SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING
QUESTION BANK

V SEMESTER
1903503 - HIGHWAY ENGINEERING
Regulation – 2019
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Prepared by

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SUBJECT : 1903503 – HIGHWAY ENGINEERING

SEM / YEAR: V/III

UNIT I - HIGHWAY PLANNING AND ALIGNMENT
Significance of highway planning – Modal limitations towards sustainability - History of road development in India – factors influencing highway alignment – Soil suitability analysis - Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods - Classification of highways – Locations and functions – Typical cross sections of Urban and Rural roads -Highway pricing

PART A

Q.No	Questions	BT Level	Competence
1.	What are the contributions made by Jayakar committee for the road development in India.	BT - 1	Remember
2.	What are the classifications of urban roads?	BT - 1	Remember
3.	Define obligatory point.	BT - 1	Remember
4.	Define National Highway Act (1956).	BT - 1	Remember
5.	List various characteristics of roadways.	BT - 1	Remember
6.	Define alignment and types of alignment	BT - 1	Remember
7.	List the factors controlling highway alignment?	BT - 1	Remember
8.	State the classification of roads according to Nagpur road plan.	BT - 1	Remember
9.	What are the recommendations of the CRRI.	BT - 1	Remember
10.	Summarize a short note on road ecology.	BT - 3	Apply
11.	Classify the various types of Engineering surveys.	BT - 2	Understand
12.	Summarize the salient features of Nagpur Road plan.	BT - 3	Apply
13.	Explain the stages in engineering surveys?	BT - 3	Apply
14.	Explain Road Ecology.	BT - 3	Apply
15.	Summarize the four factors controlling highway alignment.	BT - 3	Apply
16.	Explain the Highway pricing	BT - 3	Apply
17.	Explain the objectives of Central Road Fund?	BT - 3	Apply
18.	Summarize the objectives of the Indian Roads Congress?	BT - 3	Apply
19.	Illustrate about the significance of highway planning.	BT - 1	Remember
20.	Write the objectives of highway research board?	BT - 3	Apply

21.	Write short notes on second twenty-year plan.	BT - 3	Apply
22.	What is meant by an Expressway?	BT - 1	Remember
23.	What is a Cul-De Sac?	BT - 1	Remember
24.	What is meant by an arterial road?	BT - 1	Remember
25.	Write Short notes on Highway Research Board?	BT - 3	Apply

PART B			
Q.No	Questions	BT Level	Competence
1.	Write in detail about the engineering surveys conducted for highway alignment.	BT - 3	Apply
2.	Write in detail about highway planning in India for the first twenty-year plan.	BT - 3	Apply
3.	Write some brief notes on: 1. Central Road Fund (4) 2. Indian Roads Congress (5) 3. National Highway Authority of India (4)	BT - 3	Apply
4.	Write various Classification of highways and its locations and functions	BT - 3	Apply
5.	List the salient features of Nagpur road plan and its classification of roads.	BT - 1	Remember
6.	Identify the length of national and state highways required in a district with a total area of 7200 km^2 developed semi developed and undeveloped areas being 30, 45 and 25% of the district. The number of towns with population over 1.0, 0.5-1.0, 0.2-0.5 and 0.1-0.2 lakhs are 3,7,12 and 20 respectively in the district. Use Bombay road plan.	BT - 4	Analyse
7.	Illustrate the activities of National Highway Authority of India.	BT - 2	Understand
8.	Summarize the various requirements of ideal highway alignment	BT - 2	Understand
9.	Compare the two modes of Transportation – Railways and Highways	BT - 2	Understand
10.	Explain the detail about second twenty year road plan	BT - 3	Apply
11.	The following data were collected for planning the road developed programme of a backward district. Total area = 9600 km ^{2} Agricultural and developed area = 3200 km^2 Existing railway track length = 105 km Existing length of surfaced road = 322 km Existing length of unsurfaced road = 450 km Number of towns or villages in different population ranges are given below; Population: > 5000, 2001-5000, 1001-2000, 501-1000, < 500 No of Villages & Towns: 8, 40, 130, 280, 590 Calculate the additional length of surfaced and unsurfaced roads for the road based on Nagpur Road plan formula for this district.	BT - 4	Analyse
12.	The area of a certain district is 13,400 km^2 and there are 12 towns as	BT - 4	Analyse

	per 1981 census. Determine the length of different categories of road to be provided in this district by the year 2001.		
13.	Develop how modern methods such as GIS and GPS may be used for the reconnaissance survey for highway alignment.	BT - 1	Remember
14.	Explain in detail about the obligatory points controlling highway alignment.	BT - 3	Apply
15.	List the factor influencing the highway alignment	BT - 1	Remember
16.	Briefly explain the role of MORTH and IRC in highway development?	BT - 3	Apply
17.	Describe the classifications of urban roads in India. Give the cross section of urban road with all its features.	BT - 3	Apply
PART C			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Explain the third twenty year road plan.	BT - 3	Apply
2.	Calculate the total length of NH, SH, MDR,ODR and VR needed in a district as per second 20 year road development plan. The data collected from the district are given below. Total area = 18,400 km^2 Developed and agricultural area = 8000 km^2 Undeveloped area = 4800 km^2 <table><tr><th>Population Range</th><th>No of towns</th></tr><tr><td><500</td><td>200</td></tr><tr><td>500-1000</td><td>350</td></tr><tr><td>1000-2000</td><td>750</td></tr><tr><td>2000-5000</td><td>360</td></tr><tr><td>5000-10,000</td><td>150</td></tr><tr><td>10,000-20,000</td><td>80</td></tr><tr><td>20,000-50,000</td><td>25</td></tr><tr><td>50,000-1,00,000</td><td>10</td></tr><tr><td>>1,00,000</td><td>5</td></tr></table>	BT - 4	Analyse
3.	Write shortly the significance of Soil suitability analysis and road ecology in highway planning?	BT - 3	Apply
4.	Develop in detail about various steps involved in a new highway project.	BT - 3	Apply
5.	Write in brief the history of road development in India after independence?	BT - 3	Apply

UNIT II - GEOMETRIC DESIGN OF HIGHWAYS

Cross sectional elements - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves - Gradients, Special consideration for hill roads – Hairpin bends –Lateral and vertical clearance at underpasses.

PART A

Q.No	Questions	BT Level	Competence
1.	Define Road margins.	BT - 1	Remember
2.	Where the vertical curves are provided?	BT - 1	Remember
3.	Define design speed.	BT - 1	Remember
4.	Define gradient.	BT - 1	Remember
5.	What do you understand by non-passing sight distance?	BT - 1	Remember
6.	What is meant by off tracking?	BT - 1	Remember
7.	Define transition curve.	BT - 1	Remember
8.	Differentiate lag or reaction distance and braking distance?	BT - 2	Understand
9.	What are the different Sight Distances?	BT - 1	Remember
10.	What is mean by geometric design?	BT - 1	Remember
11.	Illustrate the requirements of an ideal transition curve.	BT - 2	Understand
12.	Interpret the lag distance required for an automobile moving with a speed of 80Kmph with driver's reaction time of 2 sec?	BT - 2	Understand
13.	Draw a typical Transition curve and mark all its zones.	BT - 2	Understand
14.	Explain the importance of hair pin bend in hill roads.	BT - 3	Apply
15.	Compare summit and valley curves	BT - 2	Understand
16.	What are the elements in geometric design?	BT - 1	Remember
17.	What is the factor governing super elevation of a road surface?	BT - 1	Remember
18.	Construct the importance of grade compensation on horizontal curves.	BT - 3	Apply
19.	What is mean by super elevation?	BT - 1	Remember
20.	Construct ruling gradient and exceptional gradient.	BT - 3	Apply
21.	What are overtaking zone?[	BT - 1	Remember
22.	Define stopping sight distance	BT - 1	Remember
23.	State the reasons for widening of roads at curves.	BT - 1	Remember
24.	State PIEV theory.	BT - 1	Remember
25.	What is mean by minimum gradient in highway? Why it is provided?	BT - 1	Remember

Q.No	Questions	BT Level	Competence
	PART B		

1.	The radius of the horizontal curve is 120 m, The design speed is 60 kmph and the design coefficient of lateral friction is 0.15.
	  i. Calculate the super elevation required
	  ii. Calculate the Coefficient of friction if no super elevation is provided.
		BT - 4	Analyse

2.	A valley curve is formed due to two gradients +3.5% and -2.75%.if the design speed of this highway is 80kmph, determine the stopping sight distance and design the valley curve to fulfill both comfort and head light distance conditions.	BT - 4	Analyse

3.	The speed of overtaking and overtaken vehicles is 80 and 50 kmph respectively. On a two way traffic road, the acceleration of overtaking vehicle is 0.99 m/sec^2
	  i. Calculate safe OSD
	  ii. Mention the minimum length of overtaking zone
	  iii. Draw the sketch of overtaking zone with all details.
		BT - 4	Analyse

4.	Find the safe stopping sight distance for the design speed of 50 kmph. Assume co-efficient of friction as 0.37 and reaction time of driver as 2.5 seconds.
	  i) Two way traffic on a two lane road and
	  i) Two way traffic on a single lane road.
		BT - 4	Analyse

5.	What are the objectives of widening of road pavement at horizontal curves? Derive an expression for the extra widening.	BT - 1	Remember
6.	Derive the formula for calculating super elevation on horizontal curves.	BT - 2	Understand
7.	Calculate the minimum sight distance required to avoid a head on collision of two cars approaching from the opposite direction at 90 and 60 kmph. Assume a reaction time of 2.5 seconds coefficient of friction of 0.7 and brake efficiency of 50 % in either case.	BT - 2	Understand
8.	The speed of overtaking and over taken vehicles, 70 and 40 kmph, respectively on a two-way traffic road. If the acceleration of overtaking vehicle is 0.99m/s^2. Calculate SSD, OSD and ISD	BT - 2	Understand

9.	The design speed of the vehicle is 70 kmph and the coefficient of friction is 0.35. If the reaction time of the driver is 2.5 seconds calculate,
	  i.SSD for Two-way two-lane road
	  ii.SSD for Two- way single lane road
	  iii.SSD for Two-way two-lane road with an ascending gradient of 2%
	  iv.SSD for Two- way two-lane road with the breaking efficiency of 75%
		BT - 4	Analyse

10.	A National highway passing through a rolling terrain has a horizontal curve of radius 220m. If the design speed is 80 kmph, calculate super elevation, extra widening, stopping sight distance and intermediate sight distance. Assume necessary data suitably.	BT - 2	Understand
11.	i. A vertical summit curve is formed by $n_1 = +3.0\%$ and $n_2 =−5.0\%$. Estimate the length of the summit curve for V=80 kmph. (7) ii. A valley curve is formed by descending gradient n_1= 1 in 25 and	BT - 4	Analyse

	ascending gradient n₂= 1 in 30. Predict the length of the valley curve for V =80kmph. (6)		
12.	Explain the Types of Gradient.	BT - 3	Apply
13.	A valley curve is formed due to two gradients +2.5% and –1.75%. If the design speed of this highway is 80 kmph, determine the stopping sight distance and design the valley curve to fulfill both comfort and head light sight distance conditions.	BT - 3	Apply
14.	Explain the factors influencing overtaking sight distance.	BT - 3	Apply
15.	The following are the details pertaining the road, Pavement width = 7 m, Radius of curve = 200 m, Maximum length of wheel base = 6 m, Design speed = 70 kmph. Calculate the extra widening required.	BT - 4	Analyse
16.	Explain the factors affecting sight distances	BT - 3	Apply
17.	A descending gradient of 1/30 meets an ascending gradient of 1/40 to form a valley curve. Calculate the length of the curve. Take SSD as 150 m.	BT - 4	Analyse
PART C			
Q.No	**Questions**	**BT Level**	**Competence**
1.	Explain the steps involved in the design of hill roads.	BT - 3	Apply
2.	Calculate the stopping sight distance required to avoid head on collision of two cars approaching opposite directions at a speed of 75kmph and 85kmph.assume that the reaction time of drivers be 2.5 secs and co-efficient between road surface and tyres be 0.4.	BT - 4	Analyse
3.	Illustrate the various types of horizontal curves with neat sketches.	BT - 2	Understand
4.	The design speed of a highway is 80 kmph. There is a horizontal curve of radius 200m on this road. If maximum super elevation of 1 in 15 is not to be exceeded calculate the maximum allowable speed on the curve. Also determine the extra widening required and length of the spiral transition curve using the following data. Length of the wheel base = 6.1m, Pavement width = 7.2m and number of lanes = 2. Rate of introduction of super elevation is 1 in 200.	BT - 4	Analyse
5.	Write short notes on: i) Right of way (4) ii) Carriage way (4) iii) Camber (4) iv) Kerbs (3)	BT - 3	Apply

	UNIT III - DESIGN OF FLEXIBLE AND RIGID PAVEMENT		
Pavement components and their role - Design principles -Design practice for flexible and rigid Pavements (IRC methods only) – Embankments- Problems in Flexible pavement design.
PART A
Q.No	**Questions**	**BT Level**	**Competence**
1.	Define pavement.	BT - 1	Remember
2.	Define equivalent radius of resisting section.	BT - 1	Remember
3.	Bring out the difference between flexible and rigid pavements.	BT - 2	Understand
4.	Define critical load positions.	BT - 1	Remember
5.	What are the types of pavement Structure?	BT - 1	Remember
6.	Explain about prime coat and tack coat.	BT - 3	Apply
7.	What is rigidity factor in the design of Highway Pavements?	BT - 1	Remember
8.	What are the design methods available in flexible pavement?	BT - 1	Remember
9.	List the factors which affect the stability of the pavement?	BT - 1	Remember
10.	What are the factors considered in design of pavements?	BT - 1	Remember
11.	State the recommendation of IRC on distribution of commercial vehicles over carriage way.	BT - 1	Remember
12.	How is the load stress in the corner region obtained for the design of rigid pavement?	BT - 1	Remember
13.	Define ESWL.	BT - 1	Remember
14.	List the general functions of a pavement component?	BT - 1	Remember
15.	Illustrate about the rigid pavement with sketch.	BT - 2	Understand
16.	Explain flexible pavement.	BT - 3	Apply
17.	Mention the types of joints in rigid pavements.	BT - 2	Understand
18.	How to measure the contact pressure?	BT - 1	Remember
19.	How is edge temperature stress calculated for the design of rigid pavement?	BT - 1	Remember
20.	State the components of the flexible pavements	BT - 1	Remember
21.	List the applications of Rigid pavements.	BT - 1	Remember
22.	What is vehicle damage factor?	BT - 1	Remember
23.	Define CBR.	BT - 1	Remember
24.	What are the major effects in climatic variations?	BT - 1	Remember
25.	Write about dowel bars in rigid pavement.	BT - 3	Apply

	PART B		
Q.No	**Questions**	**BT Level**	**Competence**
1.	Find the thickness of the pavement for construction of a new two lane carriage way for the design life of 15 years using IRC method. The initial traffic in the year of completion in each the direction is 150 CPVD and growth rate 5%, VDF based on axle load survey=2.5standad axle per commercial vehicle. Design CBR of subgrade soil=4%.	BT - 5	Evaluate
2.	Show in detail about the design of joints in rigid pavement.	BT - 2	Understand
3.	Explain the functions of the components of flexible pavements.	BT - 3	Apply
4.	Explain the factors governing the structural design of pavements.	BT - 3	Apply
5.	A cement concrete pavement has a thickness of 18 cm and has two lanes of 7.2 m with a longitudinal joint along the centre. Indicate the dimension and spacing of tie bar using the following details. Allowable working stress in tension=1400kg/cm^2 Unit weight of concrete= 2400kg/m^3 Coefficient of friction=1.5 Allowable bending stress in deformed bars in concrete=2.5kg/cm^2	BT - 5	Evaluate
6.	Explain the various factors influencing design of Rigid pavements and the design procedure as per IRC 58.	BT - 3	Apply
7.	Design the pavement for construction of a new bypass with the following data: Two lane carriage way, Initial traffic in the year of completion of construction = 400 CVPD (sum of both directions), Traffic growth rate = 7.5 %. Design life = 15 years, Vehicle damage factor based on axle load survey = 2.5 standard axle per commercial vehicle and Design CBR of subgrade soil = 4%.	BT - 5	Evaluate
8.	Explain the CBR method of design of flexible pavements.	BT - 3	Apply
9.	Compare between flexible and rigid pavement.	BT - 2	Understand
10.	Explain the design consideration for spacing of expansion and contraction joints.	BT - 3	Apply
11.	Construct the different stresses induced in the cement concrete pavement. Discuss the critical combination of these stresses.	BT - 2	Understand
12.	Explain the functions of the components of the Rigid pavements	BT - 3	Apply
13.	Design the reinforcement of a cement concrete slab of 200 mm thick assuming the following data: Concrete density= 2400kg/m^3 Transverse joint spacing =15m Working stress in steel =140 Mpa Friction coefficient=1.5 Pavement width= 3.75m	BT - 5	Evaluate
14.	Using the following data, design the flexible pavement layers: CBR of the subgrade soil = 5% CBR of poorly graded gravel sub-base = 15%	BT - 5	Evaluate

	CBR of WBM = 80% Design life = 15 years Annual rate of increase in the heavy vehicles = 7.5% No. of heavy vehicles per day during last count = 200 No. of years between the year of completion and year of last count = 3 years. Assume any other data found required.		
15.	Explain mud pumping. What are the causes for mud pumping and how it can be prevented?	BT - 3	Apply
16.	i. Describe the factors influencing the design of flexible pavements. ii. Define ESWL and lane distribution factor and explain their significance.	BT - 3	Apply
17.	Calculate the stress at the interior, edge and corner regions of the CC pavement using Westergaard's stress equation where wheel load P=6100kg, Pavement thickness h=18cm, Modulus of subgrade reaction k=6kg/cm^2, Radius of contact area a=15 cm^2	BT - 4	Analyse

PART C

Q.No	Questions	BT Level	Competence
1.	Explain in detail about the IRC method of flexible pavement design. Discuss the limitation of this method.	BT - 3	Apply
2.	Design a flexible pavement for the following details: No. of commercial vehicle in each direction = 500, Construction period= 2 years, Annual traffic growth rate = 7.5%, CBR Value = 6%, Road type=SH, Pavement width = 7 m, Design period = 20 years.	BT - 4	Analyse
3.	Explain in detail about embankment in pavement.	BT - 3	Apply
4.	Identify the stresses at interior, edge and corner region of cement concrete pavement using Westergaard's equation. Use the following data. Wheel load = 5200 kg, Pavement thickness=20 cm, Poisson's ratio of concrete=0.15, Subgrade Modulus=6kg/cm^3, E=3x10^5 kg/cm^2, Radius of contact area=15cm^2.	BT - 4	Analyse
5.	Determine the stresses at interior, edge and corner regions of a rigid pavement using Westergaard's method. Take P=4100KG; E=3X10^5 kg/cm^2, h=20cm, μ=0.15, k=4.0kg/cm^2 and a=15cm^2.	BT - 4	Analyse

UNIT IV - HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE

Highway construction materials, properties, testing methods – CBR Test for subgrade - tests on aggregate & bitumen – Test on Bituminous mixes-Construction practice including modern materials and methods, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fiber, Plastic, Geo-Textiles, Geo-Membrane (problem not included) – Quality control measures - Highway drainage — Construction machineries.

PART A

Q.No	Questions	BT Level	Competence
1.	List the significance of CBR test.	BT - 1	Remember
2.	What are the requirements of good aggregates?	BT - 1	Remember
3.	Define flakiness index.	BT - 1	Remember
4.	What is the purpose of applying prime coat?	BT - 1	Remember
5.	What is the purpose of conducting abrasion test?	BT - 1	Remember
6.	What is the purpose of applying tack coat in bituminous road construction	BT - 1	Remember
7.	Mention the desirable properties of highway materials.	BT - 2	Understand
8.	What are the Index properties available in soil?	BT - 1	Remember
9.	Define flaky aggregates.	BT - 1	Remember
10.	Define angularity number.	BT - 1	Remember
11.	Write the importance of California bearing ratio.	BT - 3	Apply
12.	Define softening point of bitumen.	BT - 1	Remember
13.	Define elongation Index.	BT - 1	Remember
14.	How to calculate the CBR value in highway materials?	BT - 1	Remember
15.	State the desirable properties of road aggregate	BT - 1	Remember
16.	Mention the names of tests recommended by Indian standards for testing highway materials.	BT - 2	Understand
17.	What do you understand about flash and fire point of bitumen?	BT - 1	Remember
18.	Differentiate between cut back bitumen and emulsions.	BT - 2	Understand
19.	Define the three groups of evaluation of soil strength?	BT - 1	Remember
20.	Write about the specific gravity test on bitumen.	BT - 3	Apply
21.	Differentiate between Tar and Bitumen.	BT - 2	Understand
22.	Why joints are provided in cement concrete pavements?	BT - 1	Remember
23.	Define PMB.	BT - 2	Understand
24.	How adding up the waste plastics help in the improvement of bituminous pavements?	BT - 2	Understand
25.	What do you understand by bitumen 90?	BT - 2	Understand

PART B

Q.No	Questions	BT Level	Competence
1.	Explain the California bearing ratio test.	BT - 3	Apply
2.	Explain the construction procedure of WBM.	BT - 3	Apply
3.	Discuss the any 2 properties of Aggregates and Bitumen and its laboratory investigations	BT - 3	Apply
4.	Briefly explain the ductility test and softening point test.	BT - 3	Apply
5.	Explain the importance and procedure of field density test and crushing strength test.	BT - 3	Apply
6.	What are the different forms of Bitumen?	BT - 1	Remember
7.	Demonstrate the construction procedure of a flexible pavement. Explain the equipment required for various layers while constructing the flexible pavement.	BT - 3	Apply
8.	Describe the procedure recommended by bureau of Indian standards for carrying out Abrasion Test and Flakiness Index Test.	BT - 3	Apply
9.	Demonstrate the essential properties of good highway materials.	BT - 2	Understand
10.	Explain the steps involved in the construction of cement road.	BT - 3	Apply
11.	What are the modern construction materials used for the construction of pavements? Explain their characteristics and usage in details.	BT - 1	Remember
12.	Briefly explain the penetration test and softening point test on bitumen.	BT - 3	Apply
13.	Describe how impact value of aggregate and specific gravity of bitumen is found in laboratory.	BT - 3	Apply
14.	Construct the merits and demerits of cement concrete roads.	BT - 2	Understand
15.	Specify the design approach for the surface drainage system of highways.	BT - 3	Apply
16.	Explain the construction procedure for bituminous concrete.	BT - 3	Apply
17.	Explain the test procedure for assessing polishing value of aggregate.	BT - 3	Apply

PART C

Q.No	Questions	BT Level	Competence
1.	Explain briefly the construction of earth roads. Discuss the advantages And limitations of earth roads	BT - 3	Apply
2.	List the applications of geotextile and geo membrane in road construction.	BT - 1	Remember
3.	Explain the procedure for determination of binder content of bitumen.	BT - 3	Apply
4.	Distinguish with neat sketches the surface and sub surface drainage system of roads.	BT - 2	Understand
5.	Explain any four properties of good aggregates used for bituminous construction and describe anyone test to evaluate its suitability. How do aggregate properties affect the service behaviour of bituminous surfacing?	BT - 3	Apply

	UNIT V - EVALUATION AND MAINTENANCE OF PAVEMENTS		
	Pavement distress in flexible and rigid pavements – Types of maintenance – Pavement Management Systems - Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements (Benkelman beam deflection test) – Strengthening of pavements – Overlay design - Highway Project formulation.		
	PART A		
Q.No	**Questions**	**BT Level**	**Competence**
1.	List the various types of routine maintenance?	BT - 1	Remember
2.	List the parameters that should be observed for evaluating a rigid pavement.	BT - 1	Remember
3.	What are the causes of cracks?	BT - 1	Remember
4.	Write short notes on Alligator Crack.	BT - 3	Apply
5.	What is FWD and state its use.	BT - 1	Remember
6.	Give examples of surface defects in pavements.	BT - 1	Remember
7.	What is pavement evaluation?	BT - 1	Remember
8.	Define Bleeding.	BT - 1	Remember
9.	Define the term "Highway Project Formulation".	BT - 1	Remember
10.	Compare Pumping and Ravelling	BT - 1	Remember
11.	Explain: a) Underpass b) Lateral clearance c) Vertical clearance	BT - 3	Apply
12.	What is meant by pavement serviceability?	BT - 1	Remember
13.	What is mean by spalling of joint?	BT - 1	Remember
14.	Define frost heaving.	BT - 1	Remember
15.	Outline the causes of Scaling.	BT - 3	Apply
16.	What are the causes of potholes and how are they repaired?	BT - 1	Remember
17.	Classify the types of cracks formed in the cement concrete roads.	BT - 2	Understand
18.	Mention the reason for the development of cracks in rigid pavement.	BT - 1	Remember
19.	Give the various types of overlay.	BT - 1	Remember
20.	What is unevenness index.	BT - 1	Remember
21.	Differentiate delamination and depression?	BT - 2	Understand
22.	List out the types of defects in flexible pavements.	BT - 1	Remember
23.	State the basic principle of deflection method using Benklemenn beam.	BT - 1	Remember
24.	What is mud pumping in rigid pavements?	BT - 1	Remember
25.	What is meant by shoving?	BT - 1	Remember

Q.No	Questions	BT Level	Competence
	PART B		
1.	List the possible causes for longitudinal cracking.	BT - 1	Remember
2.	Explain in detail the possible causes and remedial measures for joint spalling.	BT - 3	Apply
3.	List the procedure for structural evaluation of pavements.	BT - 1	Remember
4.	Write brief note of the following: 1.Use of Benkelman Beam Test 2. Warping Cracks 3. Road construction in water logged areas.	BT - 3	Apply
5.	Explain in detail the possible causes and remedial measures for joint failure.	BT - 3	Apply
6.	Illustrate the methods employed for evaluation of pavements.	BT - 2	Understand
7.	Explain the method of strengthening of existing pavement with flexible overlay	BT - 3	Apply
8.	Illustrate briefly the different types of failures of rigid pavements.	BT - 2	Understand
9.	i. What are the general causes of pavement failures? ii. What is meant by rutting? Explain the symptoms, causes and treatment.	BT - 1	Remember
10.	i) List the defects in flexible pavements (4) ii) Symptoms of defects (3) iii)Causes of defects (3) iv)Treatment for each defect (3)	BT - 1	Remember
11.	Discuss any 3 failures, Repairs and Maintenance of flexible and rigid pavements	BT - 3	Apply
12.	Develop the causes for the disintegration of flexible pavements.	BT - 3	Apply
13.	Explain any two commonly employed methods for the structural evaluation of flexible and rigid pavements.	BT - 3	Apply
14.	Classify the different types of failures in flexible pavement and mention the important causes of each.	BT - 2	Understand
15.	Explain how resealing of cracks may be carried out in rigid pavements.	BT - 3	Apply
16.	i. Explain briefly the maintenance of bituminous surface. ii. Write short notes on maintenance management system?	BT - 3	Apply
17.	Explain the methods of strengthening damaged pavements.	BT - 3	Apply
	PART C		
Q.No	Questions	BT Level	Competence
1.	Explain any three non-destructive testing methods of pavement deflection.	BT - 3	Apply
2.	Describe the symptoms, causes and remedial measures for the different types of failure in flexible pavements.	BT - 3	Apply
3.	i.Illustrate flexible overlays. (5)	BT - 2	Understand

	ii. Outline how the Benkelman Beam is used to design the thicknessof the overlay. (10)		
4.	Explain how the maintenance of the following pavements is carried out? a) Earth roads b) Cement concrete pavements	BT - 3	Apply
5.	Explain the principle and uses of Benkelman beam test and Describe the complete procedure of carrying out Benkelman beam test to evaluate the pavement with model calculation	BT - 3	Apply