Time: 03 Hours **Total Marks: 80**

Instructions: (1) Question **N0.1** is compulsory
(2) Answer any ***Three Questions*** from the remaining questions.
(3) Each full question carries **20 marks**.
(4) Draw neat sketches wherever essential.

Q1.		Attempt **any four** out of six.	**5 M**
	A)	Define admixture and Explain retarders.	**5 M**
	B)	Enlist the limitations of NDT.	**5 M**
	C)	What are the objectives in mix design?	**5 M**
	D)	Explain use of Plaster of Paris in construction.	**5 M**
	E)	Classify Concrete based on their grades as per IS456	**5 M**
	F)	Classify the basic construction materials used for building construction.	**5 M**
Q2.	A)	Explain any five properties of CA and their influence on properties of concrete.	**10M**
	B)	Why is seasoning of timber important before using it in construction? Explain methods of seasoning of timber in detail.	**10M**
Q3.	A)	Discuss the methods of determining compressive strength of accelerated cured concrete test specimens as per IS 9013-2004. Explain any one of them in detail.	**10M**
	B)	Write various components of the RMC plant and draw a neat layout sketch of the RMC plant.	**10M**
Q4.	A)	What do you mean by concrete mix design? What are the objectives in mix design?	**10M**
	B)	What are the properties of fresh concrete? Explain segregation & bleeding of concrete in detail.	**10M**
Q5.	A)	Enlist the factors affecting durability of concrete. Explain any two in detail	**10M**
	B)	Enlist factor affecting the strength of concrete and explain role of water cement (W/C) ratio in strength of concrete	**6M**
	C)	Draw a cross-section of a tree trunk and label it.	**4M**
Q6.	A)	What is hydration of cement? Explain.	**5M**
	B)	Elaborate on types of vibrators used in concrete	**5M**
	C)	Write a note on methods of curing concrete.	**5M**
	D)	Explain demerits of distemper as compared to paints	**5M**

(3 Hours) **[Total Marks: 80]**

N.B.: 1) Question No. 1 is Compulsory.
2) Answer any THREE questions from Q.2 to Q.6.
3) Figures to the right indicate full marks.

Q.1 **(a)** Calculate Correlation coefficient between the variables x and y for the following data **(5)**

X	18	20	34	52	12
Y	39	23	35	18	46

(b) A random variable x has the following probability function **(5)**

X	0	1	2	3	4	5
P(x)	0	C	2C	2C	3C	2C

Find i) C ii) P(x<3) iii) E(X) iv) V(X)

(c) The mean life time of a sample of 25 bulbs is found as 1550 hours with standard deviation of 120 hours. The company manufacturing the bulbs claims that the average life of their bulbs is 1600 hours. Is the claim acceptable at 5% LOS? **(5)**

(d) Prove that $\bar{F} = (x + 2y + 4z)i + (2x - 3y - z)j + (4x - y + 2z)k$ is solenoidal and irrotational. **(5)**

Q.2 **(a)** Fit a straight line to the following data **(6)**

X	1	2	3	4	5
Y	25	28	33	39	46

(b) Find the work done in moving a particle in the force field $\bar{F} = (3x^2 + 6y)i - 14yzj + 20xz^2k$ along $x = t, y = t, z = t$ from $(0,0,0)$ to $(1,1,1)$. **(6)**

(c) Find all possible Laurent's series expansion of the function $f(z) = \frac{z-1}{(z+1)(z-3)}$ about $z = 0$ indicating region of convergence. **(8)**

Q.3 **(a)** The regression lines of a sample are x + 6y = 6 and 3x + 2y =10 Find (a) $\bar{x}$ and $\bar{y}$ (b) correlation coefficient r. Also estimate y when x =12. **(6)**

(b) Use Green's theorem to evaluate $\int_c (3x^2 - 8y^2)\,dx + (4y - 6xy)dy$ where c is the boundary of the region enclosed by the lines $x = 0, y = 0, x + y = 1$. **(6)**

(c) A certain drug is claimed to be effective in curing cold in an experiment on 500 persons with cold. 300 of them were given drug and 200 of them were given the sugar pills. The patients reaction to the treatment are recorded in the following table using χ^2 -test (use 5% LOS) **(8)**

	Helped	Harmed	No Effect	Total
Drug	200	40	60	300
Sugar pills	120	30	50	200
Total	320	70	110	500

Test the hypothesis that the drug is effective in curing cold.

Q.4 **(a)** Let X be a continuous random variable with probability density function $f(x) = k(x - x^2),\ 0 \le x \le 1$Find k, mean and variance. **(6)**

(b) Following result were obtained from two samples each drawn from two different populations A and B **(6)**

Group	A	B
Sample Size	25	17
Sample SD	4	3

Test the hypothesis that variance of A is less than or equal to variance of B.

Given $(F(0.05) = 2.24\ ford.o.f.24\ and\ 16)$

(c) Show that $\bar{F} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$ is conservative. Find scalar potential such that $\bar{F} = \nabla\emptyset$ and hence, find the work done by in displacing a particle from (1,2,0) to (3,3,2) . **(8)**

Q.5 **(a)** If X denotes the outcome when a fair die is tossed, find MGF of X about origin and hence find the mean of X. **(6)**

(b) Using Stoke's Theorem to evaluate $\int_c \bar{F}.d\bar{r}$where $\bar{F} = (x^2 - y^2)i + 2xyj$ and c is the boundary of $x = 0, y = 0, x = 4, y = 2$. **(6)**

(c) Evaluate$\int_c \frac{z^2+3}{z^2-1}dz$ where $c$is (i) $|z - 1| = 1$ (ii) $|z + 1| = 1$. **(8)**

Q.6 **(a)** Three factories A, B, C produce 30%, 50% & 20% of the total production of an item .Out of their production 80%, 50% & 10% are defective. An item is chosen at random and found to be defective. Using Bayes theorem find the probability that it was produced by the factory A. **(6)**

(b) Use Gauss Divergence theorem to evaluate $\iint_s \bar{F}.\hat{n}ds$ where $\bar{F} = x^3\hat{i} + y^3\hat{j} + z^3\hat{k}$ and s is the surface of the sphere $x^2 + y^2 + z^2 = 1$ **(6)**

(c) In an intelligence test administered to 1000 students, the average was 42 and standard deviation was 24. Find the number of students (i) exceeding the score 50 (ii) between 30 and 54 (iii) less than 30. **(8)**

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Duration of Exam: 03 Hours **Total Marks: 80 Marks**

NOTE: (1) Question No 1 is compulsory.
(2) Attempt any THREE questions from the remaining questions.
(3) Assumptions made should be clearly stated.
(4) Figures to the right indicate full marks.

Q1. Attempt any **FOUR** questions **20**

a) Enlist the various types of minor and major losses
b) A nozzle is fitted at the end of a pipe of length 500 m and of diameter 40 mm. For the maximum transmission of power through the nozzle, find the diameter of nozzle. Take f = 0.006
c)What are the important Characteristics of laminar flow? Live the examples.

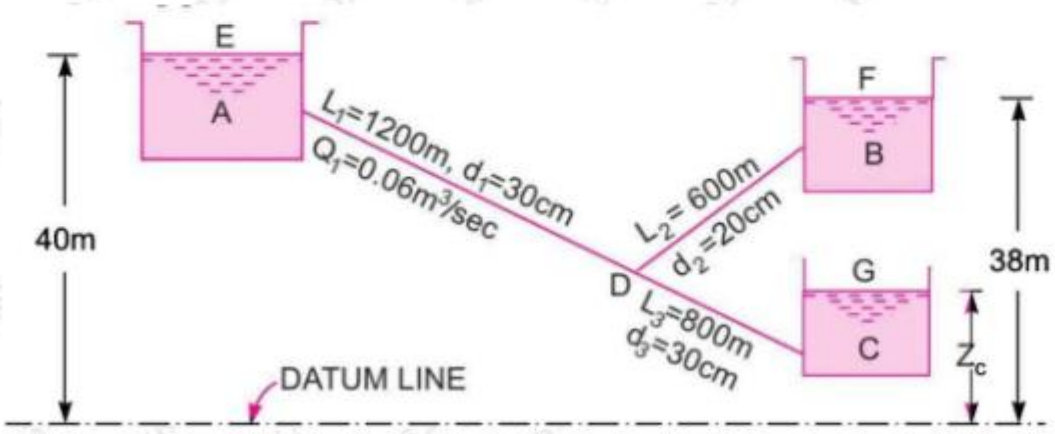
d) For turbulent flow in pipes, find the distance from the pipe at which the local velocity is equal to the average velocity.

e) What do you mean by repeating variables? How are the repeating variables are selected for dimension analysis?

f) What are the different methods of preventing the separation of boundary layers?

Q2a. Three pipes of diameters 400 mm, 300mm and 500mm and length 550m,350m and 420 m respectively are connected in series. The ends of this compound pipe are connected with two tanks whose difference of water levels is 18 m. If co-efficient of friction for these pipes are 0.0078,0.0079 and 0.0073 respectively, determine the discharge through the compound pipe including the minor losses. **10**

Q2b. Three reservoirs A, B and C are connected by a pipe system as shown in the following figure. Find the discharge into or from reservoir B and C if the rate of flow from reservoir A is 70 liters/s. Find the height of water level in the reservoir C. Take f =0.006 for all pipes. **10**



Q3a. Explain different steps in solving distribution network by Hardy Cross method. **10**

Q3b. An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of Diameter 60mm and of length 400m.The rate of flow of fluid through the pipe is 4 liters/s. Find The pressure drops in a length of 400m and also the shear stress at the pipe wall. **10**

Q4a. Determine (i) the pressure gradient, (ii) the shear stress at the two horizontal parallel plates and (iii) the discharge per meter width for the laminar flow of oil with a maximum velocity of 2m/s between two horizontal parallel fixed plates which are 100mm apart. $\mu = 2.455\ \frac{Ns}{m^2}$. **10**

Q4b Explain Prandtl's mixing length theory. **10**

Q5a. Air is flowing over a flat plate 500mm long and 600mm wide with a velocity of 4m/s. The kinematic viscosity of air is given as $0.15 \times 10^{-4}\ m^2/s$. Find (i) the boundary layer thickness at the end of the plate, (ii) Shear stress at 200mm from the leading edge and (iii) drag force on one side of the plate. Take the velocity profile over the plate as $u/U = \sin\left(\frac{\pi}{2}, \frac{y}{\delta}\right)$ and density of air is $1.24\ k\,g/m^3$. **10**

Q5b. Derive on the basis of dimensional analysis suitable parameters to present the trust developed by a propeller. Assume that the thrust developed by a propeller P depends upon the angular velocity ω, speed of advance V, diameter D, dynamic viscosity μ, mass density ρ, elasticity of the fluid medium which can be denoted by the speed of sound in the medium C **10**

Q6a. A rough pipe of diameter 400mm and length 1000m carries water at the rate of $0.4\ m^3/s$. The wall roughness is 0.012mm. Determine the co-efficient of friction, wall shear stress, center line velocity and velocity at a distance of 150mm from the pipe wall. **10**

Q6b. A lawn sprinkler has two nozzle of diameter 3mm each is connected across a tap of water. The nozzles are at 48cm and 34cm from the center of tap. The rate of water through tap is $10\ m^3/s$. The nozzle discharge water in the downward directions. Determine the angular speed at which the sprinkler will rotate free. **10**

Time: 3 Hours **Maximum Marks: 80**

Notes:

1. Question No. 1 is compulsory.
2. Attempt any three out of remaining 5 Questions.
3. Figures to the right indicate full marks.
4. Assume suitable data if required.

Q.1 Attempt any ***FOUR*** of the following

a. State Characteristics of contour Lines. **05**

b. Explain repetition method of determination of horizontal angle using theodolite. **05**

c. A 30 m chain was found to be 10 cm too short after a chaining of 1450 m. It was 14 cm too short after a chaining of 2650 m. If the chain was correct before the commencement of work, Find the true distance between two points. **05**

d. Explain types of horizontal and vertical curves used in Highways. **05**

e. Draw neat labelled sketch of Prismatic compass showing all components. **05**

Q.2 Attempt the following Questions

a. Survey was conducted around a lake and bearing was obtained as follows. Determine which station are affected by local attraction and gives values of the corrected bearings. Also find true bearing if declination is $5^0 10'$ E **10**

Line	Fore Bearing (F.B.)	Back Bearing (B.B.)
AB	$75^0 5'$	$254^0 20'$
BC	$115^0 20'$	$296^0 35'$
CD	$165^0 35'$	$345^0 35'$
DE	$224^0 50'$	$44^0 5'$
EA	$304^0 50'$	$125^0 5'$

b. State different uses of surveying. **5**

c. Explain methods of orientation of plane table with neat sketch. **5**

Q.3 Attempt the following Questions

a. State and explain different accessories used in plane table surveying with neat sketch **5**

b. Write short note on Reciprocal levelling. **5**

c. An incomplete traverse table is obtained as follows: **10**

Line	Length (m)	Bearing
AB	100	?
BC	80.5	$140^0 30'$
CD	60	$220^0 30'$
DA	?	$310^0 15'$

Calculate the length of DA and bearing of AB.

Q.4 Attempt the following Questions

a. The following perpendicular offsets were taken by a chain line to a hedge: **10**

Chainage (m)	0	15	30	45	60	70	80	100	120	140
Offset (m)	7.60	8.5	10.7	12.8	10.6	9.5	8.3	7.9	6.4	4.4

Calculate the area between the survey line and the offset by (a) Trapezoidal Rule and (b) Simpson's Rule

b. The following readings are successively taken with a level: **10**
0.355,0.485,0.625,1.755, 1.895,2.350,1.780,0.345,1.230, 2.345, 3.125,0.545,1.390, 2.055, 2.955.
The instrument was shifted after the 4^{th}, 7^{th} and 11^{th} staff reading. Prepare a page of level book and calculate the RL's of different points. Also apply necessary check. Reduced level of first point is 255.500 m.

Q.5 Attempt the following Questions

a. A tacheometer is set up at an intermediate point 'O' on a traverse PQ and the following observations are made on vertical staff. **10**

Staff Station	Vertical Angle	Staff Intercept	Axial Hair reading	Remark
P	$+8^0 36'$	2.350	2.105	RL of P= 321.50 M
Q	$+6^0 6'$	2.055	1.895	

The instrument is fitted with anallactic lens with multiplying constant 100. Calculate the length of PQ & RL of Q. Also calculate elevation difference between stations P & Q.

b. State fundamental axis of theodolite and interrelationship between them **5**

c. Explain different uses of total station. **5**

Q.6 Attempt the following Questions

a. Explain in detail Road Project with neat sketches. **10**

b. Tabulate the data required for setting out a curve by deflection angle method by considering the following information **10**

1. Angle of Intersection: 145^0
2. Chainage of point of intersection: 1580.
3. Degree of curve: 5^0.
4. Least count of theodolite: $20''$.
5. Peg Interval: 30 m.

Duration: 3 Hours. **[Total Marks:80]**

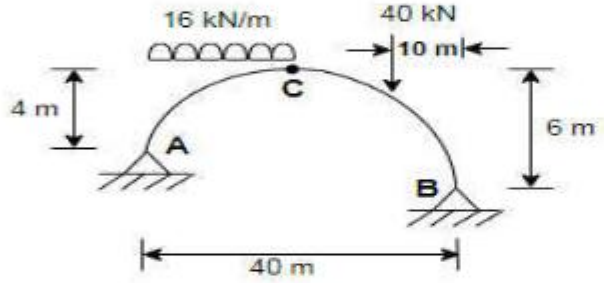
NOTE:

- **Question No. 1 is compulsory.**
- **Attempt any Three out of the remaining five questions.**
- **Figure to the right indicates full marks. Draw neat sketches wherever necessary.**
- **Assume suitable data wherever required.**

Q.1 Answer **any four** from the following. **20**

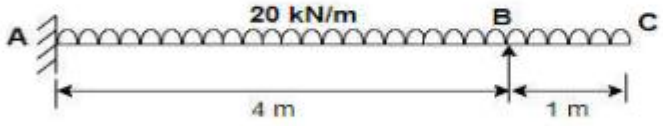
(a) Two-wheel loads 20kN and 50kN spaced at 3m apart, move on a girder of span 15m. Find the maximum bending moment at a section 6m from the left end. Any wheel load can lead the other. **05**

(b) A three hinged parabolic arch is hinged at A,B and C. Rise for arch AC is 4 m and for BC is 6 m. Arch AC carries udl of 16 kN/m and arch BC carries load of 40 kN at 10 m from B as shown. Total span of arch is 40 m Determine reactions and horizontal thrust. **05**



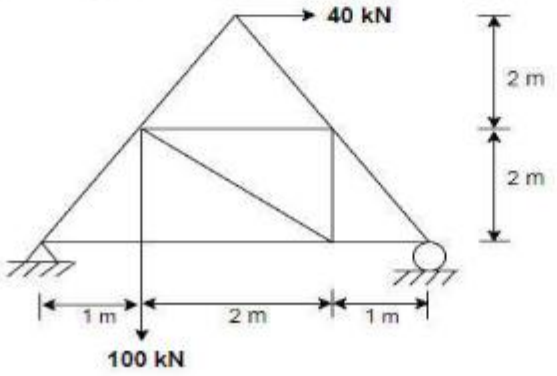
(c) Explain perfect frame, deficient frame and redundant frame showing sketches. **05**

(d) Draw BMD for the following propped cantilever beam using Moment Distribution method. **05**



(e) Find the shape factor for a solid circular section of diameter D. **05**

Q.2 **(a)** Find the forces in members of pin-jointed frame as shown. **12**



(b) State the static and kinematic indeterminacy of structures given below: IH = Internal Hinge

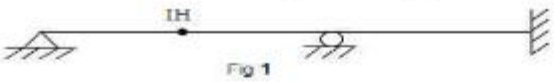


Fig 1

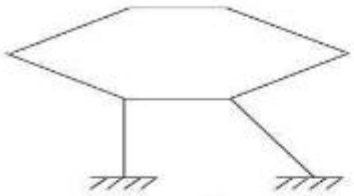


Fig 2

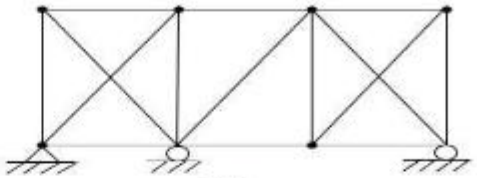
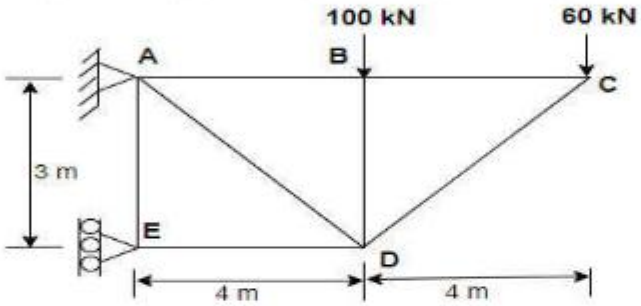


Fig 3

06

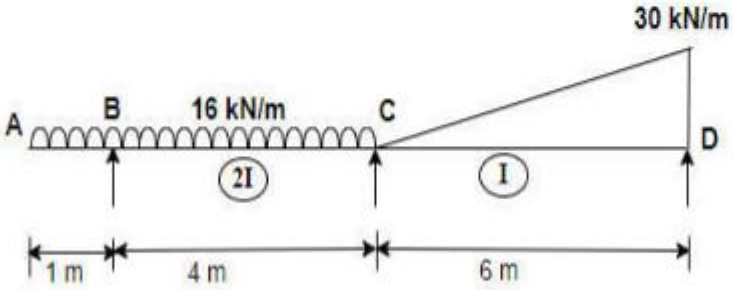
(c) State the limitation of Clapeyron's theorem. **02**

Q.3 **(a)** Determine the vertical deflection of joint **C,** for a pin jointed frame as shown, cross-sectional area of all members are equal and take E = 200 GPa.



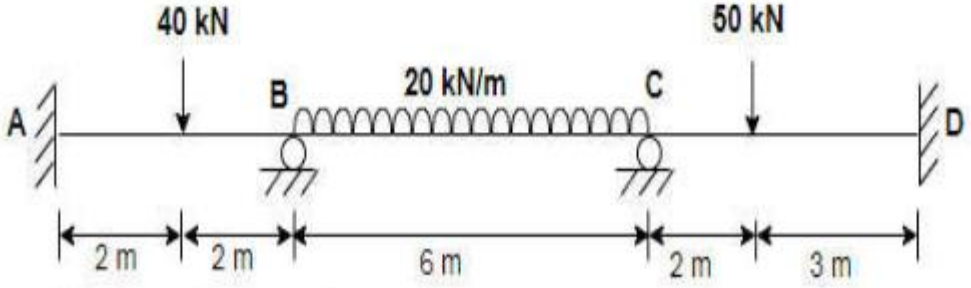
10

(b) Draw the BMD for a continuous beam using Three moment Clapeyron's theorem



10

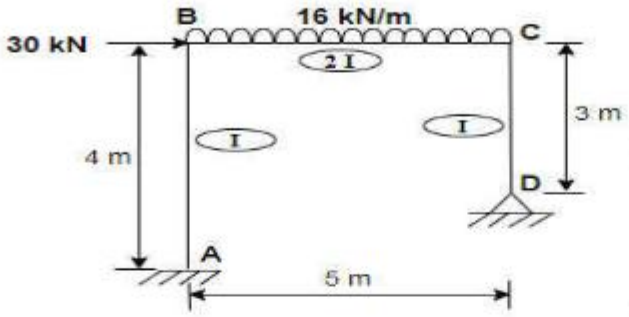
Q.4 **(a)** A continuous beam ABCD is loaded as shown. The support B sink by 10 mm. Draw BMD, Use moment distribution method. Take E =200 X 10^6 kN/m^2 and I = 100 X 10^6 mm^4



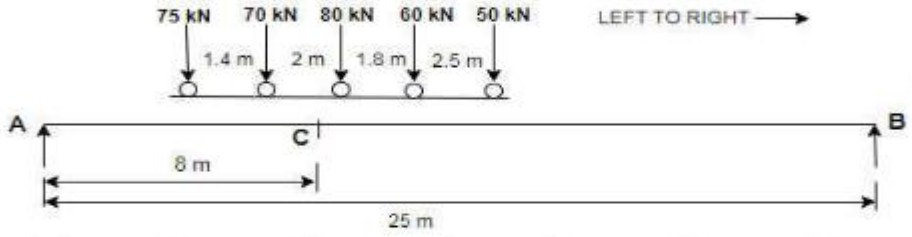
12

(b) A three hinged symmetric parabolic arch has span 40 m and a central rise 6 m. it is loaded with udl of 16 kN/m on left half span and 60 kN at 15 m from right support.. Calculate Normal Thrust and Radial Shear at 12 m from left support. **08**

Q.5 (a) Analyse the frame as shown in the figure using Flexibility method. **12**

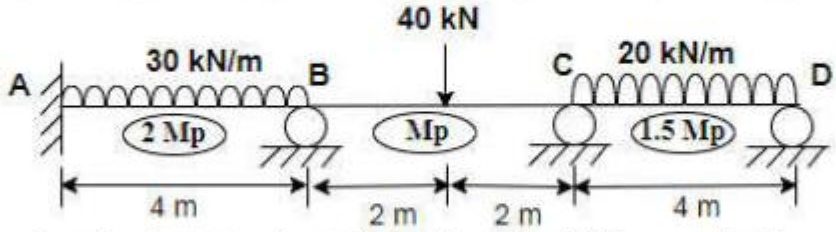


(b) The wheel loads as shown in the figure moves over a girder of 25m. Find the maximum bending moment at 8 m from the left end. **08**



Q.6 Determine the Plastic moment of resistance for a continuous beam as shown.

(a) **10**



(b) Analyse the frame as shown in the figure by Stiffness method. **10**