S.Y.B.Tech. (Civil): 2017 Pattern Set 2

* Model Ans., Marking scheme & Solutions of Numericals *

Infrastructure Engg. (CVUA21173) U218-113 (ESE)

Q.1(a) PPP or PPP means Private-Public-Partnership.

BRTS means Bus Rapid Transit System.

In cities and towns, it is essential to provide fast (rapid) Transportation system for masses. Hence Mass Rapid Transit System (MRTS) is necessary. BRTS is one major component of MRTS. It is successfully implemented in many developed countries and in few cities in India. e.g. Ahmedabad. Separate track (road) is provided for specially designed buses for BRTS. It includes e-ticketing, user friendly buses and bus stops with modern facilities such as wifi, mobile charging points as well as safety through CCTV.

For implementing systems such as BRTS, modern railways such as metro-rail, mono-rail; as well as for big infrastructure projects, Private-Public-Partnership is the best solution. This ensures speedy completion of project and regular repair/maintenance through partial Govt. funding. There are many forms of PPP or PPP such as BOT (Build Operate Transfer), BOOT (Build Own Operate Transfer), etc. Project is completed as per the Govt. requirements and opened for public use. e.g. Pune-Mumbai expressway is completed by I.R.B., same projects are done by Reliance Co. Ltd, Adani group, etc.

(½ mark each for meanig, 2½ marks each for expl.) (6)

OR (b) Due to rapid industrialization and urbanization, there is need to provide basic facilities, amenities; as well as modern facilities for speedy and safe transportation, drinking water, power supply, efficient waste disposal, open spaces, parks, playgrounds, medical facilities, educational facilities, etc. This will ensure quality life for citizens. Hence concept of smart city is necessary for modern (21st century) India.

Advantages: (1) Safety and convenience of people ensured.

(2) Higher standard of living.

(3) All necessities are provided to the citizens.

Drawbacks: (1) More & more crowd in cities

(2) High initial (capital) cost

(3) Hike in taxes

(Expl. 4 marks, ½ mark each for 2 adv. & 2 drawbacks) (6)

Q.2(a) Ballast testing is necessary to check (and ensure) the physical/engineering properties & quality of ballast. 2 marks

Generally 4 tests are done on ballast:

i) Abrasion Test: This is necessary to find how much friction, wear & tear the ballast can withstand. It is done in Los Angeles abrasion testing machine. It should not be more than 30%

ii) Impact value: This test gives indication of how much impact the ballast can withstand. Railway track is subjected to the impact load due to rail joints. Done in Impact testing machine. It should not be more than 20%

iii) Water Absorption & Sp. gr. test: This gives indication of what is the compactness and density of ballast. It should not be light and should not absorb water much. W.A. should be max. 1%

iv) Flakiness Index: This shows the grain or particle size (angularity) of ballast. If they are too flaky, strength is less and durability is also less. Value (limit) not specified.

(4 marks for tests, significance and/or values) ⑥

OR

(b)	CI sleeper	Wooden sleeper	Concrete sleeper
Durability	30 to 40 years	About 12 to 30 years	40 – 50 years
Manufacture	Difficult. In factory costly.	Easy and cheap	Easy. On the site also possible. Costly.
Shock absorbing	Moderate	V. Good damping & shock absorbing quality	Good.

Q.3(a) In this case, equilibrium speed $= \frac{\Sigma(n.V)}{\Sigma n} = \frac{10(45)+6(63)+(2)(72)}{10+6+2}$

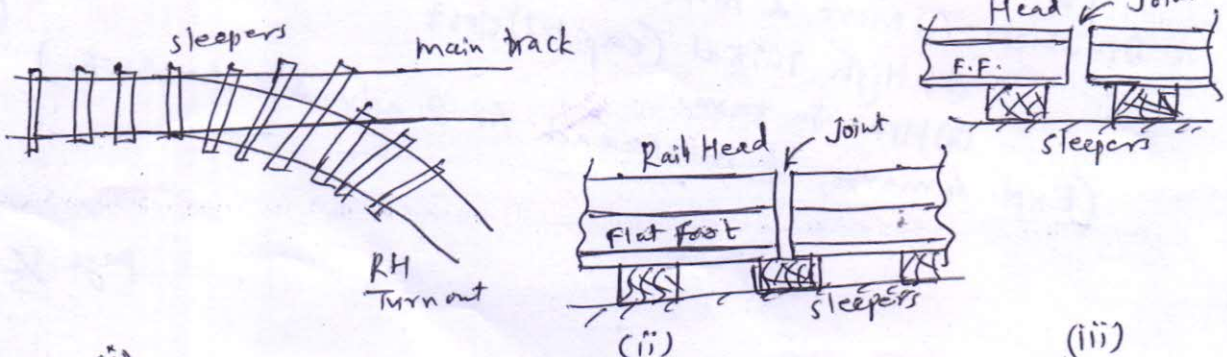
$\therefore V = 54$ km/h --- 2 marks

$R = \frac{1750}{D} = \frac{1750}{3} = 583.33$ --- 2 marks ⑥

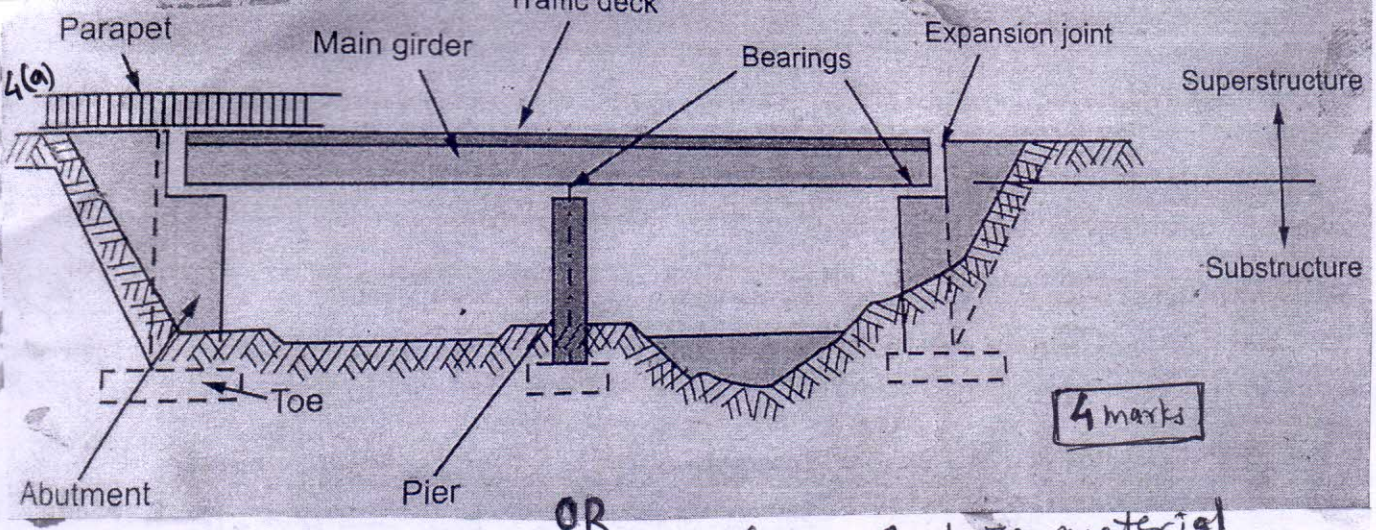
$e = \frac{GV^2}{127R} = 68.88$ mm ---- 2 marks

OR

(b) 2 marks for each correct labelled plan ⑥



Q.4(a)



4 marks

OR

(b) (i) False. Lining prevents leakage, falling of loose material from the roof or sides of tunnel. 1+1 marks

(ii) False. First holes are drilled, then charged and lastly blasting is done in roks. 1+1 marks (4)

Q.5(a) Ports classified on the basis of availability of enclosure; (i) Natural, (ii) Artificial, (iii) Seminatural ---3 marks for types & sketches.

Ports classified on the basis of utility : (i) Commercial, (ii) Defence (Naval), (iii) Fishing (iv) Refuse port/harbour. ---3 mark (6)

Note: Brief expl. required for each type. (Min. 1 sentense)

(b) (i) False. It is called quay. Jetty is inclined or perpendicular.

(ii) True. Huge ships built or repaired have to be launched or commissioned. Hence slipway is necessary to 'slip' the boat/ship.

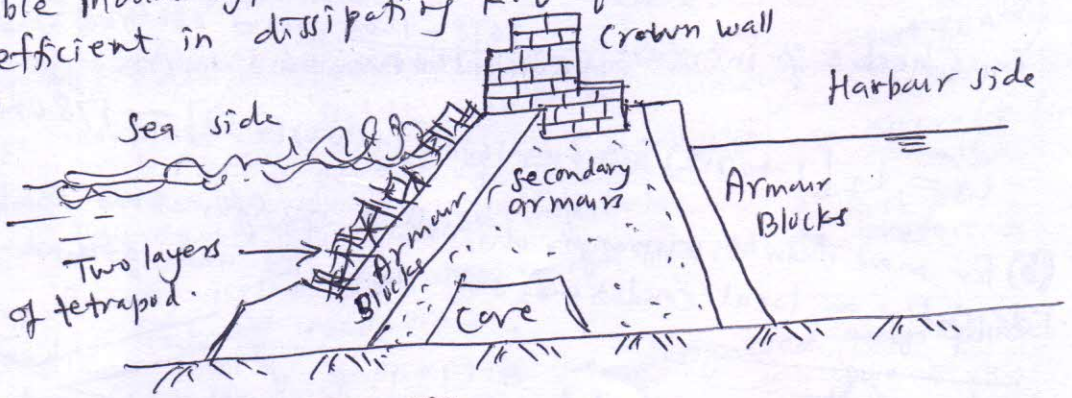
1+1 mark for each : (4)

Q.1(a) Breakwater is a structure or protective barrier built to enclose harbours to withstand the waves so that inner portion of water of port / harbour is undisturbed. 01 mark

Rubble mound type breakwater supplemented by tetrapod is very efficient in dissipating K.E. of sea-waters (waves & currents)

Expl. 02 marks

Sketch 03 marks (6)



OR

Q.5(c) Breakwater is a structure or protective barrier provided to dissipate K.E. of sea water and provide safety & calm conditions inside it. 1 mark.

Forces : Hydrostatic force, wave force, wind force, forces by insects/fish, seismic force. (4)

(Brief expl. expected) --- 3 marks.

Q.6(b) Discussion of facilities at major port (Any 2):

- Docking facilities – Diff types of docks.
- Repairing facilities – Docks, slipway, cranes,
- Approach facilities – Proper entrance, gates/locks
- Loading & unloading facilities –
- Storage facilities – Transit sheds, warehouses, cold storage
- Dredging facilities
- Navigation/guiding facilities – Lighthouse, mooring, signals

④

(c) Capital or Primary Dredging is done to create harbour in a demarcated area. After hydrographic survey, horizontal and vertical control points are established to remove bed material for achieving desired water depths. This is done for entrace channel also. ---- 2 marks

Maintenance Dredging is done on a regular (periodic) basis to maintain ~~design~~ designed/desired depth of water. Sea waves & currents continuously result into litteral drift, which reduces effective (available) water depth. The silting needs to be monitored & removed. ---- 2 marks.

Q.7(a) $L = 1260$ m, $h = 400$m

Correction for elevation → 7% per 300m elevation above msl

$\therefore L_1 = L\left[1 + 0.07\left(\frac{h}{300}\right)\right] = 1260\left[1 + 0.07\left(\frac{4}{3}\right)\right] \approx 1378$m

-- 2 marks

L_2 = Length corrected for elev. & Temp. $= L_1[1 + (0.01)(\Delta T)]$

$ART = T_m + \frac{T_m - T_a}{3} = 26.2 + \frac{44.8 - 26.2}{3} = 32.4^\circ C$ ---- 1 mark

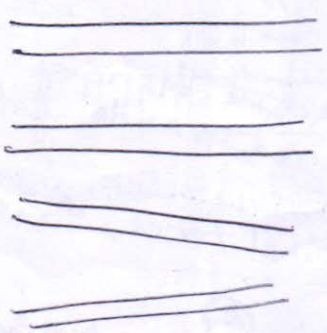
$\therefore L_2 = 1378[1 + (0.01)(32.4^\circ - 15^\circ)] \approx 1618$ m --1 mark

Check: % increase $= \frac{1618 - 1260}{1260} \times 100 = 28.4\% < 35\%$ (as per ICAO) OK

$L_3 = L_2[1 + (0.2)\, i_{eff}] = 1618[1 + (0.2)(0.5)] \approx 1780$m ----2 marks

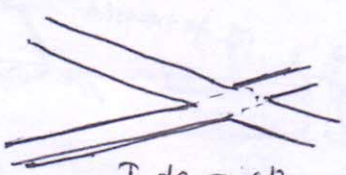
⑥

(b) for more than 1 runways, different configurations can be adopted depending on local conditions, such as wind and ground slope.

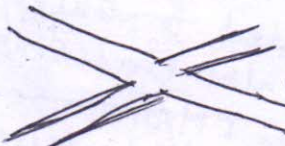


parallel

Nearly parallel 'V'



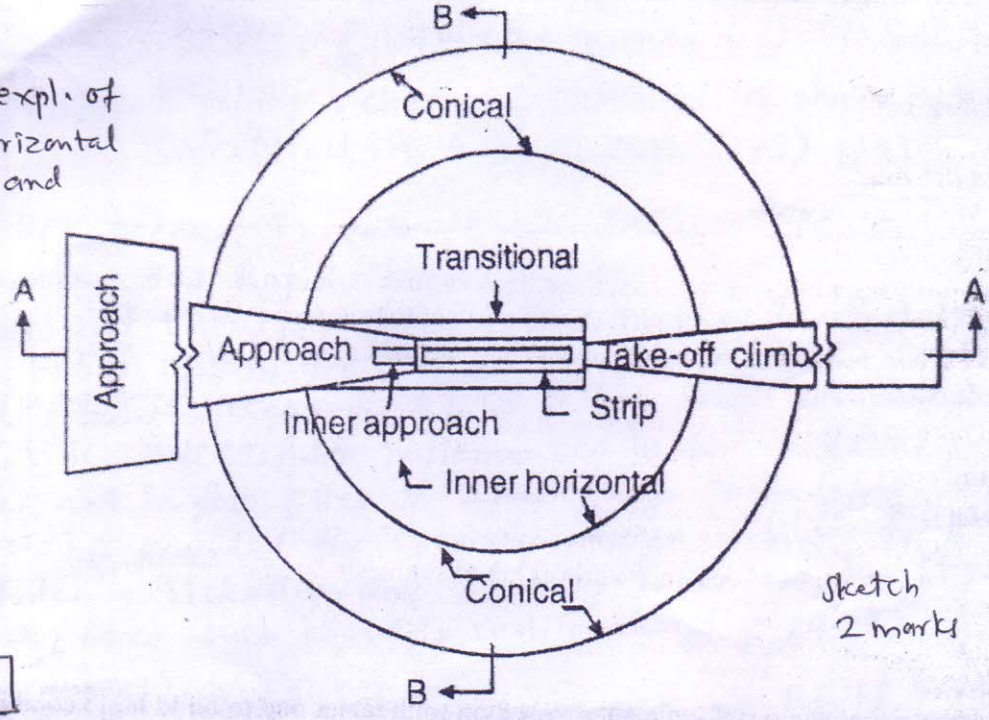
Intersecting near Threshold



Intersecting at center

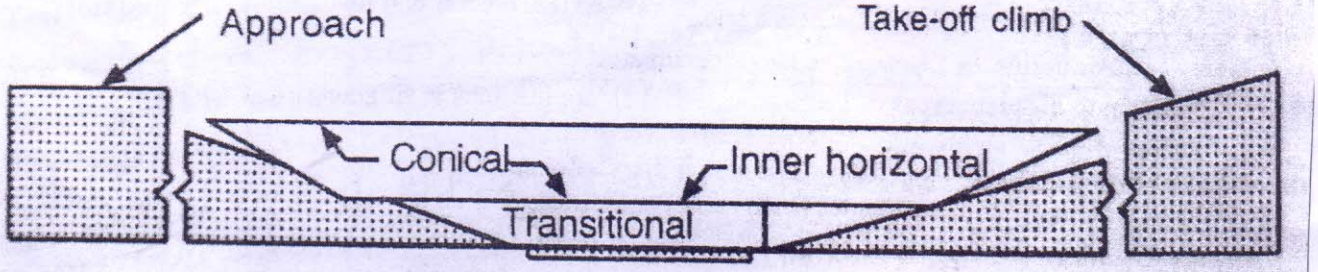
Brief Expl. required. ④

(c) Brief expl. of outer horizontal surface and conical surface
2 marks



Sketch
2 marks

Total 4 marks



OR

Q.8(a) Factors for runway design:
① Runway length & width, ② Orientation ③ Longitudinal gradient
④ Transverse gradient ⑤ Rate of change of longitudinal
⑥ Sight distance ⑦ Length & width of landing strip. ⑥

(b) Corrections for elevation, temperature and gradient
Formula/values and necessity ④ marks
Refer Q.7(a)

(c) RVR is the distance over which pilots can see runway surface markings or lights, while on runway.
- Touchdown Zone is a portion of runway, which an aircraft first touches. Its generally beyand threshold.
- Primary Runway is the runway which is used as the first preference for landing-takeoff operations.
- Airport Reference Point (ARP) is the designated geographical location of an airport. --- 1 mark each ④