout' method				
	d) Combination of 'Blowin' and 'Blow				
9)	What is the correct sequence of the following events of construction of shaft in a rock?				
	1) Drilling and blasting	2) Timbering			
	3) Pumping	4) Mucking			
	Select the correct answer using the	_			
	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 Priv	ate Partnership		
	c) Partnership Public Private	d) Public Pro	vident 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	own as			
	a) wearing course	b) base cour	se		
	c) sub-base course	d) subgrade			
13)	3) The terrain may be classified as rolling terrain if the cross slope of la				
	a) upto 10%	b) between 1	0% and 25%		
	c) between 25% and 60%	d) more than	60%		
14)	Rapid curing cutback bitumen is prod	uced by blend	ling bitumen with		
	a) Kerosene b) Petrol	c) Diesel	d) Benzene		



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.

Set R



## 4. Answer any two questions (7 marks each):

 $(2 \times 7 = 14)$ 

- 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):

 $(2 \times 7 = 14)$ 

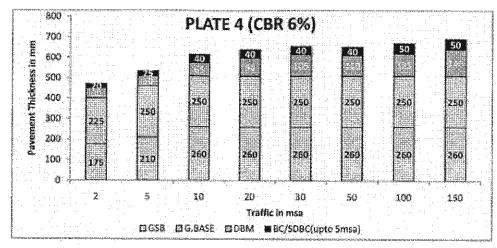
a) Calculate the annual cost of a stretch of higway from the following data.

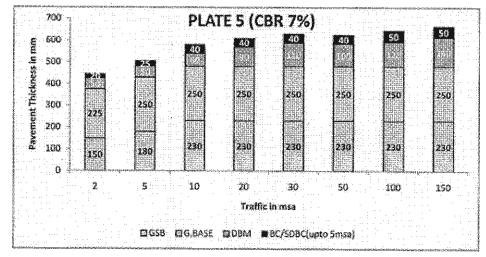
Item	Total Cos, Rs. In Lakhs	Estimated Life, years	Rate of Interest, %
Tand		100	
Land	35	100	6
Earth work	40	40	8
Bridges, culverts &	50	60	8
Drainage			
Pavement	100	15	10
Traffic signs and road	15	5	10
appurtenaces		·	

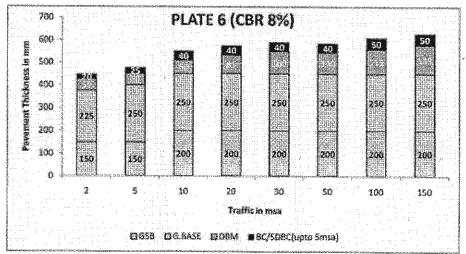
The average cost of maintenance of the road is Rs. 1.5 lakhs per year.

- 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.











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 th	ne 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	own as		
	a) wearing course	b) base course		
	c) sub-base course	d) subgrade		
8)	The terrain may be classified as rolling			
	a) upto 10%	b) between 10% and 25%		
	c) between 25% and 60%	d) more than 60%		
9)	Rapid curing cutback bitumen is proc			
	,	c) Diesel d) Benzene		
10)	For highway geometric design purpos	-		
	a) 15 <sup>th</sup> percentile	b) 50 <sup>th</sup> percentile		
	c) 85 <sup>th</sup> percentile	d) 98 <sup>th</sup> percentile		
11)	For the design of super elevation for reduced by	mixed traffic conditions, the speed is		
	•	c) 25% d) 75%		
12)	Widening of curve on horizontal curve			
	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		



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.

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b) Discuss the importance of Highway Drainage.

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

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Set S



## 4. Answer any two questions (7 marks each):

 $(2 \times 7 = 14)$ 

- 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):

 $(2 \times 7 = 14)$ 

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

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

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.



