SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING
QUESTION BANK

V SEMESTER

CE3563 - HIGHWAY AND RAILWAY ENGINEERING

Regulation – 2023

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Prepared by

Mr.N.VINOTH KUMAR

Assistant Professor(Sr.G)

UNIT I - HIGHWAY PLANNING PRINCIPLES, ALIGNMENT AND GEOMETRIC DESIGN			
Highway Planning Principles: Introduction to transportation, different modes of transportation, classification of roads, network patterns, planning surveys. Highway Alignment: Requirements and factors controlling and Engineering surveys. Geometric Design: Cross section Elements, Sight distances, Horizontal alignment and Vertical alignment. Concepts of Highway project preparation			
PART A - 2 Marks			
Q. No.	**Questions**	**BTL**	**Competence**
1	List are the contributions made by Jayakar committee for the road development in India.	1	Remembering
2	Mention the classifications of urban roads.	1	Remembering
3	Define National Highway Act (1956).	1	Remembering
4	List various characteristics of roadways.	1	Remembering
5	Define alignment and types of alignment	1	Remembering
6	List the factors controlling highway alignment?	1	Remembering
7	State the classification of roads according to Nagpur road plan.	1	Remembering
8	Indicate the recommendations of the CRRI.	2	Understanding
9	List the four factors controlling highway alignment.	1	Remembering
10	Explain the Highway pricing.	2	Understanding
11	Explain the objectives of Central Road Fund.	2	Understanding
12	Name the objectives of the Indian Roads Congress.	1	Remembering
13	List the significance of highway planning.	1	Remembering
15	Write the objectives of highway research board?	1	Remembering
16	Explain the importance of hair pin bend in hill roads.	2	Understanding
17	Compare summit and valley curves.	2	Understanding
18	Write are the elements in geometric design?	2	Understanding
19	Name the factor governing super elevation of a road surface?	1	Remembering
20	List the importance of grade compensation on horizontal curves.	1	Remembering
21	Define super elevation.	1	Remembering
22	Differentiate the ruling gradient and exceptional gradient.	2	Understanding
23	State the reasons for widening of roads at curves.	1	Remembering
24	State PIEV theory.	1	Remembering
25	Describe the reason for minimum gradient in highway.	1	Remembering
PART B - 16 Marks			
Q. No.	**Questions**	**BTL**	**Competence**
1	Illustrate in brief about the historical development of road construction.	3	Applying
2	Write in detail about the engineering surveys conducted for highway alignment.	2	Understanding
3	Explain in detail about highway development and planning in India.	2	Understanding
4	Outline the classification of highways and its locations and functions	4	Analysing
5	Calculate 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	3	Applying

<table>
<tr><td></td><td>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.</td><td></td><td></td></tr>
<tr><td>6</td><td>Categorise the various requirements of ideal highway alignment</td><td>4</td><td>Analysing</td></tr>
<tr><td>7</td><td>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
Calculate the additional length of surfaced and unsurfaced roads for the road based on Nagpur Road plan formula for this district.
Number of towns or villages in different population ranges are given below;
<table>
<tr><th>Population</th><th>> 5000</th><th>2001-5000</th><th>1001-2000</th><th>501-1000</th><th>< 500</th></tr>
<tr><td>No of Villages & Towns</td><td>8</td><td>40</td><td>130</td><td>280</td><td>590</td></tr>
</table></td><td>3</td><td>Applying</td></tr>
<tr><td>8</td><td>Illustrate the factor influencing the highway alignment</td><td>3</td><td>Applying</td></tr>
<tr><td>9</td><td>Discuss the classifications of urban roads in India. Give the cross section of urban road with all its features.</td><td>2</td><td>Understanding</td></tr>
<tr><td>10</td><td>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></td><td>3</td><td>Applying</td></tr>
<tr><td>11</td><td>Describe in details about the objectives of widening of road pavement at horizontal curves with an expression for the extra widening.</td><td>1</td><td>Remembering</td></tr>
<tr><td>12</td><td>Explain about deriving the formula for calculating super elevation on horizontal curves.</td><td>2</td><td>Understanding</td></tr>
<tr><td>13</td><td>Explain the Types of Gradient.</td><td>2</td><td>Understanding</td></tr>
<tr><td>14</td><td>Illustrate the various types of horizontal curves with neat sketches.</td><td>3</td><td>Applying</td></tr>
<tr><td>15</td><td>Explain the steps involved in the design of hill roads.</td><td>2</td><td>Understanding</td></tr>
<tr><td>16</td><td>The design speed of a highway is 80 kmph. There is a horizontal curve of</td><td>3</td><td>Applying</td></tr>
</table>

	radius 200 m 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 = 6.1 m, Pavement width = 7.2 m and number of lanes = 2. Rate of introduction of super elevation is 1 in 200.		
17	Calculate the stopping sight distance required to avoid head on collision of two cars approaching opposite directions at a speed of 75 kmph and 85 kmph. Assume that the reaction time of drivers be 2.5 secs and co-efficient between road surface and tyres be 0.4.	3	Applying
18	Analyse in detail about various steps involved in a new highway project.	4	Analysing
19	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.	3	Applying
20	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. Determine the extra widening required on curves.	3	Applying
21	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.	3	Applying
22	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, 1. SSD for Two-way two-lane road 2. SSD for Two- way single lane road 3. SSD for Two-way two-lane road with an ascending gradient of 2% 4. SSD for Two- way two-lane road with the breaking efficiency of 75%	3	Applying
23	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	3	Applying
24	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 1. Calculate safe OSD 2. Mention the minimum length of overtaking zone 3. Draw the sketch of overtaking zone with all details.	3	Applying
25	Explain the factors affecting sight distances.	2	Understanding

UNIT II - TRAFFIC ENGINEERING PRINCIPLES AND TRAFFIC OPERATIONS			
Traffic studies on flow, Speed and travel time, Highway capacity and level of service of rural highways and urban roads. Types of intersections, and channelization; Traffic operations: traffic signs, road markings, signals and warrants and Road safety.			
PART A - 2 Marks			
Q. No.	**Questions**	**BTL**	**Competence**
1	State the objectives of traffic engineering.	1	Remembering
2	List the purpose of accident data collection.	1	Remembering
3	Write the advantages of Rotary intersection	2	Understanding
4	List the objectives of Channelization.	1	Remembering
5	Name the methods of traffic volume study.	1	Remembering
6	Distinguish between 'Time Mean Speed' and 'Space Mean Speed'.	2	Understanding
7	State any two vehicular characteristics, which affect road designs.	1	Remembering
8	Discuss on Average Daily Traffic and the 85th percentile speed.	1	Remembering
9	Name the methods of traffic volume study.	1	Remembering
10	Define the terms basic capacity and possible capacity.	1	Remembering
11	State the purpose of Origin and Destination survey.	1	Remembering
12	Write any four object markings used on a road.	2	Understanding
13	Describe Pedestrian signal.	1	Remembering
15	State about conflicts at intersection.	1	Remembering
16	Distinguish between intersections and interchanges.	2	Understanding
17	Distinguish between 'Traffic Capacity' and 'Traffic Density'	2	Understanding
18	State the drawbacks of a conventional roundabout.	1	Remembering
19	Draw the typical rotary intersection with all its design elements.	1	Remembering
20	Name the any for regulatory signals.	1	Remembering
21	Differentiate between signal coordination and area traffic control.	2	Understanding
22	List out various types of street furniture normally provided in common.	1	Remembering
23	Write any four objectives of markings used on a road.	2	Understanding
24	Explain the pedestrian signal.	1	Remembering
25	Write down the actors responsible for the road accidents?	2	Understanding
PART B - 16 Marks			
Q. No.	**Questions**	**BTL**	**Competence**
1	Write the scope and significance of traffic engineering with various functions of Traffic engineer?	2	Understanding
2	Explain the various vehicular characteristics which affect the road design and traffic performance.	1	Remembering
3	Briefly explain the factors affecting highway capacity and level of service.	1	Remembering
4	Illustrate the various levels of service as per IRC for arterial streets and down town streets.	3	Applying
5	Discuss briefly with neat sketches on collision and condition diagrams.	2	Understanding

6	Outline the term practical capacity and summarise the various factors affecting the practical capacity of road	3	Applying
7	Explain in brief the origin and destination survey methods which are commonly used in traffic planning of metro cities.	1	Remembering
8	Illustrate the various data collection method of origin destination survey.	3	Applying
9	Outline how you would organize and conduct road side interview for studying the Origin and Destination of vehicles entering and leaving a study area.	4	Analysing
10	Discuss in details about presentation of traffic volume data.	2	Understanding
11	List the various methods to calculate the spot speed. Explain any three.	1	Remembering
12	Define the term traffic volume. Describe the objectives of carrying out the traffic volume studies.	1	Remembering
13	Illustrate with neat sketch about the details have to be collected while conducting parking inventory survey.	3	Applying
14	Summarize the various design factors for off street parking.	2	Understanding
15	Explain in brief the various types of channelizing islands with neat sketches.	1	Remembering
16	Interpret the various types of grade separated intersections along with its functions.	3	Applying
17	Point out various advantages and disadvantages of rotary intersection.	4	Analysing
18	Explain with neat sketches about different types of rotary islands.	1	Remembering
19	Discuss in details about the factors are to be considered whiling installing traffic sign boards.	2	Understanding
20	Summarise the various types of road side signs with neat sketches.	2	Understanding
21	Explain with neat sketches about various road markings commonly used.	1	Remembering
22	Explain centreline and lane markings with neat sketches.	1	Remembering
23	Illustrate the effect of accidents in detail.	3	Applying
24	Explain in brief the various causes of road accidents with preventive measures.	2	Understanding
25	Write briefly the different factors causing accidents?	2	Understanding

UNIT III - PAVEMENT MATERIALS, DESIGN & CONSTRUCTION			
Experimental characterization of pavement materials; Types of pavement structures, Concepts on Analysis and Design of pavement systems; functions of pavement components, design factors. Design of flexible and rigid pavement as per IRC methods. Highway Construction: Types of Pavement layers, Construction of Granular, Bituminous and Cement Concrete layers.			
PART A - 2 Marks			
Q. No.	**Questions**	**BTL**	**Competence**
1	Define pavement.	1	Remembering
2	Define equivalent radius of resisting section.	1	Remembering
3	Differentiate between flexible and rigid pavements.	2	Understanding
4	Define critical load positions.	1	Remembering
5	Write the types of pavement structure.	2	Understanding
6	Explain about prime coat and tack coat.	2	Understanding
7	Write about rigidity factor in the design of highway pavements.	2	Understanding
8	List the design methods available in flexible pavement.	1	Remembering
9	List the factors which affect the stability of the pavement.	1	Remembering
10	State the factors considered in design of pavements.	1	Remembering
11	State the recommendation of IRC on distribution of commercial vehicles over carriage way.	1	Remembering
12	Sate how is the load stress in the corner region obtained for the design of rigid pavement.	1	Remembering
13	Define ESWL.	1	Remembering
15	List the general functions of a pavement component?	1	Remembering
16	Draw the rigid pavement with sketch.	1	Remembering
17	Explain flexible pavement.	2	Understanding
18	State the types of joints in rigid pavements.	1	Remembering
19	Discuss the measure of contact pressure.	2	Understanding
20	State the components of the flexible pavements	1	Remembering
21	List the applications of Rigid pavements.	1	Remembering
22	Define vehicle damage factor.	1	Remembering
23	Define CBR.	1	Remembering
24	Name major effects in climatic variations.	1	Remembering
25	Write about dowel bars in rigid pavement.		
PART B - 16 Marks			
Q. No.	**Questions**	**BTL**	**Competence**
1	Describe in detail about the design of joints in rigid pavement.	1	Remembering
2	Illustrate the functions of the components of flexible pavements.	3	Applying
3	Outline the factors governing the structural design of pavements.	3	Applying
4	Design the reinforcement of a cement concrete slab of 200 mm thick assuming the following data: Concrete density= 2400 kg/m^3 Transverse joint spacing = 15m Working stress in steel = 140 MPa	6	Creating

	Friction coefficient = 1.5 Pavement width = 3.75m		
5	Using the following data, design the flexible pavement layers: CBR of the subgrade soil = 5% CBR of poorly graded gravel sub-base = 15% 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.	6	Creating
6	Calculate the stress at the interior, edge and corner regions of the CC pavement using Westergaard's stress equation where wheel load P = 6100 kg, Pavement thickness h = 18 cm, Modulus of subgrade reaction k = 6 kg/cm^2, Radius of contact area a = 15 cm^2.	3	Applying
7	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. Assume any other data found required.	6	Creating
8	Determine 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.	3	Applying
9	Determine the stresses at interior, edge and corner regions of a rigid pavement using Westergaard's method. Take P = 4100 kg; E = 3x10^5 kg/cm^2, h = 20 cm, μ = 0.15, k = 4.0 kg/cm^2 and a = 15cm^2.	3	Applying
10	Experiment the penetration test and softening point test on bitumen.	3	Applying
11	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. Compute 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.	3	Applying
12	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	6	Creating

	commercial vehicle and Design CBR of subgrade soil = 4%.		
13	Illustrate the various factors influencing design of Rigid pavements and the design procedure as per IRC 58.	3	Applying
14	Explain the CBR method of design of flexible pavements.		
15	Explain the design consideration for spacing of expansion and contraction joints	2	Understanding
16	Outline the different stresses are induced in the cement concrete pavement. Discuss the critical combination of these stresses.	3	Applying
17	Illustrate the various functions of the components of the Rigid pavements	3	Applying
18	Explain mud pumping. What are the causes for mud pumping and how it can be prevented?	2	Understanding
19	Explain in detail about the IRC method of flexible pavement design. Discuss the limitation of this method.	2	Understanding
20	Experiment the California Bearing Ratio test.	3	Applying
21	Illustrate the essential properties of good highway materials.	3	Applying
22	Experiment how impact value of aggregate and specific gravity of bitumen is found in laboratory.	3	Applying
23	Compare the merits and demerits of cement concrete roads.	5	Evaluating
24	Outline the applications of geotextile and geo membrane in road construction.	3	Applying
25	Distinguish with neat sketches the surface and sub surface drainage system of roads.	2	understanding

UNIT IV - INTRODUCTION, PERMANENT WAY, GEOMETRIC DESIGN

Role of Indian Railways in National Development – Railways for Urban Transportation – LRT & MRTS. Permanent Way: Components and their Functions; Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks; Sleepers & Ballast – Functions, Materials, Density; Geometric Design of Railway Tracks: Gradients and Grade Compensation, Speed types, Cant, Negative super elevation, Widening of Gauges in Curves, Transition Curves, Horizontal / Vertical Curves.

PART A - 2 Marks

Q. No.	Questions	BTL	Competence
1	State few important events in the history of Indian railways.	1	Remembering
2	Compare the road and railway transport.	2	Understanding
3	Name the roles of Indian railways	2	Understanding
4	Write the organizations of Indian railways?	2	Understanding
5	List the strength of Indian railways.	1	Remembering
6	Discuss the weakness of Indian railways.	2	Understanding
7	Differentiate between LRT and MRTS.	2	Understanding
8	Define creep in sleepers.	1	Remembering
9	Label the functions of sleepers?	1	Remembering
10	Describe the requirements of an ideal sleeper.	1	Remembering
11	Explain sleeper density.	2	Understanding
12	Define the term ballast.	1	Remembering
13	Show size of ballast is used for the main line, and points and crossings on Indian Railways?	1	Remembering
15	Estimate the optimum thickness of the stone ballast required below sleepers of density $M + 7$ on a BG track.	1	Remembering
16	Show a typical section of an MG line on wooden sleepers and show the ballast cushion and side slopes for a sleeper density of $M + 3$.	1	Remembering
17	List the functions of the ballast in a railway track.	1	Remembering
18	State the necessity for geometric design.	1	Remembering
19	Draw the sketch of permanent way cross section.	1	Remembering
20	Identify the cause of kinks in rails.	1	Remembering
21	Define super elevation in railways.	1	Remembering
22	Classify the types of gradient in railways.	2	Understanding
23	Write the importance of widening of gauge in curves.	2	Understanding
24	Specify the types of gauges.	1	Remembering
25	Write few points about grade compensation in curves	2	Understanding

PART B - 16 Marks

Q. No.	Questions	BTL	Competence
1	Categorise the role of Indian railways in the social and economic development of the country. Mention briefly the strengths and weaknesses of the Indian railways.	4	Analysing
2	Illustrate the strength and weakness of Indian railways.	3	Applying
3	Explain briefly about the need for railways for urban transportation	2	Understanding

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4	Discuss about the various geometric design parameters of a railway track.	2	Understanding
5	Explain with neat sketches any four obligatory points controlling railway alignment.	2	Understanding
6	Discuss in details the points on functions and requirements of various elements of railway permanent way.	2	Understanding
7	Draw a neat sketch of permanent way and list the functions of different components of permanent way.	1	Remembering
8	State and discuss briefly the factors that control the alignment of a railway track.	1	Remembering
9	Interpret the functions of sleepers? Also, compare the different types of sleepers.	3	Applying
10	Relate the various gauges prevailing in India with their gauge widths. What factors govern the selection of a suitable gauge? Discuss.	3	Applying
11	Illustrations the various types of rails and their defects.	3	Applying
12	Describe in brief the basic requirements of a good alignment. What are the factors that control the alignment of a railway line?	2	Understanding
13	List the various surveys that need to be undertaken for the construction of a new railway line and outline their essential objectives.	1	Remembering
14	Name the various types of stresses induced in a rail section? Explain briefly how these are evaluated.	1	Remembering
15	Compare the various types of rails widely used in India.	5	Evaluating
16	Categorize the types of rail wear, methods by which wear in rails can be measured and methods to reduce wear.	4	Analysing
17	Illustrate the various functions and requirements of a good sleepers.	3	Applying
18	Compare the characteristics of various types of sleepers used on Indian Railways with its merits and demerits.	5	Evaluating
19	Draw a neat sketch of the prestressed concrete sleeper used on Indian Railways for broad gauge tracks. Give details of the location of wires and the seating and fastening arrangements.	1	Remembering
20	Interpret the six materials commonly used as ballast on Indian Railways with the specifications.	3	Applying
21	Illustrate with sketches the various fastenings used to fasten rails to sleepers in contrast with their merits and demerits.	3	Applying
22	Outline the geometric design of a track with parameters which affect the geometrical design.	4	Analysing
23	Discuss briefly about the super elevation and its necessity to provide super elevation on the curves of a railway track.	2	Understanding
24	Calculate the super elevation, maximum permissible speed, and transition length for a 3° curve on a high-speed BG section with a maximum sanctioned speed of 110 km/h. Assume the equilibrium speed to be 80 km/h and the booked speed of the goods train to be 50 km/h.	3	Applying
25	Explain the objective of providing transition curves on either side of a circular curve.	2	Understanding

UNIT V - POINTS & CROSSINGS, SIGNALING & INTERLOCKING, STATIONS & YARDS			
Design of turnouts, Classification of signals, Control systems of train movements, Points and signals interlocking, Types of Stations and Yards, Rolling Stock, Tractive Power, Track Maintenance.			
PART A - 2 Marks			
Q. No.	**Questions**	**BTL**	**Competence**
1	Draw the turnout of similar flexure.	2	Understanding
2	Define double turnout.	1	Remembering
3	Write shore note on diamond crossing?	2	Understanding
4	Differentiate between diamond crossing and diamond junction.	2	Understanding
5	Write the objectives of signaling?	2	Understanding
6	List the visible signals.	1	Remembering
7	Draw the sketch of semaphore signals.	1	Remembering
8	State the various types of signals with reference to their location on a station.	1	Remembering
9	Name systems are chiefly used for controlling the movement of trains on Indian Railways.	1	Remembering
10	Indicate the purpose of a railway station.	2	Understanding
11	List the factors for the selection of site for a railway station	1	Remembering
12	State the facilities required at railway stations.	1	Remembering
13	Write the requirements of a passenger station yard?	2	Understanding
15	Classify the railway stations based on operational considerations	2	Understanding
16	Classify the railway stations based on functional considerations.	2	Understanding
17	Name the various types of yards.	1	Remembering
18	List the advantages of track maintenance.	1	Remembering
19	Write down the steps involved in trough packing.	2	Understanding
20	List the various forces offer resistance to the movement of a train on the track.	2	Understanding
21	Differentiate between the hauling capacity and the tractive effort of a locomotive.	2	Understanding
22	State the Gauge tolerance for different tracks.	1	Remembering
23	Define interlocking.	1	Remembering
24	Specify the types of 12 – month cycle of maintenance.	1	Remembering
25	Write necessity and advantages of track maintenance?	2	Understanding
PART B - 16 Marks			
Q. No.	**Questions**	**BTL**	**Competence**
1	Draw a neat sketch of a diamond crossing and list its important features.	1	Remembering
2	Explain briefly the classification of signals according to their locations in station yards along with suitable sketches.	2	Understanding
3	Describe the objectives of signalling and its classification. Mention the functions of each signal.	1	Remembering
4	Describe semaphore signals and coloured light signals.	1	Remembering
5	Discuss briefly one method of interlocking used on Indian Railways.	2	Understanding

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6	Illustrate the essential purposes are served by signalling and interlocking.	3	Applying
7	Outline the various devices and equipment used in station yards with neat sketch.	4	Analysing
8	Illustrate the principal types of marshalling yards and the basic facilities that should be provided with each one of them.	3	Applying
9	Explain how goods train arriving at such a yard from different directions could be rearranged into their proper order with the help of a neat sketch	1	Remembering
10	Explain the purpose of providing marshalling yards and write the points to be considered in the design of marshalling yards	1	Remembering
11	Mention the functions of a railway station? Explain briefly the various requirements of a railway station at an important city.	1	Remembering
12	Outline the main salient features of marshalling yards?	3	Applying
13	Compare the signaling systems.	5	Evaluating
14	Write down the essentials of interlocking? Distinguish between direct and indirect interlocking.	2	Understanding
15	Explain the interlocking in a railway system with neat sketch of any three types.	1	Remembering
16	Illustrate the special design features of the modern coaching and goods stock on Indian Railways.	3	Applying
17	Illustrate the various resistances that a locomotive in motion has to overcome.	3	Applying
18	Calculate the maximum permissible load that a BG locomotive with three pairs of driving wheels bearing an axle load of 22 t each can pull on a straight level track at a speed of 80 km/h. Also calculate the reduction in speed if the train has to run on a rising gradient of 1 in 200. What would be the further reduction in speed if the train has to negotiate a 4° curve on the rising gradient? Assume the coefficient of friction to be 0.2.	3	Applying
19	Compute the steepest gradient that a train of 20 wagons and locomotive can negotiate given the following data: weight of each wagon = 20 t, weight of locomotive = 150 t, tractive effort of locomotive = 15 t, rolling resistance of locomotive = 3 kg/t, rolling resistance of wagon = 2.5 kg/t, speed of the train = 60 km/h.	3	Applying
20	Compare the various characteristics of steam, diesel and electric traction.	5	Evaluating
21	Chart the measuring equipment and maintenance tools with their functions.	3	Applying
22	Categorize and briefly describe the various duties of a permanent way inspector.	4	Analysing
23	Discuss the procedure of deep screening of ballast.	2	Understanding
24	Describe the procedure involved in the annual through maintenance of a track commonly known as through packing.	1	Remember
25	Illustrate the need for the proper maintenance of a track and the various methods that ensure that a track is well maintained.	3	Applying