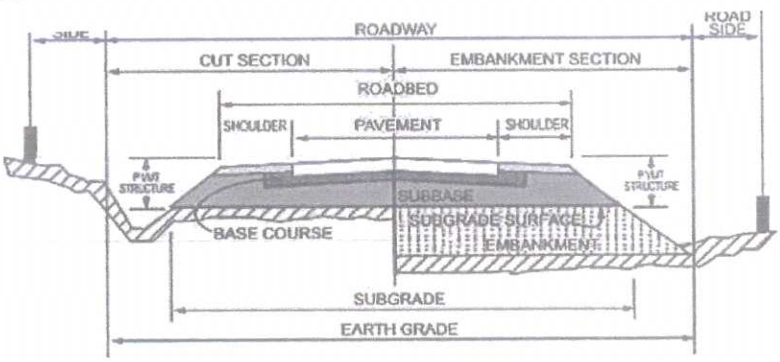
Revision:2015		Course Code:6014		
	Course Title: TRANSPORTATION ENGINEERING			
Qst No	Scoring Indicator	Split up score	Sub Total	Total
	PART A			
I.1	National Highway, State Highways , Major District Roads , Minor District Roads , Other District Roads , Village Roads	4X 1/2	2	10
I.2	Amount by which the outer edge of a curve on a road or railway is banked above the inner edge.	2	2	
I.3	The distance between the inner edges of the opposite rails.	2	2	
I.4	Span is less than 6m for culvert .Span >6m Bridge	2	2	
I.5	Total area acquired for construction of a road way.	2	2	

	PART B			
II.1	In 1928 the Jayakar Committee recommended that since the Provisional Governments and the Local bodies were unable to look after all the roads and therefore, the Central Government should look after all the important roads of national importance. On recommendation of the Jayakar Committee the Central Road Fund was enforced on March 1929. The petrol charge surcharge at the rate of 2.64 paise per litre of the petrol consumed by motor traffic was imposed to build the road development fund. Out of annual revenue thus collected, 20 percent was to be retained by the Central Government for meeting expenses on the administration purpose, research and the development of roads under its charge. The balance 80 percent of the Central Road fund was to be distributed among the Provinc according to their petrol consumption, for maintenance and construction of roads	6	6	30
II.2	1. Subgrade or formation. 2. Sub base. 3. Base course or foundation course. 4.Base coat or intermediate course. 5.Wearing course. Explain each in one line	3+ 3	6	

II.3	Remove water from the road surface. Prevent ingress of water into the pavement. Pass water across the road, either under or over. Prevent scour and/ or washout of the pavement, shoulder, batter slopes, water courses and drainage structures.	1.5 x4	6	
II.4	To support the **rails** firmly and evenly To hold the rails to proper gauge To hold the rails at proper level or at inward transverse tilt To act as an elastic medium in between the rails and ballast To counteract the tendency of wheel loads to disturb the track To distribute the load coming **on** the rails over sufficiently large area of the ballast To prov stability to the permanent way on the whole	6X 1	6	
II.5	**Signalling:** This refers to controlling of train traffic using signal system. The main **objectives of signalling** are listed. • Ensure safe and comfortable journey • Prevent conflicting movement of trains • To keep a safe distance between trains running in a track in the same direction • To regulate speed of trains • To give information or directions to the loco-pilot • To provide a fool proof interlocking arrangement with points & crossings and level crossing.	6X 1	6	
II.6	i) Harbours of refuge:- On dangerous coast lines, disabled or damaged ships under stress of weather condition will need quick shelter and immediate repair. All types of naval craft, small and big, will need refuge in an emergency and hence such refuge harbours should provide commodious accommodation. Modern big ships will require a lot of elbow room for purpose of manoeuvring or turning about. ii) Commercial harbours:- Commercial harbourscould be situated on coasts or estuaries of big rivers or even on inland river coasts. They do not normally have any emergency demand like a harbour of refuge and practically the size and number of ships using such harbours are known factors. iii) Fishing harbours:- Requirement of fishing harbour are a) Harbour should be constantly open for departure and arrival of fishing ships. b) Loading and unloading facilities and quick dispatch facilities. c) Refrigerated stores with ample storing space . iv) Military harbours:- These harbours are the naval bases which are meant to accommodate the naval vessels. They serve as supply depot also. v) Maina harbour:- It is a harbour providing facilities of fuel, food, washing machine, telephone etc.for small boat owners having temporary or permanent berths.	6	6	

II.7	i) Atmospheric and meteorological condition ii)Availability land for expansion iiiAvailability of utility iv Development of the surrounding area v)Economy of construction vi) Ground accessibility vii) Presence of other airport viii) Regional plan ix) Soil characteristics x) Surrounding obstructions xi) Topography xii) Use of airport	2 2 2	6	
III.a	**Sight distance:** Sight distance is the visualising distance of an object of size 15 cm or more when the eye level of the driver is at 1.2m above the road level. **Braking sight distance** is the distance required for safely stopping a vehicle after seeing an object of size 15 cm or more when the eye level of the driver is at 1.2m above road level. This is the sum of the distance moved by the vehicle during the reaction time (Time taken for applying the brake after the brain takes a decision to apply the brake by visualising an obstruction. Ideally it is less than 2 sec) and the distance moved by the vehicle after applying the brake till it stops. **Overtaking sight distance** is the distance required for safely overtaking a slow moving vehicle by a fast moving vehicle when another vehicle is advancing from the opposite direction. This is the sum of distance moved by the fast moving vehicle closely chasing the slow moving vehicle seeking permission for over taking, the distance moved by the slow moving vehicle during the process of overtaking and the distance advanced by a vehicle approaching from the opposite direction at the designed speed. Where it is not feasible to provide overtaking sight distance, twice the braking sight distance is considered as limited overtaking sight distance	1+ 3+ 3	7	15
III.b	1. Warning/coautionary signs 2. Prohibitory signs 3. Manndatory signs 4. Informatory signs 5. Temporary signs Explain any 4	2x 4	8	
IV.a	1)**Channelizing Islands** These are designed to control and direct traffic movement, usually turning. They are very useful for intersections at grade, particularly when the area is large. The size and shape of channelizing island will vary much depending upon the layout and dimensions of the intersection. 2) Divisional Islands These are designed to divide opposing or same direction traffic streams, usually through movements. 3) Pedestrian islands	2X 4	8	15

	Pedestrian islands are provided to serve as safe zones for the aid and protection of persons on foot. If a divisional island is located in an urban area where pedestrians are present, portions of each island can be considered a refuge island. 4) Rotary island This is the large central island of rotary intersection. This helps to convert crossing manoeuvre to weaving by providing sufficient weaving length.			
IV.b	Reconnaissance survey, Preliminary survey, location survey, soil survey i) Reconnaissance survey:- A general examination of a fairly broad stretch of land between the terminal stations in the field, along the proposed alternative alignments marked on the map is known as reconnaissance survey. It is a rapid and rough survey of the area lying between the terminal stations. It is comparatively easier in plains than in hilly areas. ii) Preliminary survey:- The art of finding the details of alternative alignments found suitable during the reconnaissance survey is known as preliminary survey. This type of survey is essentially a field to office work. In this survey the routes selected during reconnaissance survey are actually located on the ground. The highway Engineer then collects the necessary data in the field and convert the data into drawings by sitting in his office. After this quantities are worked out and approximate estimates are prepared to compare the alternative routes and to decide the best possible alignment of the road. iii) Location survey:-The detailed examination of the field along the alignment finally recommended during the preliminary survey is called location survey. In this survey the centre line of the route finally recommended during the preliminary survey,is first located on the ground. Then detailed survey is carried out for collecting the information necessary for the preparation of plans and construction details for the highway project.	2+ 3+ 2	7	
V.a	Summit curve - different cases Valley curve-different cases	3.5 +3. 5	7	15

V.b	Centre line of road is fixed after survey' Reference pegs driven borrow pits selected outside right of way cleaning and grubbing Subgrade prepared with camber 1 in 24 watered and rolled Subgrade compacted 100mm soil layer spread evenly rolled with sheep foot roller.finished with light roller.laid in 2 layer watered for 4-5days openned to traffic	8	8	
VI.a	 Explain	5+ 2	7	15
VI.b	Flexible 1. Elastic deformation 2. Yielding under heavy load to form local depression 3. Not subject to temperature stresses 4. Regains original shape after deformation Rigid 1. Resist deformation by beam action 2. Ruptrure under heavy load 3. Suject to temperature stresses 4. Permanent deformation	4 x 2	8	

VII.a	Types of gauges i) Broad gauge(1.676m) ii) Metre gauge(1.00m) iii) Narrow gauge(0.762m ,0.610m)	3		
	a) i) Railways provide convenient and safe means of transporting people and goods over large distance in a country ii) Help in uniting the people of different regions iii) Help in developing cultural and social tie among the people living in different parts of a country Help in providing efficient distribution of natural resources and agricultural products all over the country. v)Value of land increases vi) Growth of trade and industrial development vii) Employment opportunities viii) Form a main source of revenue ix) Help in maintaining better law and order in a country	4	7	
VII b	b. **Permanent way (P-way):** Permanent way refers to the railway track comprising of formation, ballast, sleeper, rail and the related fasteners & fixtures. Formation is the compacted soil formed to lay the track. Sleeper is the transverse member laid under the rail for supporting and fixing rails. The types of sleepers are wooden sleeper, cast iron sleeper, steel sleeper, CST-9 sleeper, Pot sleeper and Pre-stressed concrete sleeper. Now-a- days concrete sleepers are mostly in use due to its advantages. Fixing of rails and maintaining the gauge is easy in the case of concrete sleeper. Pandrol clips are used to fix the rail with the concrete sleeper. The rails provide the path for the train. The three types of rails are double headed rail, bull headed rail and flat footed rail. Due to stability, economy and easiness to fix only flat footed rails are used these days. When wooden sleepers were in use rail chairs with rail screws and dog spikes were used to fix the rail to the sleeper. Ballast is the broken stone laid in the track. The bed of ballast is known as ballast crib. Ballast provides elasticity to the track and facilitates track drainage. It will prevent the growth of weeds or vegetation in the track. Ballast help in track maintenance to keep the gauge of the track. Commonly used ballast materials are trap, basalt and granite. Over burned bricks, Cinder and Moorum are used for un-important tracks like sidings. Fasteners and fixtures are fitments used to connect rails and also to fix the rails with other track components like sleepers, points and crossings etc. These include fish plates, rail clamps, chairs, nuts and bolts, rail screw, dog spike, pandrol clip etc. (Components 4 marks and functions 4 marks)	8	8	15

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<td>VIII.b</td>
<td>

Supported Joints

- Sleeper is placed exactly below the joint
  - It appears like rails are supported at weakest part.
  - These are not used at present
  - Supported joint did not give sufficient support to the heavy axle loads
  - If the joint is packed too hard it prevents it from settling at times
  - It leads to the battering of rails as wave motion is not carried uniformly.

Suspended Joints

- The rail joint when placed at the center of 2 consecutive sleepers is known as suspended joint.
  - Load is equally distributed on sleepers
  - When the joint is pressed down both the rail ends are pressed down evenly.
  - More commonly adopted
  - Provide greater elasticity to the track
  - Cause less disturbance to the wave motion of track
  - Require more maintenance

Bridge joints

- The end sleepers are supposed to work as unyielding fixed supports.
- But practically they are not working as fixed unyielding supports.
- As a compromise between supported and bridge joints Indian railways provide semi-supported joints.
- Sleepers at rail joints are bought close here in this case.

</td>
<td>3+
3+
2</td>
<td>8</td>
<td>15</td>
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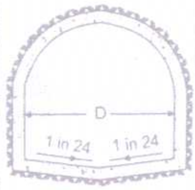
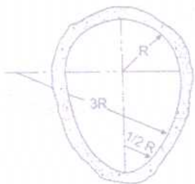
<tr><td>VIII.a</td><td>This fool proof arrangement by which the points & crossings and the signal as well as the level crossing and the signal are electro-mechanically interlocked is known as interlocking. The signal can be operated for permission to proceed only when the level cross gate is locked or the points & crossings are set accordingly. The interlocking could be reversed only after the signal is reversed. This kind of mutual interlocking is provided between signals, level crossings and points and crossing as a fool proof arrangement.

The main objective is ensuring safety through fool proof arrangement by avoiding conflicting movement of trains in the same track and between road and railway. Due to interlocking the signals and the switch or level cross gate can be operated only in cyclic order.</td><td>4+ 3</td><td>7</td><td></td></tr>
<tr><td>IX.b</td><td>
<table>
<tr><td>(a) D Sections

</td><td>• They are also called the segmental roof section.
• They are suitable for sub-ways or navigation tunnels.
• These shapes may provide additional floor space and a flat floor for moving equipment.
• Vertical sides with a flat floor.</td><td>(c) Egg-shaped Section

</td><td>• Provides least cross-section area at the bottom
• Used for carrying sewerage.
• Effective in resisting external and external pressures.</td></tr>
<tr><td>(b) Circular Section

</td><td>• Greatest c/s area for least perimeter
• They can withstand heavy internal or external radial pressures.
• Best theoretical section for resisting forces.
• Used for carrying water and sewers.</td><td>(d) Horse-Shoe section

</td><td>• Semi-circular roof with arched sides and curved invert.
• The best shape for traffic purposes.
• Most suitable for soft rocks and carrying water or sewerage.
• Most widely used for highways and railway tunnels.
• Provides more working space.</td></tr>
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</td><td>4x 2</td><td>8</td><td></td></tr>
<tr><td>IX.a</td><td>Harbour is the portion of the sea near to the land which is sufficiently deep for vessels to embark or take refuge when the sea is rough. The harbours are protected from high waves by beak waters. Break water is a manmade bund called dykes which breaks the high waves preventing their entry in to the harbour area. (3 marks)

Dock is the facility provided in a harbour for berthing of vessels for carrying out loading, unloading, fuelling, repair and maintenance operation. Docks can be classified as wet dock and dry dock. Usually the vessels are berthed in wet dock for routine operations. For certain repair operation of exterior of the vessel it has to be berthed in dry dock. Dry docks are made by making a recess towards the land and will be provided with gates. After the entry of the vessel in to the dock, the gate will be closed and the water will be pumped out to the sea. As the water level lowers the vessel sinks and rests on support blocks. When the repair is over water is again pumped in to make up the water level inside the dock with sea level, floating the vessel. Then the gate will be opened and vessel taken out with the help of tugs. (4 marks)</td><td></td><td>7</td><td>15</td></tr>
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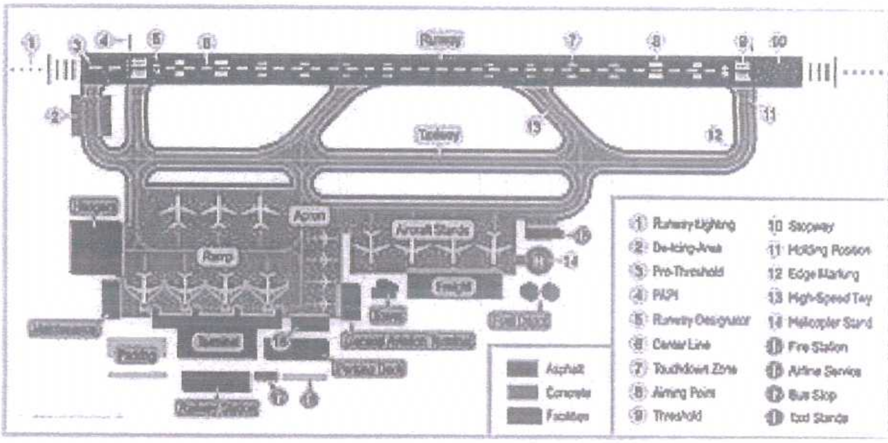
X.a	• Arch bridge • Girder bridge • Truss bridge • Suspension bridge Explain each	7	7	
X.b	 The major components of an airport are the following – 1) Runway for landing and take-off of aircraft. Blast pad or threshold area is provided at either ends of the runway to check the functioning of various components of the aircraft at full throttle before the take-off. 2) Taxi way used for the movement of aircraft after attaining normal land speed during landing operation and while proceeding to the runway for take-off. This will enhance runway utilisation efficiency, 3) Apron is used for parking of aircraft while loading, unloading, fuelling or while waiting for runway entry before take-off 4) Hangars are halting facility for aircrafts while not in operation or for carrying out the maintenance operation 5) Fuelling facility 6) Fire fighting 7) Air traffic control 8) Cargo facility 9) Terminal building housing the passenger lounges (arrival lounge and departure lounge), baggage clearance area, Security check-up, customs & emigration clearance, money exchange facility, airlines office, duty free shop, shopping mall, communication centre, transportation facility, restaurants, medical aid, wash rooms etc. 10) Parking and circulation area for vehicles reaching an airport.	4 4	8	15