(03 HOURS) **TOTAL MARKS : 80**

Instructions : (1). Question No .1 is compulsory
(2) Answer any ***Three Questions*** from the remaining.
(3) Each full question carries **20** marks.
(4) Numbers in the parenthesis are right to indicate full marks.
(5) Assume suitable data, if needed and state it clearly.

Q.1		Attempt any *four o*f the following.	
	a)	Define concrete and enlist merits and demerits of it.	[05]
	b)	Enlist the properties of glass.	[05]
	c)	Enlist methods of damp proofing and explain D.P.C.	[05]
	d)	Enlist the physical properties of OPC as per BIS code and explain any one of them in brief.	[05]
	e)	Define durability of concrete and explain factors affecting of it.	[05]
	f)	What is the NDT of concrete? Enlist the ratings of pulse velocity for various quality grades of concrete.	[05]
Q.2	a)	Design a nominal mix of M20 concrete grade for zone-II grading of fine aggregates and MSA 10 mm to carry-out DPC work at site, in accordance with clause number 9.3 of IS 456 : 2002. Tabulate the results in: 1) by mass & 2) by ratio.	[12]
	b)	Define admixture. Enlist the functions of admixture.	[04]
	c)	Explain heat of hydration in-case of Ordinary Portland Cement.	[04]
Q.3	a)	What are the points to be considered while selecting a quarry site? Explain wedging method of quarrying of stone with neat labeled sketches.	[10]
	b)	Give any two material which can used for sound insulating purpose.	[02]
	d)	Draw a neat layout sketch of RMC plant.	[08]
Q.4	a)	Define bulking of a sand and explain bulking phenomenon of sand with labeled sketches.	[10]
	b)	Define workability of a fresh concrete and enlist the laboratory tests required to measure woarkability of it.	[03]
	c)	Draw a neat, labeled sketch of 'Tamping rod' with dimensions and state it's practical application.	[03]
	d)	Explain the relation between durability and permeability of concrete.	[04]
Q.5	a)	Calculate the ingredients of concrete, required to perform the 'Slump Cone Test' in the lab. If the Design mix proportions for M30 grade of concrete by ratio's are 0.45 : 1 : 1.32 : 2.86 and density of concrete as 2450 kg/m^3.	[12]
	b)	Explain 'Schmidt's Rebound Hammer Test' in the case of NDT of concrete.	[08]
Q.6	a)	Write any five types of Paints used in Building construction.	[05]
	b)	State & Explain Duff Abram's W/C ratio law.	[05]
	c)	Enlist any four physical properties of CA and explain their influence on properties of concrete.	[05]
	d)	Enlist the advantages of RMC.	[05]

Data for Q.2 a)

Table-Proportions for Nominal Mix Concrete

Grade of Concrete	Total Quantity of Dry Aggregates By Mass per 50 kg of Cement, to be Taken as the Sum of the Individual Masses Fine and Coarse Aggregate kg, Max	Proportion of Fine Aggregate to Coarse Aggregate (by Mass)	Quantity of Water per 50 kg of Cement, Max litres
M5	800	Generally 1:2 but subject to an upper limit of 1:1.5 and a lower limit of 1:2.5	60
M7.5	625		45
M10	480		34
M15	330		32
M20	250		30

Note:- The proportion of fine to coarse aggregates should be adjusted from upper limit to lower limit progressively as the grading of fine aggregates becomes finer and the maximum size of coarse aggregates becomes larger. The graded coarse aggregate shall be used.

Example

For an average grading of fine aggregate(that is zone-II of table 4 of IS383), the proportions shall be 1:1.5, 1:2 and 1:2.5 for maximum size of aggregates 10 mm. 20 mm and 40 mm respectively

Data for Q. 5 a)

Slump Cone Mould :- The mould for the test specimen shall be in the form of the frustum of a cone having the following internal dimensions:

Dimensions	cm
Bottom diameter	20
Top diameter	10
Height	30

****

(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)** Fit a straight line to the following data **(5)**

X	1	2	3	4	5	6
Y	49	54	60	73	80	86

(b) Calculate Correlation coefficient between the variables x and y for the following data **(5)**

X	12	15	18	21	27
Y	2	4	6	8	12

(c) Let X be a continuous random variable with probability density function **(5)**
$f(x) = \frac{x}{6} + k,\ 0 \le x \le 3$ Find k and $(1 \le x \le 2)$.

(d) Find the line integral of $\bar{F} = x^2 i + xyj$ along line OP where, **(5)**
$O = (0,0)\ and\ P = (1,1)$.

Q.2 **(a)** A random variable x has the following probability function **(6)**

X	-2	-1	0	1	2	3
P(x)	0.1	k	0.2	2k	0.3	3k

Find i) k ii) P(x > 2) iii) E(X)

(b) Prove that $\bar{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is solenoidal and find the constants a,b,c if $\bar{F}$ is irrotational. **(6)**

(c) Evaluate $\int_c \frac{z+6}{z^2-4} dz$ where c is (i) $|z| = 1$ (ii) $|z-2| = 1$ (iii) $|z+2| = 1$. **(8)**

Q.3 **(a)** The average breaking strength of steel rods is specified to be 17.5 (in units of 1000 kg) to test this sample of 14 rods tested & gave the following results: 15, 18, 16, 21, 19, 21, 17, 17, 15, 17, 20, 19, 17, 18. Is the result of the experiment significant? **(6)**

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

(c) If height of 500 students are normally distributed with mean 68 inches and standard deviation 4 inches, Find the number of students having heights (i) greater than 72 inches (ii) between 65 and 71 inches (iii) less than 62 inches. **(8)**

Q.4 **(a)** Use Gauss Divergence theorem to evaluate $\iint_S \bar{F}.\hat{n}ds$ where $\bar{F} = 4xz\hat{\imath} - y^2\hat{\jmath} + yz\hat{k}$ and s is the surface of the cube bounded by $x = 0,\ x = 1,\ y = 0,\ y = 1, z = 0, z = 1.$ **(6)**

(b) Find the lines of regression for the following data to estimate y corresponding to $x = 155$ **(6)**

X	100	110	120	130	140	150	160	170	180	190
Y	45	51	54	61	66	70	74	78	85	89

(c) Find all possible Laurent's series expansion of the function $f(z) = \frac{5z+7}{(z+3)(z+2)}$ about $z = 0$ indicating region of convergence. **(8)**

Q.5 **(a)** The standard deviation from two random samples of sizes 9 and 13 are 1.99 and 1.9. Can the samples be regard as drawn from normal population with same standard deviation? $(F_{(8,12)}(0.025) = 3.51, F_{(12,8)}(0.025) = 4.20)$ **(6)**

(b) Using Stoke's Theorem to evaluate $\int_c \bar{F}.d\bar{r}$ where $\bar{F} = yi + zj + xk$ and c is the boundary of surface $x^2 + y^2 = 1 - z,\ z > 0.$ **(6)**

(c) In an experiment on immunization of cattle from tuberculosis the following results were obtained (use 5% LOS) **(8)**

	Affected	Not Affected	Total
Inoculated	267	27	294
Not Inoculated	757	155	912
Total	1024	182	1206

Use Chi Square test to determine the efficiency of vaccine in preventing tuberculosis.

Q.6 **(a)** A bag contains 7 red balls and 3 black balls and another bag contains 4 red balls and 5 black balls. One ball is transferred from the first bag to the second bag then a ball is drawn from the second bag. If this ball happens to be red, Use Bayes' theorem to find the probability that a black ball was transferred. **(6)**

(b) A car hire firm has 2 cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the probability of days on which some demand is refused. **(6)**

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

****

3 HOURS **Marks: 80**

Note: - 1. Q.No.1 is compulsory.
2. Attempt any three questions out of remaining five questions. From Q.No.2 to Q.No .6.
3. Assume any data if required stating clearly.

Q1. Attempt **any four** from the following **(20)**

a) Explain in brief about major and minor losses through pipe.

b) Write a note on Dimensionless number.

c) Explain hydrodynamic ally smooth and rough boundaries

d) Write a note on Boundary layer separation and its control measures.

e) Explain Moment of momentum principle and its applications in fluid mechanics

f) Derive an expression for Hagen poiseuille equation.

Q.No.2 a) Three reservoirs A, B and C are connected by pipes, out of which water level in the two reservoirs namely A and B are 104.5 m and 100 m respectively above datum. A pipe joins each to a common point D, where pressure is 98 .1 KN/m^2 gauge and height is 83.5 above datum. Another pipe connects D to another tank C. What will be height of water level in C assuming the same value of f for all pipes. Take friction coefficient = 0.0075. The diameter of pipe AD, BD and CD are 300 mm, 450 mm , 600 mm respectively and their length are 240 m, 270 m and 300 m respectively. **(10)**

b) State assumption in Hardy-Cross method used for solving pipe network problem **(5)**

c) Derive an expression for Energy thickness and Momentum thickness **(5)**

Q.No.3 a) A syphon of diameter 200 mm connects two reservoirs having a difference in elevation of 15 m. The total length of the syphon is 600 m and summit is 4m above water level in upper reservoir. If the separation takes place at 2.8 m of water absolute, find the maximum length of syphon from the upper reservoir to summit. Take f = 0.004 and atmospheric pressure = 10.3 m of water **(10)**

b) . A smooth pipe of diameter 500mm and 1000m long is carrying water at the rate of 50 liters per second. If the kinematic viscosity is 0.02 stokes. Calculate: (a) loss of head, (b) wall shearing stress, (c) centre line velocity, (d) velocity and shear stress at 150mm from the pipe wall and (e) thickness of laminar sub layer. **(10)**

Q.No.4 a) Compare pipes in series and parallel **(5)**

b) A lawn sprinkler with two nozzles of diameter 4 mm each is connected a cross a tap of water. The nozzles are at a distance of 30 cm and 20 cm from the center of the tap. The rate of flow of water through tap is 120 cm^3/s. The nozzles discharge water in the downward direction. Determine the angular speed at which the sprinkler will rotate free. **(10)**

c) Find the maximum power transmitted by a jet of water discharging freely out of a nozzle fitted to a pipe 300 m long and 100 mm diameter with coefficient of friction as 0.01. The available head at the nozzle is 90 m **(5)**

Q.No.5 a) The pressure difference Δp in a pipe of diameter D and length L due to turbulent flow depends on the velocity V, viscosity μ, and density ρ and roughness k. Using Buckingham's л theorem, obtain an expression for Δp. **(10)**

b) An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and length 300 m. The rate of flow of fluid through the pipe is 3.5 lit/s . Find the pressure drop. **(5)**

c) Calculate i. Pressure gradient along flow, ii) the average velocity and iii) the discharge for an oil of viscosity 0.02 Ns/m^2 flowing between two stationary parallel plates 1 m wide maintained 10 mm apart. The velocity midway between the plates is 2 m/s. **(5)**

Q.No.6 a) Write a note on Water Hammer & Control measures **(5)**

b) Compare laminar and turbulent flow **(5)**

c) The velocity distribution in the boundary layer is given by, $\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^2$ where δ is boundary layer thickness. Find the displacement thickness, momentum thickness and energy thickness **(10)**

Time: 3 Hours **Marks: 80**

NOTE:

- **Q1 is compulsory. Attempt any three from remaining five questions**
- **Figure to the right indicates full marks. Draw neat sketches wherever necessary**
- **Assume suitable data wherever required**

Q1 Answer any **four** from the following: **20** Marks

a) Define influence line diagram and give its applications in Civil Engineering. Draw the influence line diagram for shear force and bending moment at point 4 metres from the left support of a simply supported beam of span 10 metres.

b) Draw the stress diagrams of elastic state, elastoplastic state, and fully plastic state for a beam of rectangular cross section.

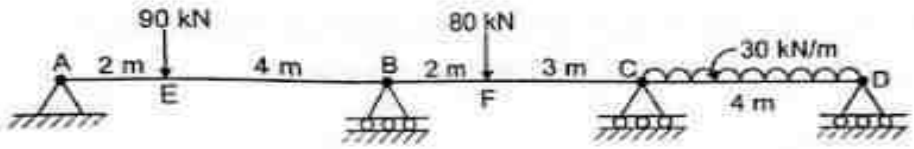
c) Explain the unit load method for determining displacements in trusses with the help of a suitable example

d) Differentiate between Determinate and Indeterminate structures. State advantages and disadvantages of indeterminate structures.

e) Explain carry over factor and distribution factor with the help of suitable examples

Q2

(a) Analyse the continuous beam loaded and supported as shown in figure by Three Moment Theorem and draw BMD **10 Marks**



Assume EI = Constant

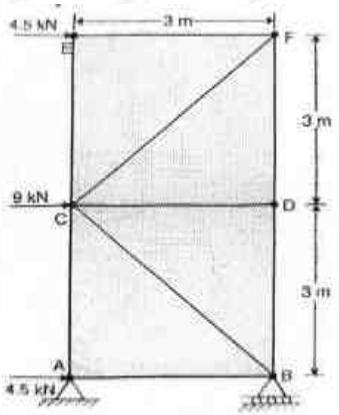
(b) A three hinged symmetrical parabolic arch has a span of 30 m and a central rise of 3 m. It is loaded with 10 kN/m on the left half of the arch

1) Calculate Normal Thrust and Radial Shear force at 7.5m from left hand support and
2) Draw BMD **10** Marks

Q3

(a) Find the forces in the truss members using Method of Joints.

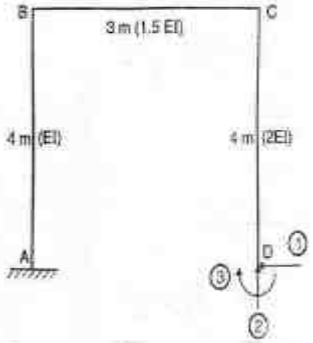
10 Marks



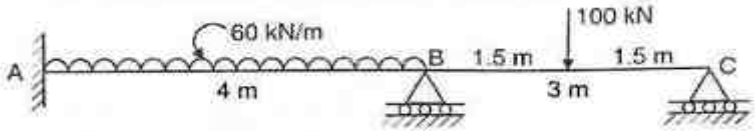
(b) A simply supported beam of span 50 m is subjected to a train of wheel loads: 20 kN, 50 kN, 60 kN and 10 kN spaced at 2m, 4m and 3m respectively (from left to right). The load train moves from the left end to right end of the beam with 10 kN as the leading load. Determine the location and magnitude of absolute maximum BM on the girder **10** Marks

Q4

(a) Develop flexibility matrix for the coordinates as shown in Figure **10** Marks

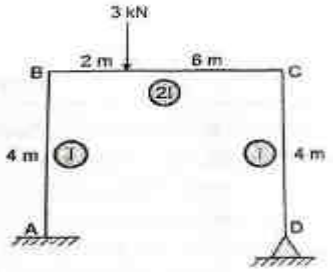


(b) Analyse the given beam as shown in Figure using Stiffness Method and draw BMD **10** Marks



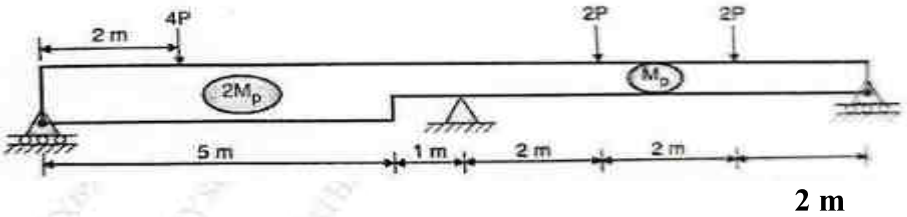
Q5.

(a) Analyse the given frame as shown in Figure using Moment Distribution method and draw BMD **10** Marks



(b) Find collapse load P for the continuous beam loaded as shown in figure.

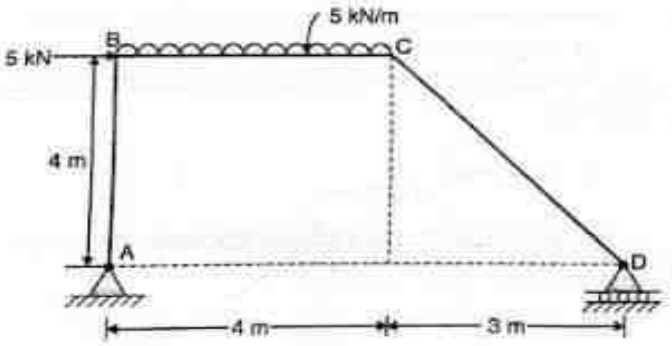
10 Marks



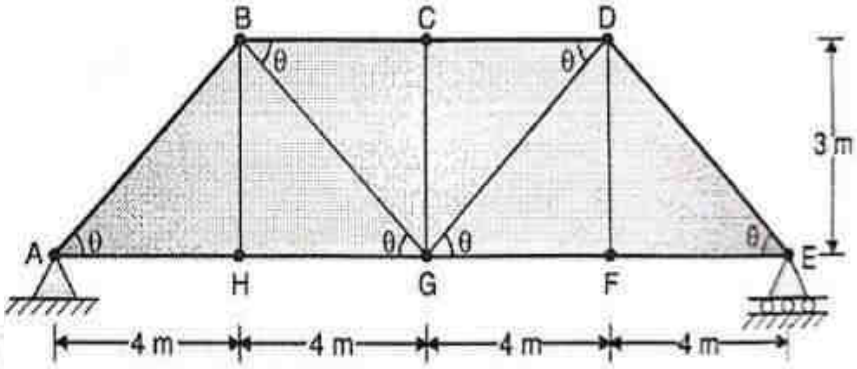
2 m

Q6 (a) A rigid jointed frame is loaded as shown in figure. Using unit load method determine horizontal movement of roller support at 'D', Take EI= constant

10 Marks



b) Draw I.L.D. for members CD, GD and GF of the truss when unit load travels over the bottom chord.



10 Marks

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

Note: i. Q. No. 1 is **compulsory**
ii. Attempt **any 3** out of remaining 5

1. **Solve any four** **(20 M)**

A. Explain the Principle of Surveying.
B. Enlist types of levelling and explain any two.
C. What are fundamental lines of theodolite? Explain the relation between them.
D. Define Tacheometry. Explain its Principle.
E. Explain types of horizontal curves with neat sketch.
F. Compare Trapezoidal and Prismoidal formula for estimating volume.

2. **A.** Following readings were taken using an Auto Level. The instrument was shifted after 4th and 7th reading. Find the RL of all staff station if the R.L of first station is 100 meters. Apply checks. If the readings were taken at distance of 20 meters, find the gradient of line joining first and last station. **(08 M)**

1.245, 2.580, 1.760, 4.595, 3.725, 1.535, 2.855, 1.680, 2.625, 1.110

B. Enlist the methods of plane table survey and explain any 2. **(07 M)**

C. Write detailed note on Total Station. **(05 M)**

3. **A.** An incomplete traverse table is obtained as follows. Calculate the length of line DA and Bearing of AB **(08 M)**

Line	Length (m)	Bearing
AB	75.50	30^0 24’
BC	180. 50	$110^0$36’
CD	60.25	$210^0$30’
DA	?	?

B. The Following offsets were taken from a chain line to a Hedge. **(08 M)**

Distance in m	0	20	40	60	80	120	160	200	240
Offsets in m	24	20	16	12	8	10	14	16	20

Calculate the area enclosed by chain line, the hedge and the end offsets by Trapezoidal Rule.

C. Compare Whole Circle Bearing and Reduced Bearing. Convert the following WCB into RB: **(04 M)**

i. 234^0 30’ ii. 270^0 iii. 48^0 45’ iv. 319^0 15’

4. A. The following observations were taken with a Tacheometer fitted with an analytic lens, Station P is between A and B. The constant of the Tacheometer is 100. **(08 M)**

Inst. Station	Height of Instrument	Staff Station	Vertical angle	Hair Readings (m)			Remark
				L	M	U	
P	1.255	A	$-4^0 20'$	1.325	1.825	2.325	RL of A 255.750
P	1.255	B	$+6^0 30'$	0.850	1.600	2.350	

Calculate the RL of B and gradient of line joining A and B.

B. Define contour. Explain characteristics of contour line with neat sketch. **(08 M)**

C. Discuss on types of vertical curves. Explain the elements of vertical curve with neat sketch. **(04 M)**

5. A. Find the local attraction and give corrected bearings. Also, if there is a declination of 2^0 20' W, give the true bearings. **(08 M)**

Line	Fore Bearing	Back Bearing
AB	80^0 45'	260^0 0'
BC	130^0 30'	311^0 35'
CD	240^0 15'	60^0 15'
DA	290^0 30'	110^0 10'

B. Write a note on Total Station. **(08 M)**

C. Define the following: **(04 M)**

i. Meridian
ii. Declination
iii. Fly levelling
iv. Bench mark

6. A. Prepare a table for setting out a simple circular curve using Rankine's method for the following data: **(08 M)**
Radius of curve = 250 meters.
Intersection angle = 150^0
Chainage of point of intersection = 1250 meters.
Peg interval = 20 meters
Least count of Vernier = 20"

B. Explain the Procedure of carrying out Tacheometric contouring on field. **(08 M)**

C. Explain Gales Travers Table **(04 M)**