Course Code: CE-C601   Course Name: Design and Drawing of Steel Structures

Time: 2 hour 30 minutes   Max. Marks: 80

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	NB 1. Attempt **all four questions** each carrying weightage of 20 marks. 2. Use of IS 800 & steel table **is permitted** during the exam. 3. Draw **neat sketches** wherever necessary. 4. Assume suitable data **if needed** & justify the same.
Q1.	**Choose the correct option for the following questions. All the questions are compulsory and carry equal marks**
1)	An ISMC 300 @ 0.363 KN/m is connected to a 12mm thick gusset plate. The size of the weld is 6 mm. Assume site welding. The strength of the weld is nearly……
Option A:	600 N/mm
Option B:	750 N/mm
Option C:	663 N/mm
Option D:	450 N/mm
2)	Calculate the net area of an angle ISA 90×90×8 which is connected to the gusset plate through a single leg. Bolts used are M20 grade 4.6. (Assume standard clearance)
Option A:	1200 mm^2
Option B:	1100 mm^2
Option C:	1000 mm^2
Option D:	1500 mm^2
3)	The shear lag width for ISA 75X75X10 connected by the bolt is…………………… (Assume gauge distance = 40 mm)
Option A:	100 mm
Option B:	105 mm
Option C:	150 mm
Option D:	120 mm
4)	An ISA 150×75×10 is connected to a gusset plate of thickness 12mm by four M18 bolts of grade 4.6. The tensile strength governed by yielding of gross section of the angle if gusset is connected to the longer leg is………………………
Option A:	450 kN
Option B:	250 kN
Option C:	390 kN
Option D:	490 kN
5)	An ISMB 300 is to be used as a compression member. Considering the buckling about y-y axis, the corresponding buckling class as per IS 800: 2007 will be………
Option A:	a
Option B:	b
Option C:	c
Option D:	d

6)	A column section with buckling class 'c' has a minimum radius of gyration of 32 mm. The effective length of the column is 3200 mm. The design compressive stress for fy = 250 MPa (as per IS 800: 2007) will be............
Option A:	102 N/mm²
Option B:	104 N/mm²
Option C:	105 N/mm²
Option D:	107 N/mm²
7)	A steel column in a multi-storied building carries an axial load of 250 KN. It is built up of two ISMC 350 channels connected by lacing. The lacing carries a load of ....
Option A:	5 kN
Option B:	6.25 kN
Option C:	12.50 kN
Option D:	18.75 kN
8)	The design shear strength of beam of section ISWB 300 @ 48.1 kg/m is...
Option A:	390.8 kN
Option B:	490.2 kN
Option C:	270.5 Kn
Option D:	291.3 kN
9)	What is the maximum distance between two consecutive bolts (in tension) if the plate thickness is 10 mm?
Option A:	160 mm
Option B:	200 mm
Option C:	250 mm
Option D:	180 mm
10)	A 20 mm diameter bolt of grade 4.6 is in double shear, the shearing strength of the bolt will be.................................. (assume threads in the shear planes)
Option A:	45.25 kN
Option B:	70.5 kN
Option C:	90.5 KN
Option D:	135.8 kN

Q 2	Solve any **Two** Questions out of **Three**	**10 marks each**
A	Two ISA 75×50×8 are connected to a gusset plate of thickness 10 mm on the same side by four M18 bolts of grade 4.6. Find the design tensile strength of the angle if (i) the gusset is connected to the longer leg (ii) the gusset is connected to the shorter leg.	
B	Design a laced column 10.5 m long to carry the factored axial load of 1000 KN. The column is restrained in position but not in direction at both ends. Provide a single lacing system. Use 2 channel sections placed as back-to-back. Assume steel of grade Fe 410 and bolts of grade 4.6.	
C	Design a welded plate girder of span 18 m and laterally supported throughout. It supports a UDL of 85 KN/m (excluding of self-weight) throughout the span. Design central	

section of plate girder for bending and shear. Use Fe 410

Q 3	Solve any **Two** Questions out of **Three**	**10 marks each**
A	Design a slab base for a column ISHB 300 @ 618 N/m subjected to a factored axial compressive load of 1200 KN when the load is transferred to the base plate by the direct bearing of column flanges. The base rests on a concrete pedestal of grade M20	
B	Design a laterally supported beam of effective span 6 m subjected to a maximum bending moment of 150 KN.m and maximum shear force of 210 KN for the following data. Use steel of grade: Fe 410 (Check for deflection is not required)	
C	Design a strut of length 2.235 m in a roof truss. It is subjected to a factored compressive force of 50 KN (due to D.L and L.L) and factored tensile force of 17.80 KN (due to D.L and W.L). Use Fe 410, 4.6 as bolt grade. Use 20 mm Bolt diameter.	

Q 4	Solve any **Two** Questions out of **Three**	**10 marks each**
A	Design a column using ISHB Section. The column is of length 3.5 m and supports factored load of 550 KN, the column is effectively restrained in position and direction at both the ends. Use Fe 410.	
B	A tie member consists of a double angle section, each 80 mm x 80 mm X 8 mm welded on the opposite side of a 12 mm thick gusset plate. Design a fillet weld for making the connections. The factored tensile force in the member is 300 KN. Draw a sketch showing the details.	
C	Design a bolted bracket connection to transfer an end reaction of 300 KN with an eccentricity of 170 mm. The steel used is of grade Fe 410. Use 20 mm diameter bolt of grade 4.6. The thickness of the bracket plate is 10 mm and the column section is ISHB 200 @ 365.91 N/m.	

Curriculum Scheme: Rev-2019 (C Scheme)
Examination: TE Semester VI

CEC 603   GEOTECHNICAL ENGINEERING-II

Time: 2hour 30 minutes   Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	A cohesionless soil having an angle of shearing resistant of φ, is standing at a slope angle of i. The factor of safety of the slope is
Option A:	tani/tanΦ
Option B:	tani - tanΦ
Option C:	tanΦ/tani
Option D:	tanΦ - tani
2.	The passive earth pressure of a soil is proportional to
Option A:	$\tan(45-\phi)$
Option B:	$\tan(45+\phi)$
Option C:	$\tan^2(45-\phi)$
Option D:	$\tan^2(45+\phi)$
3.	Coefficient of consolidation of a soil is affected by
Option A:	Compressibility and Permeability of soil
Option B:	Compressibility only
Option C:	Permeability only
Option D:	Compaction
4.	The percentage reduction in the bearing capacity of a strip footing resting on sand when the water level is at the base of the footing and when the water level is at a depth much greater than the width of footing, is approximately.
Option A:	5
Option B:	25
Option C:	50
Option D:	75
5.	The factor of safety Fc with respect to cohesive strength is based on the assumption that _____
Option A:	Frictional force is fully mobilized
Option B:	Frictional force is zero
Option C:	Total cohesive resistance is zero
Option D:	Both friction and cohesion are mobilized
6.	A square pile 300 mm size penetrates soft clay with cohesion of 85 KPa and a depth of 18 m and rest on stiff soil. Determine the capacity of pile by skin friction. Assume an adhesion factor of 0.75
Option A:	1085 kN
Option B:	1377 kN
Option C:	1550 kN
Option D:	1455 kN

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7.	For a sand having an angle of internal friction of 22°, the ratio of active to lateral earth pressure will be.
Option A:	0.482
Option B:	0.206
Option C:	0.166
Option D:	0.111
8.	The plate load test is conducted on clayey strata by using a plate of 0.45m×0.45 m dimensions, and the ultimate load per unit area for the plate is found to be 200 KPa. The ultimate bearing capacity of a 2.2 m wide square footing would be
Option A:	180 kPa
Option B:	450 kPa
Option C:	220 kPa
Option D:	200 kPa
9.	By which process some compression of soil takes place, after the hydrostatic pressure reduces to zero?
Option A:	Secondary consolidation
Option B:	Primary consolidation
Option C:	Load increment
Option D:	Effective pressure
10.	Basement walls are generally designed for
Option A:	Active pressure
Option B:	Passive pressure
Option C:	At rest pressure
Option D:	Lateral pressure

Q2.	
A	**Solve any Two** **5 marks each**
i.	Explain pre consolidation pressure with appropriate figure.
ii.	Derive an expression for the factor of safety when the slope of an earthen dam is dry. Assume the soil to possess both cohesion and friction.
iii.	What are the three standard triaxial shear tests with respect to drainage conditions? Explain with reasons the situations for which each test is to be preferred.
B	**Solve any One** **10 marks each**
i.	A layer of soft clay is 7 m thick and lies under a newly constructed building. The weight of sand overlying the clayey layer produces a pressure of 240kN/m2 and the new construction increases the pressure by 100kN/m2. If the compression index is 0.45, compute the settlement. Water content is 41% and specific gravity of grains is 2.65
ii.	A cylindrical sample of saturated clay 4cm in diameter and 8cm high was tested in an unconfined compression apparatus. Find the unconfined compression strength, if the specimen failed at an axial load of 360N, when the axial deformation was 8mm. Find the shear strength parameters if the angle made by the failure plane with the horizontal plane was recorded as 50^0. Verify results graphically.

Q3.	
A	**Solve any Two** **5 marks each**
i.	Determine the active and passive earth pressure given the following data: Height of the retaining wall = 10m, angle of internal friction of the backfill soil is 25° and dry unit weight of backfill is 17kN/m3. Ground water table is at the top of the retaining wall.
ii.	Compare Rankine's and Coulombs lateral earth pressure theory.

iii.		State assumptions in Terzaghi's bearing capacity analysis. Explain effect of water table on the bearing capacity of soil.
B		**Solve any One** **10 marks each**
i.		A concrete pile 350 mm diameter is driven into dense sand for a depth of 8.5. Estimate: (i)The safe load acting on the pile. (ii) Safe load if the water table exists at 2 m below the ground surface. Consider following properties of the sand: angle of internal friction=35 0 , unit weight = 20 kN/m3 , coefficient of friction between sand and pile=0.7,coefficient of earth pressure = 1.
ii.		Compute the safe bearing capacity of a continuous footing 1.8m wide and located at a depth of 1.2m below ground level in a soil with unit weight 20 kN/m3, c = 20kN/m2 and angle of internal friction 20º. Assume a factor of safety of 2. Terzaghi's bearing capacity factors for angle of internal friction (=20º) are Nc = 17.7 Nq = 7.4 and Nγ = 5.0. What is the permissible load per meter run of the footing?

Q4.		
A		**Solve any Two** **5 marks each**
i.		Explain Swedish Circle Method for cohesive soil for stability analysis of slopes.
ii.		Define Initial consolidation, Primary consolidation and Secondary consolidation.
iii.		What are the causes and effects of Negative skin friction? Explain the remedial measures to minimize it.
B		**Solve any One** **10 marks each**
i.		Explain classification of Pile Foundation. Show how the static bearing capacity of the Pile foundations can be estimated.
ii.		A cantilever retaining wall of 7meter height retains sand. The properties of the sand are void ratio = 0.5, angle of internal friction = 30º and specific gravity =2.7. Using Rankine's theory determine the active earth pressure at the base when the backfill is (1) dry, (2) saturated (3) submerged and also the resultant active force in each case.

Program: **Civil Engineering**

Curriculum Scheme: Rev 2019

Class: TE Semester VI

Course Code: 89272/CEDLO6018 Course Name:DLOC-2(Introduction to Offshore Engineering)

Time: 2 hour 30 minutes

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	FPSO is
Option A:	floating production and storage on loading platforms
Option B:	floating production and storage offloading platforms
Option C:	floating production and storage offloading pantoons
Option D:	flying prototype and storage on loading platforms
2.	In wave theory, the time taken for two successive crests to pass a stationary point, is called
Option A:	Period
Option B:	Amplitude
Option C:	Elevation
Option D:	Height
3.	What is major criteria in the design of offshore structures ?
Option A:	Resisting dead load and wing load only.
Option B:	Reducing the response of the structure against environmental load with compromising the functional requirement.
Option C:	Making the structure aesthetic and economical
Option D:	Reducing the response of the structure against environmental load without compromising the functional requirement.
4.	Linear wave theory is also called
Option A:	Stoke's Theory
Option B:	Gaussian Theory
Option C:	Airy Theory
Option D:	Probabilistic Theory
5.	Neutrally buoyant structures have
Option A:	2 DOF
Option B:	3 DOF
Option C:	5 DOF
Option D:	6 DOF
6.	The Spread Mooring System
Option A:	Allow the vessel to rotate in horizontal plane
Option B:	Does not allow the vessel to rotate in horizontal plane
Option C:	Allow the vessel to rotate in vertical plane
Option D:	Does not allow the vessel to rotate in vertical plane

7.	Pipe is called thin-wall pipe where D/t ratio is
Option A:	Greater than 20
Option B:	Less than 20
Option C:	Greater than 25
Option D:	Less than 25
8.	In Dynamic Positioning System 'Azimuth', 'Bow' are the name of
Option A:	Control system
Option B:	Position reference system
Option C:	Generators
Option D:	Thrusters
9.	The intermediate water depth criteria is
Option A:	$1/25 < d/L < 1/4$
Option B:	$1/25 < d/L < 1/2$
Option C:	$1/20 < d/L < 1/4$
Option D:	$1/20 < d/L < 1/2$
10.	The drilling platform moves back and forth
Option A:	In horizontal direction under only surge motions.
Option B:	In horizontal direction under both surge and sway motions.
Option C:	In horizontal direction under only sway motions.
Option D:	In vertical direction under both surge and sway motions.

Q2 (20marks)	Solve any Four 5 marks each
A	What is offshore structure? Write down the purpose of it.
B	Explain about deep draft concrete floaters (DDFCs)
C	Write down the properties of Stoke's second-order theory and Stoke's fifth-order theory.
D	Explain the ocean water properties.
E	Write a note on: Tension Leg Platforms.
F	Discuss about the properties of bottom founded and compliant structures.

Q3 (20marks)	Solve any Four 5 marks each
A	Discuss about offshore site investigations.
B	What are the codes & standards that are used in offshore pipeline projects?
C	Write a note on suction pile.
D	What are the advantages and disadvantages of catenary and taut mooring system?
E	Discuss about conceptual study and feasibility study of pipeline project.
F	Draw a neat diagram of riser model.

Q4 (20marks)	Solve any Two 10 marks each
A	Determine the linear wave properties for the following data: Water depth (d) = 150 ft., Wave height (H) = 25 ft. Wave period (T) = 8 sec. Elevation (y) = 0 ft.
B	Discuss about different types of single mooring systems.
C	Write down wall thickness calculations based on internal pressure & hoop stress.

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University of Mumbai
Examinations Summer 2022

Program: T.E (Civil) Rev 2019 (Choice Based)

Curriculum Scheme: Rev 2019

Examination: TE Semester: VI

Course Code: CE-DLO 6013   Course Name: Construction Equipment & Techniques.

Time: 2 hour 30 minutes   Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks (20 marks)
1	The raw material used in an atomic power plant is
Option A:	Sodium
Option B:	Uranium.
Option C:	Calcium
Option D:	Magnesium
2	The formwork suitable for constructing similar units in a mass housing project is
Option A:	Jump formwork
Option B:	Collapsible formwork
Option C:	Modular shuttering
Option D:	Slip formwork
3	The rate of raising slip form is
Option A:	50 cm/hr.
Option B:	100 cm/hr.
Option C:	30 to 45 cm/hr.
Option D:	10 to 15 cm/hr.
4	Well point system is a
Option A:	Well construction technique
Option B:	Dewatering technique
Option C:	Drilling technique
Option D:	Soil improvement technique
5	Removal of debris from inner portion of a tunnel to open atmosphere is called
Option A:	Lead
Option B:	Lift
Option C:	Scraping
Option D:	Mucking
6	Damages to underground utility lines can easily be located using
Option A:	Great trigonometrical radars
Option B:	Underground utility locator
Option C:	Ground positioning remotes
Option D:	Ground penetrating radar

7	The train which floats over its guide system is
Option A:	Maglev
Option B:	Mono
Option C:	Metro
Option D:	Tube train
8	The method of Tunneling in which least interruption of traffic is possible is
Option A:	Cut and Cover Method
Option B:	Needle Beam Method
Option C:	TBM Method
Option D:	English Method
9	Thermal power plants use water as a
Option A:	cleaning agent
Option B:	source of power
Option C:	backwashing agent
Option D:	working fluid
10	The equipment used to remove off old bituminous pavement for laying new layer is called
Option A:	Sack rammer
Option B:	Jack hammer
Option C:	Tack hammer
Option D:	Back rammer

Q2 (20 Marks)	Solve any Four out of Six 5 mark each
i	Explain balancing of equipment with a suitable exam.
ii	Define a)Equipment Suitability b) Ownership Cost c) Reactive Maintenance and Proactive Maintenance d) Cycle Time e) operating cost of equipment
iii	Differentiate between conventional and modern methods of formwork
iv	What is NATM? Write advantages and limitations of NATM.
v	Write a note on cut and cover method of tunnel construction
vi	State the advantages of prefabricated housing system

Q3 (20 Marks)	Solve any Two Questions out of Three 10 mark each
i	Enlist the different methods of tunneling in soft soil. State the various stages in construction of tunnels along with the equipment required. Describe with neat sketches any one method.
ii	Describe Incremental launching method of bridge construction
iii	Describe in detail with diagram about slip and jump formwork

Q4. **(20 Marks)**		
A	**Solve any Two**	**5 marks each**
i.	What is ground penetrating radar (GPR)? What is use of the GPR system?	
ii.	What are maglev trains? Explain the working of maglev trains.	
iii	Give the layout of a Hydropower station & explain the techniques for setting up the same.	
B	**Solve any ONE**	**10 mark each**
i.	What are different techniques for demolition of buildings.	
ii.	Explain different types of earth moving equipment and brief the suitability of each.	

Examinations Commencing from 17 May 2022
Program: ___Civil Engineering
Curriculum Scheme: Rev - 2019
Examination: TE Semester: VI

Course Code: CEC604   Course Name: Environmental Engineering
Time: 2hour 30 minutes   Max. Marks: 80

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170522_R19_TE_VI_CEC604_QP1

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	water can be easily diverted for fire fighting in this system
Option A:	Grid iron system
Option B:	Dead end system
Option C:	Radial system
Option D:	Gravity system
2.	Within first five days BOD demand get satisfied by
Option A:	48%
Option B:	58%
Option C:	78%
Option D:	68%
3.	Which water treatment process is done after filtration of water?
Option A:	Primary sedimentation
Option B:	Secondary sedimentation
Option C:	Disinfection
Option D:	Flocculation
4.	Which of the following is the basic indicator of river health
Option A:	BOD
Option B:	COD
Option C:	DO
Option D:	ThOD
5.	In which type of aerator, the flow of water is divided into fine streams and small droplets.
Option A:	Spray aerator
Option B:	Cascade aerator
Option C:	Inclined apron aerator
Option D:	Gravel bed aerator

6.	A right angle sleeve made of brass and gun metal is called
Option A:	Goose neck
Option B:	Ferrule
Option C:	Service pipe
Option D:	Stop cock
7.	What indicates the permanent hardness when alum is added to water
Option A:	$Al(OH)_3$
Option B:	$Ca\ SO_4$
Option C:	CO_2
Option D:	$Ca(OH)_2$
8.	Aeration is not required in this sewage processing unit
Option A:	Trickling filter
Option B:	Oxidation pond
Option C:	Activated sludge process
Option D:	Septic tank
9.	Which of the following is called secondary air pollutant
Option A:	PANs
Option B:	Carbon dioxide
Option C:	Carbon monoxide
Option D:	Nitrogen dioxide
10.	This is a suitable method of disposal of solid waste containing organic waste
Option A:	Incineration
Option B:	Landfilling
Option C:	Composting
Option D:	Chemical precipitation

Attempt any three questions out of following

Q2 (A)	**Solve any two out of three**	**5 marks each**
1	*Explain the factors affecting the location of intake structure*	
2	*Explain the mechanism of coagulation and flocculation*	
3	*Determine the velocity and rate flow of sewage flowing through the sewer of diameter 300mm and running half full. Sewer is laid at the gradient of 1in 300. Take Manning's constant N=0.013*	
Q2 (B)	**Solve any one of the following**	**10 marks each**
1	*Design the rapid sand filter with under drainage system to treat 7.5MLD Of raw water. Assume rate of filtration 6000 lit/hr/m², assume 5% water and 30 minutes required for back washing.*	
2	*Following is the data for the single stage trickling filter* *a)Sewage flow= 4.5MLD b) BOD5 of raw sewage= 250mg/l*	

	c)recirculation ratio=2 d)depth of media=2M e)BOD of effluent=25mg/l f) BOD removal in primary tank = 30% *Determine size of single stage trickling filter and find out efficiency.*	
Q3 (A)	**Solve any Four Questions out of six** **5 marks each**	
1	*Write down the effect of air pollution on human health*	
2	*Show that 70dB + 70dB ≠ 140dB*	
3	*Explain in detail self-purification capacity of stream*	
4	*Explain functional elements of solid waste management*	
5	*Explain the process of break point chlorination*	
6	*.Explain different methods of water softening.*	
Q4 (A)	**Solve any Two Questions out of Three** **5 marks each**	
1	*Differentiate between one pipe and two pipe system*	
2	*Chlorine usage in treatment of 20 MLD of water is 16Kg/day. The residual After 10 minute of contact is 0.2 mg/l. Calculate chlorine dosage in mg/l and chlorine demand of water.*	
3	*A sewage sample has 5 day BOD of 180 mg/l at 20^0C. calculate the 2 day BOD of the sample at 37^0C . Take $K_D=0.1$*	
B	*Solve any one of the following* **10 marks each**	
1	*Design a Septic tank for housing colony of 200 people, water supply rate is 150l/c/day and tank is to be clean once in two years. Draw the sectional sketch showing all the details.*	
2	* Design the sedimentation tank to treat 10 MLD of raw water. Assume flow velocity 0.25m/minute, overflow rate 600 lit/hr./m^2 and detention time of 4hour.*	

Time: 2hour 30 minutes Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	For growing irrigated paddy, the ideal water application method is……
Option A:	drip irrigation
Option B:	flood irrigation
Option C:	zigzag irrigation
Option D:	sprinkler irrigation
2.	Dupuit's assumptions are valid for
Option A:	artesian aquifer
Option B:	confined aquifer
Option C:	leaky aquifer
Option D:	unconfined aquifer
3.	If the intensity of irrigation for Kharif is 45% and that for Rabi is 60%; then the annual intensity of irrigation, is:
Option A:	45%
Option B:	60%
Option C:	100%
Option D:	105%
4.	A hyetograph is a graphical representation of
Option A:	Rainfall intensity and time
Option B:	Rainfall depth and time
Option C:	Discharge and time
Option D:	Cumulative rainfall and time
5.	In case of a flowing well, the piezometric surface_____
Option A:	is always below the ground level
Option B:	is always above the ground level
Option C:	is always at the ground level
Option D:	may be above or below the ground level
6.	One amongst the following is Canal ESCAPE
Option A:	Cutting Escape
Option B:	Scouring Escape
Option C:	Unbalanced Escape
Option D:	Balanced Escape
7.	For no tension to be develop in the gravity dam the eccentricity of the resultant force should be
Option A:	<b/2
Option B:	<b/3
Option C:	<b/4
Option D:	<b/6
8.	Which of the following is not a type of precipitation?
Option A:	Arithmatic
Option B:	Orographic
Option C:	Convective
Option D:	Frontal

9.		Which of the following is a false statement?
Option A:		Canal lining reduces seepage losses
Option B:		Canal lining is a permeable layer
Option C:		Canal lining improves the life of a canal
Option D:		Canal lining improves discharge capacity of a canal
10.		According to Lacey's, what is the proposed shape of regime channel?
Option A:		Hyper-bolic
Option B:		Circular
Option C:		Rectangular
Option D:		Semi-elliptical

	Q. 2	20 Marks
	Solve any four Questions out of Six	**5 marks each**
1.	Compare Kennedy and Lacey's theories	
2.	Define the following: aquifer, aquifuge, aquiclude, transmissibility, drawdown, cone of depression.	
3.	Derive the relation between duty, delta and base period. Also find delta for a crop if duty for a base period of 100 days is 1800 ha/cumecs.	
4.	Explain any one type of Automatic rain gauge instrument with sketch.	
5.	Explain in detail with a neat sketch different Zones of Storage of Reservoirs	
6.	Describe hydrograph and hyetograph. Also draw neat diagrams	

	Q. 3	20 Marks
	Solve any Two Questions out of Three	**10 marks each**
1.	Using Lacey's theory, design an irrigation channel for the following data: Discharge Q=50 cumecs, silt factor f=1, side slopes = 0.5H:1V	
2.	Describe in detail the failures of an earthen dam, along with neat diagrams	
3.	Given below are the ordinates of a 6h unit hydrograph for a catchment. Calculate the ordinates of direct runoff hydrograph due to a rainfall excess of 4.5	

Time hrs	0	3	6	9	12	15	18	24	30	36	42	48	54	60	69
Flow cumecs	0	25	50	85	125	160	185	160	110	60	36	25	16	8	0

	Q. 4	20 Marks
	Solve any Two Questions out of Three	**10 marks each**
1.	Define Precipation. Explain any one type of precipitation and explain different forms of precipitation	
2.	Describe with the help of sketches various types of Cross Drainage Work.	
3.	For a homogenous Earthen Dam with height = 52m and freeboard of 2m, flow net was constructed and following results were obtained. Number of potential drops = 25, Number of Flow Channels = 4. Dam has horizontal filter 40 m in length at its downstream end. Calculate discharge per meter length of dam . A) Soil is Iso-tropic and the co-efficient of permeability of the dam is 3×10^{-5} m/sec B) Soil is Anisotropic Soil where $kx = 4 \times 10^{-4}$ m/sec and $ky = 10^{-6}$ m/sec	