SECOND SESSIONAL EXAMINATION

Railways, Airport & Waterways (RCE076) Solution

SECTION-A

Sol.1 (a): Harbour may be defined as a place on the coast where ships can be tied up and protected from the sea & bad weather.

Sol.1 (b): It refers to the value which is one-tenth of the bearing of the centre line of runway with respect to magnetic north in clockwise direction.

Sol.1 (c): Aircraft characteristics which affect the design of runway are:
i. Engine Type ii. Speed iii. Wings span iv. Length v. Height
vi. Minimum turning radius vii. Minimum Circling radius.

Sol.1 (d): The interlocking is defined as the mechanical relationships established between various levers operating the signals and the points through mechanical or electrical agencies such that contrary effects are not at all possible in the working of the signal mechanism.

Sol.1 (e): The paved path linking runways and also runways and aprons or the terminal building is called taxiway.

SECTION-B

Sol.2 (a): The different types of harbours are:

- **Natural Harbours**: It refers to the place where the surrounding land area on the coast is convenient and there is an elevated part of the land which protects the body of water. Due to such sheltered protection, there is no need to construct breakwaters.

- **Semi-Natural Harbour:** It refers to a place on the coast which is naturally protected on one side from tides and need artificial protection from other side and modified to accommodate large ships with required facilities such as berthing etc.

- **Artificial Harbours:** The harbours are built by artificially constructing large structures that provide suitable anchorage and deep water; such harbours are called artificial or man-made harbours.

- **Military Harbours:** These are situated near any naval base in which military vessels and their armoury can be received, stored and dispatched.

- **Commercial Harbour:** It provides large storage capacity, large space for exchange of cargo, and sufficient fuel capacity tankers.

Sol.2 (b): A dock is an artificial basin for the use of vessels. It is an area of water between two piers or alongside a pier that is used for loading, unloading and repair of ships.

Classification:

1. **Dry dock:** It is provided with dock gates so that the water in it can be emptied and allowed investigation, repair and maintenance of the underwater parts of the ships.

   The unique construction allows the water to be filled up in an area, also known as a lock so that vessels can be manoeuvred in and out of the area. Once the vessel enters the dry dock, the gates are closed and the seawater is drained out.

2. **Wet or impounding dock:** In this type of dock the water is impounded (enclosed) by dock gates so that ships remain afloat at low tide and exchange of cargo takes place. The lock and gate system facilitates maintenance of a constant level of water and allows passage of ships.

Sol.2 (c): The different methods of interlocking are:

I. **Tappets & Locks System:** This method is useful when levers are to be interlocked so as to prevent the conflicting movements. The tappets are attached to the levers and they have suitably shaped notches in them. The locks have the shapes which suit the notches in the tappets.

II. **Key System:** The principle of this system is to provide two locks which are worked by a single key. The withdrawal of the key locks the signal in the horizontal position and the points in the normal setting for the main line.

III. **Route Relay System:** In this system, the points and signals for movement of trains are electrically operated. A panel with buttons is provided in the control cabin and it is possible to set the line by pushing the buttons in a very short time.

Sol.2 (d): Gradient = (RL of highest point – RL of lowest point) / total length

$= (98 – 96) / 2000 = 1 \times 10^{-3}$ or 0.1%

Correction for Gradient = (20/100) x 2000 x 0.1 = 40 m

Therefore corrected runway length = 2040 m.

SECTION-C

Sol.3 (a): The railway signals are classified on following basis:

i. **Operation Basis-** Audible and Visible signal
ii. **Function Basis-** Stop signal, Warner signal, Shunting signal, Coloured signal.
iii. **Location Basis-** Reception and Departure signal.

Reception Signal: It controls the reception of trains into a station. It consists of:

(a) **Outer signal:** It is the first stop signal at a station, which indicates the entry of a train into the station

(b) **Home signal:** After the outer signal, the next stop signal towards the station side is a home signal.

Departure Signal: It controls the departure of train from the station, It consists of:

(a) **Starter Signal:** Train leaves the station only when the starter signal is in the 'off' position.

(b) **Advance Starter Signal:** It is the last stop signal provided for the departure of trains from the station. It gives the permission to attain full speed of the train when it is in 'off' position**.**

Sol.3 (b): Inland water transport consists of transport by rivers, canals and lakes.

Advantages:

1. Low Cost:

Rivers are a natural highway which does not require any cost of construction and maintenance. Even the cost of construction and maintenance of canals is much less or they are used, not only for transport purposes but also for irrigation, etc. Moreover, the cost of operation of the inland water transport is very low. Thus, it is the cheapest mode of transport for carrying goods from one place to another.

2. Larger Capacity:

It can carry much larger quantities of heavy and bulky goods such as coal, and, timber etc.

3. Flexible Service:

It provides much more flexible service than railways and can be adjusted to individual requirements.

4. Safety:

The risks of accidents and breakdowns, in this form of transport, are minimum as compared to any other form of transport.

Disadvantages:

1. Slow:

Speed of Inland water transport is very slow and therefore this mode of transport is unsuitable where time is an important factor.

2. Limited Area of Operation:

It can be used only in a limited area which is served by deep canals and rivers.

3. Seasonal Character:
Rivers and canals cannot be operated for transportation throughout the year as water may freeze during winter or water level may go very much down during summer.

4. Unreliable:
The inland water transport by rivers is unreliable. Sometimes the river changes its course which causes dislocation in the normal route of the trade.

5. Unsuitable for Small Business:

Inland water transport by rivers and canals is not suitable for small traders, as it takes normally a longer time to carry goods from one place to another through this form of transport.

Sol.4 (a): The important factors to be considered for airport site selection are:

- **Proximity to nearby airport:** The distance between two adjacent airport should be sufficient so that flight operation of one airport should not obstruct that of other airport.

- **Ground accessibility:** Airport site should accessible through highways as well as other modes of public transport system.

- **Topography:** A raised ground such as a hill top is usually considered to be an ideal site for an airport because it has less obstruction, natural drainage, good wind.

- **Visibility:** The site selected should be free from visibility reducing conditions such as fog, smoke etc.

- **Wind:** Runway is so oriented that landing and take-off is done by heading into the wind.

- **Noise Nuisance:** The site should be selected that the landing and take-off paths of the aircrafts pass over the land which is free from residential area.

Sol.4 (b): The different systems of controlling the movement of trains in India are:
i. One Engine Only System ii. Time Interval System. iii. Pilot Guard System
iv. Absolute Block System v. Automatic Bock System
vi. Centralised Train Control System (CTC)

Advantages of CTC:

- Points and signals can be operated in few seconds by means of thumb switches.
- It is capable of detecting the defects of the track.
- It increases the track capacity.
- It is possible for the controller to arrange train movements before hands and then he may attend other office work.

Sol.5 (b): Correction for elevation = 7% x 1620 x (270/300) = 102 m

Corrected length = 1620 + 102 = 1722 m

Standard atmospheric temperature = 15˚ - 0.0065 x 270 = 13.18˚ C
Rise in Temperature = 32.90 – 13.18 = 19.72˚C
Correction for temperature = (1722/100) x 19.72 = 340 m
Corrected length = 1722 + 340 = 2062 m

Total correction in percentage = (2062 – 1620)/1620 x 100
= 27% < 35% OK
Correction for gradient = 20% x 2062 x 0.2 = 82.48 m
Corrected length = 2062 + 82.48 = 2144.48 m