G 538 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Civil Engineering

CE 010 406—CIVIL ENGINEERING DRAWING (CE)

(New Scheme—2010 admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Select suitable scale for drawing, indicating the same.
Assume suitable data wherever needed reasonably, stating the same.
Marks will be given for neatness.
Drawing sheet will be supplied.

Part A

Answer any **one** *question.*

1. Design a stair, draw the plan and sectional elevation of RCC dog-legged, for a residential building for a room measuring inside 2.5 × 5.5 m. and floor to floor height 3.3 m. Assume suitable data reasonably.

Or

2. A hall measuring 12 m × 24 m is required to be roofed over with Manglore tile on queen post truss. The truss are spaced at 3 m c/c and supported on two-brick thick wall at either end. Sketch the following :

   (i) A sectional elevation.

   (ii) Section joint of port truss with the beam and struts.

(30 marks)

Part B

Answer the following.

3. Design and draw plan, elevation and suitable section of a residential building having the following accommodation :

   Drawing room – 4.5 × 3.0

   Bed room – 3.0 × 3.5

Turn over

Office room	– 3.0 × 2.4
Dining room	– 3.0 × 3.0
Kitchen	– 3.0 × 2.4
Guest room	– 3.0 × 2.5

Passage, front and rear verandah, bath and WC may also be provided appropriately.

Also draw the site plan and appropriate specifications for the work.

(70 marks)

G 544 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

ENGINEERING MATHEMATICS—III (CMELRPTANSUF)

(Old Scheme—Supplementary/Mercy Chance—Prior to 2010 admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*
Each full question carries 20 *marks.*
Use of Statistical tables is permitted.

1. (a) Solve $x^2\frac{dy}{dx} = 3x^2 - 2xy + 1$. (5 marks)

(b) Solve $\left(D^3 + 1\right)y = \sin(2x+3)$. (7 marks)

(c) Solve $(3x+2)^2\frac{d^2y}{dx^2} + 3(3x+2)\frac{dy}{dx} - 36y = 3x^2 + 4x + 1$. (8 marks)

Or

2. (a) Solve $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \log x \sin(\log x)$. (8 marks)

(b) By method of variation of parameters solve $y'' - 2y' + 2y = e^x \tan x$. (7 marks)

(c) Solve $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$. (5 marks)

3. (a) From the p.d.e. by eliminating the arbitrary function from $z = f(x+it) + g(x-it)$. (5 marks)

(b) Solve $px - qz = z^2 + (x+y)^2$. (7 marks)

(c) A string is stretched and fastened to two points l apart motion is started by displacing the string in the form $y = a\sin\frac{\pi x}{l}$ from which it is released at time $t = 0$. Show that the displacement of any point at a distance x from one end at time t is given by $y(x,t) = a\sin\frac{\pi x}{l}\cos\frac{\pi ct}{l}$. (8 marks)

Or

4. (a) A rod of length l with insulated sides is initially at a uniform temperature u_0 its ends are suddenly cooled to 0°C and are kept at that temperature. Find the temperature function $u(x,t)$.

(8 marks)

(b) Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} - \frac{6\partial^2 z}{\partial y^2} = 0$. (5 marks)

(c) Solve $\left(p^2 + q^2\right) y = qz$. (7 marks)

5. (a) Using Fourier sine integral show that :

$$\int_0^\infty \frac{1-\cos \pi\lambda}{\lambda} \sin x\lambda \, d\lambda = \begin{cases} \frac{\pi}{2}, & 0 < x < \pi \\ 0, & x > \pi \end{cases}$$ (8 marks)

(b) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & \text{of } |x| < 1 \\ 0 \quad , & |x| > 1 \end{cases}$ and use it to evaluate

$$\int_0^\infty \frac{x\cos x - \sin u}{x^3} \cos\left(\frac{x}{2}\right) dx \, .$$

(12 marks)

Or

6. (a) Find the Fourier cosine transform of e^{-x^2}. (8 marks)

(b) Using Parseval's identity show that $\int_0^\infty \frac{x^2 dx}{\left(1+x^2\right)^2} = \frac{\pi}{4}$. (12 marks)

7. (a) Out of 800 families with *four* children each how many families would you expect to have

(i) 2 boys and 2 girls. (ii) Atleast one boy.

(iii) No girl. (iv) Atleast 2 girls.

Assume equal probabilities for boys and girls.

(10 marks)

(b) Derive the mean and variance of Poisson distribution. (10 marks)

Or

8. (a) Fit a binomial distribution to the following data :

x :	0	1	2	3	4	5
	2	14	20	34	22	8

(12 marks)

(b) In a normal distribution 31% of the items are under 45 and 8% and over 64. Find the mean and standard deviation of the distribution.

(8 marks)

9. (a) The following figures refer to observations in live independent samples :

Sample I :	25	30	28	34	27	20	13	32	22	38
Sample II :	40	34	22	20	31	40	30	23	36	17

Analyse whether the samples have been drawn from the populations of equal mean.

(12 marks)

(b) A coin was tossed 400 times and returned heads 216 times. Test the hypothesis that the coin is ubiased.

(8 marks)

Or

10. (a) Two independent samples of sizes 7 and 6 had the following values :

Sample A :	28	30	32	33	31	29	34
Sample B :	29	30	30	24	27	28	

Examine whether the samples have been drawn from normal populations having the same variance.

(12 marks)

(b) A sample of 20 items has been 42 units and S.D. 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units.

(8 marks)

[5 × 20 = 100 marks]

G 527 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Civil Engineering

CE 010 405—SURVEYING – II (CE)

(New Scheme—2010 admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. What is meant by eccentricity of signal ?
2. Distinguish between systematic error and accidental error.
3. List the equipments required for sounding.
4. What is relief displacement ?
5. What is declination–hour angle co-ordinate system ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Describe a method of extending a baseline.
7. Explain the method of developing normal equation.
8. With a suitable example, explain the distance measurement using EDM.
9. Explain various parts of aerial camera and their uses.
10. Obtain the relationship among LMT, LAT and equation of time.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. Two triangulation stations A and B are 40 km apart and have elevations of 170 m and 166 m respectively. Find the minimum height of signal required at B so that the line of sight may not pass nearer the ground than 3 m. The intervening ground may be assumed to have a uniform elevation of 150 m.

Or

12. The attitudes of two proposed triangulation stations A and C, 65 miles apart, are 703 ft and 3520 ft respectively above the level datum, while the heights of two eminences B and D on the profile between A and C are 1170 and 2140 ft respectively. The distance AB and AD being 24 miles and 45 miles respectively. Ascertain if A and C are intervisible and, if necessary, determine a suitable height of a scaffold at C, given that A is a ground station. The earth's mean radius may be taken as 3960 miles, and coefficient of refraction 0.07.

13. The observations closing the horizon at a station are :

$A = 24^\circ\ 22'\ 18''.2$ weight 1

$B = 30^\circ\ 12'\ 24''.4$ weight 2

$A + B = 54^\circ\ 34'\ 48''.6$ weight 3

$C = 305^\circ\ 35'\ 13''.9$ weight 2

$B + C = 335^\circ\ 37'\ 38''.0$ weight 3

Find the most probable values of the angles A, B and C.

Or

14. Adjust the following station observations :

$A = 34^\circ\ 18'\ 20''.4$ weight 1

$B = 23^\circ\ 32'\ 12''.8$ weight 2

$C = 22^\circ\ 48'\ 32''.6$ weight 2

$A + B = 62^\circ\ 50'\ 29''.6$ weight 2

$A + B + C = 85^\circ\ 39'\ 08''.6$ weight 1

15. (a) Explain how the soundings are located by :

(i) Two angles from the shore.

(ii) Intersecting ranges. (2 + 2 = 4 marks)

(b) Derive the analytical solution of the three point problem.

(8 marks)

Or

16. Describe a total station. Explain surveying procedure using a total station. What are its advantages and applications ?

17. The elevations of points in an area vary from 136 m to 184 m. Aerial photographs were taken with a camera having a focal length of 200 mm. Determine :

    (i) The flying height required to have a photographic scale of 1 in 8000 ; and

    (ii) The photographic scale if the flying height is 2500 m.

Or

18. Define remote sensing. Explain the electromagnetic energy and electromagnetic spectrum used in remote sensing.

19. Explain the corrections for refraction, parallax semidiameter and dip, required in astronomical observations.

Or

20. (a) Define and draw the following with neat sketches (i) Declination ; (ii) Hour angle ; and (iii) Right ascension.

(3 × 2 = 6 marks)

(b) Calculate the local apparent time of an observation taken at local mean time 10 hr. 30 min at longitude 78° 30' E. The equation of time at GMN is 3 min 4.52 sec subtractive from the apparent time and decreasing at the rate of 0.3 sec/hour.

(6 marks)

[5 × 12 = 60 marks]

G 509 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Civil Engineering

CE 010 403—MECHANICS OF SOLIDS—II (CE)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. What is conjugate beam ? Draw the conjugate beam for simply supported beam.
2. State and explain the Maxwell's reciprocal theorem. Why it is called law of reciprocal deflections ?
3. Why are influence lines for statistically determinate beams invariably made of straight lines ?
4. What are the differences in behaviour between the saddle support and the pulley support provided at the top of the pylon in a cable suspended bridge ?
5. Define principal planes and principal stresses.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Show how the moment area method and the conjugate beam method are closely related to each other.
7. Derive the equation for the strain energy due to bending.
8. Under uniformly distributed loading in a simply supported beam, the shear force at the mid-span location is zero, under dead load, but not under live load. Is this statement true or false ? Explain.
9. What are the advantages of providing internal hinge in the middle of the stiffening girder ? Explain.
10. Obtain an expression for the maximum principal stress on an oblique section of a rectangular body, when it is subjected to a direct stress in one plane only.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. A horizontal beam AB is freely supported at A and B, 8 m apart and carries a uniformly distributed load of 15 kN/m run (including its own weight). A clockwise moment of 160 kN-m is applied to the beam at a point C, 3 m from the left hand support A. Calculate the slope of the beam at C. Given EI = 40,000 kN-m^2.

Or

12. A beam of length l is simply supported at the ends and carries a concentrated load W at a distance a from each end. Find the slope at each end and under each load. Also find the deflection under each load and at the centre.

13. A mild steel bar 100 mm diameter is bent as shown in fig 1. It is fixed horizontally at A and a load of 500 N hangs at D. Draw the bending moment diagram for the parts AB, BC and CD indicating the maximum values. Find the maximum bending stress. Also find the deflection at D. Take E = 2×10^5 N/Mm^2.

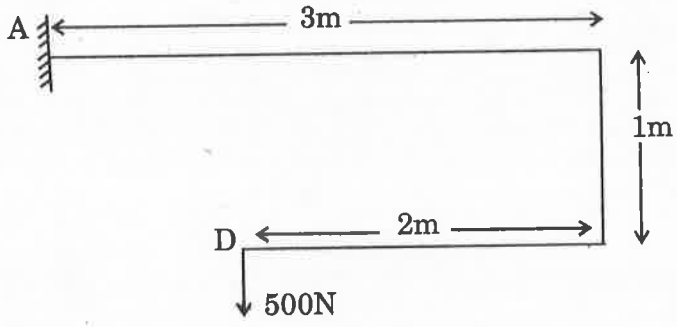


Figure. 1

Or

14. Find the vertical deflection of A of the structure shown in fig 2. All members have the same sectional area.

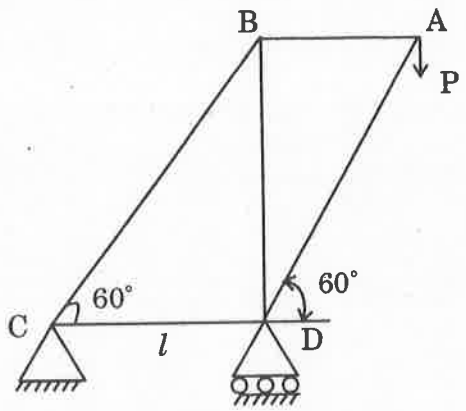


Figure. 2

15. A uniformly distributed live load of 60kN/m run, of length 5 meters moves on a girder of span 16 meters. Find the maximum shear force and bending moment at a section 6 meters from the left end. Also calculate the maximum shear force and absolute maximum bending moment.

Or

16. The load system shown in fig 3 below moves from right to left along a girder of span 20 meters. Find the maximum shear force at a section 7.5 meters from the left end.

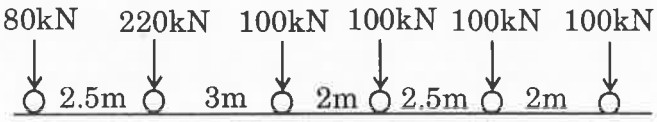


Figure. 3

17. A three-hinged parabolic arch of span 20 meter and rise 4 meter carries a uniformly distributed load of 20 kN/m run on the left half of the span. Calculate the maximum bending moment for the arch.

Or

18. Three-hinged stiffening girder of a suspension bridge of span 120 m is subjected to two point loads of 240 kN and 300 kN at distances 25 m and 80 m from the left end. Find the shear force and bending moment for the girder at a distance of 40 m from the left end. The supporting cable has a central dip of 12 m. Also find the maximum tension in the cable and draw the BM diagram for the girder.

19. A rectangular block of material is subjected to a tensile stress of 100 N/mm^2 on one plane and a tensile stress of 50 N/mm^2 on a plane at right angles, together with shear stresses of 60 N/mm^2 on the same planes. Find

    (a) the direction of the principal planes ;

    (b) the magnitude of the principal stresses ; and

    (c) the magnitude of the greatest shear stress.

Or

20. A beam 3 m long of I-section is freely supported at its ends with the web vertical. It carries concentrated loads of 100 kN. at 0.6 m. from each end. The flanges are each 150 mm wide and 25 mm thick, the overall depth being 400 mm. The thickness of the web is 12.5 mm. Calculate the principal stresses and the maximum shearing stress in a section of the beam where the bending moment and shearing force, both have maximum values.

(5 × 12 = 60 marks)

20. (a) Given :

Day	:	Mon	Tue	Wed	Thu	Fri	Sat	Sun
f	:	16	8	12	11	6	14	14

(No. of accidents)

Is there any reason to doubt that the accident is equally likely to occur on any day of the weak ? (6 marks)

(b) A machine produced 20 defective units in a sample of 400. After overhauling the machine, it produced 10 defective units in a batch of 800. Has the machine improved due to overhauling ? (6 marks)

[5 × 12 = 60 marks]

G 500 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

EN 010 401—ENGINEERING MATHEMATICS—III

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

(Common to all Branches)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. If $f(x) = \begin{cases} kx, & 0 \le x \le l/2 \\ k(l-x), & l/2 \le x \le l \end{cases}$

find a_0.

2. Show that the Fourier Cosine transform of Fourier Cosine transform of a given function is itself.

3. Solve : $a(p+q) = z$.

4. Find the distribution function from $f(x) = \begin{cases} c(3+2x), & 0 < x < 2 \\ 0, & \text{otherwise} \end{cases}$

5. What are type-I and type-II errors ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Write the Fourier Series for $f(x) = \begin{cases} 1-x, & -\pi < x < 0 \\ 1+x, & 0 < x < \pi \end{cases}$.

7. Find the finite Fourier Cosine transform of $f(x) = \frac{\pi}{3} - x + \frac{x^2}{2\pi}$.

Turn over

8. Solve : $\left(\frac{y^2z}{x}\right)p + xzq = y^2$.

9. Fit a binomial distribution for :

x	:	0	1	2	3	4
f	:	5	29	36	25	5

10. Write the application of ψ^2 -test.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. Obtain the Fourier Series for $f(x) = \begin{cases} l - x, & 0 < x \le l \\ 0, & l \le x < 2l \end{cases}$

Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots = \frac{\pi}{4}$ and $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots = \frac{\pi^2}{8}$.

(12 marks)

Or

12. If $f(x) = lx - x^2$ in $(0, l)$, show that the half range, sine series for $f(x)$ is

$\frac{8l^2}{\pi^3} \sum_{n=0}^{\infty} \frac{1}{(2n+1)^3} \sin\frac{(2n+1)\pi x}{l} \ldots$ and deduce that $\frac{\pi^3}{3^2} = 1 - \frac{1}{3^3} + \frac{1}{5^3} - \ldots$.

(12 marks)

13. Show that the Fourier transform of $f(x) = \begin{cases} a^2 - x^2 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a > 0 \end{cases}$

is $2.\sqrt{\frac{2}{\pi}}\left(\frac{\sin as - as\cos as}{s^3}\right)$. Hence deduce that $\int_0^{\infty} \frac{\sin t - t\cos t}{t^3} dt = \pi/4$. (12 marks)

Or

14. (i) Find the finite sine transform of $f(x) = x^3$. (6 marks)

(ii) Find the cosine transform of $f(x) = \begin{cases} \cos x, & 0 < x < a \\ 0, & x > a \end{cases}$ (6 marks)

15. (a) Solve : $r - 2s + t = \sin(2x + 3y)$. (6 marks)

(b) Solve : $\left(D^2 + D^{1^2}\right)z = \cos mx \cos ny$. (6 marks)

Or

16. (a) Solve : $D(D + D' - 1)(D + 3D' - 2)\, z = x^2 - 4xy + 2y^2$. (9 marks)

(b) Solve : $r - s + p = 1$. (3 marks)

17. (a) If 15% of a normal population lies below the value 30 and 10% of the population lies above the value 42, calculate its Mean and Standard Deviation.

(6 marks)

(b) Fit a Poisson Distribution to :

x	:	0	1	2	3	4
f	:	43	38	22	9	1

(6 marks)

Or

18. (a) Six coins are tossed once. Find the probability of obtaining heads.

(i) exactly 3 times.
(ii) atmost 3 times.
(iii) atleast 3 times.
(iv) atleast once.

(8 marks)

(b) Given : X is a Poisson variate with $P(X = 2) = \frac{2}{3}P(X = 1)$. Find $P(X = 0)$ and $P(X \ge 2)$.

(4 marks)

19. (a) Test for the difference of variances for :

Method 1	:	20	16	27	26	22	23
Method 2	:	27	33	42	32	35	34	38

(6 marks)

(b) The 9 items of a sample have 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these values differ significantly from the assumed mean 47.5 ?

(6 marks)

Or

Turn over

G 503 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Civil Engineering

CE 010 402—CONSTRUCTION ENGINEERING AND MANAGEMENT

(New Scheme—2010 Admission onwards)

[Regular/Improvement—Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 marks.

Write short notes on the following :—

1. Distempering.
2. Building automation.
3. Time estimates.
4. Floats.
5. Industrial safety.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 marks.

Write notes on :

6. Scaffolding and formwork.
7. Earthwork computation.
8. Mile-stone charts.
9. Crashed critical paths.
10. Labour welfare and social security.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 12 marks.

11. With neat sketches, explain the important features of (i) expansion joints ; (ii) Contraction joints ; and (iii) Sliding joints.

(3 × 4 = 12 marks)

Or

12 Explain clearly the procedure to be adopted in laying (i) mosaic flooring ; and (ii) granite flooring.

(2 × 6 = 12 marks)

13. What is meant by orientation of buildings ? Explain with neat sketches, the effects of orientation of buildings.

Or

14. Explain clearly the principles and performances of the pneumatic and hoisting equipments.

15. (a) How do you plan and control a project ? (4 marks)

(b) What are the purposes of CPM ? (4 marks)

(c) Define network analysis. Bring out the similarities and dissimilarities between PERT and CPM. (4 marks)

Or

16. The activities of a project with their time estimates are given below :

	Time estimates (days)		
Activity	*Optimistic*	*Most likely*	*Pessimistic*
10–20	2	5	14
10–30	3	10	20
10–40	2	5	8
20–40	5	14	14
20–50	6	15	30
30–50	1	4	7
30–60	3	6	20
40–60	3	6	9
50–60	5	8	17

Draw the network. Find the expected length of the project, standard deviation and variance of the project.

17. (a) Explain with illustration (i) free float ; and (ii) independent float.

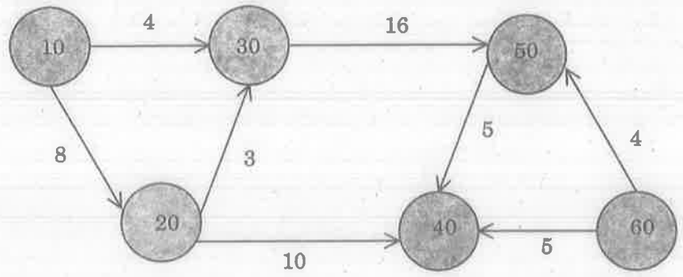
(b) Explain the characteristics of cost versus time curve.

(c) What is network compression ? How it is achieved ?

(3 × 4 = 12 marks)

Or

18. For the network given below, calculate the floats for each activity in tabular form and find the critical path :



19. Discuss payment of wages act and minimum wages act. Comment on both as is perceived by the labourer.

Or

20. Clearly explain the role of state in labour welfare and social security.

[5 × 12 = 60 marks]

G 518 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Civil Engineering

CE 010 404—OPEN CHANNEL FLOW AND HYDRAULIC MACHINES (CE)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Define the term most economical section of a channel.
2. Draw and describe back-water curve.
3. What are the various applications of hydraulic jump.
4. Define unit speed, unit discharge and unit power as related to turbines.
5. What are the functions of air vessel provided in a reciprocating pump ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Show that the condition for the discharge to be maximum for a given specific energy in an open channel flow is the same as that for the specific energy to be minimum for the given discharge.
7. Derive the differential equation of the gradually varied flow.
8. With the help of neat sketches, explain briefly the different types of jump.
9. Explain the velocity triangle for a Francis turbine.
10. With the help of a neat sketch, explain the components of a centrifugal pump.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. Water flows at a uniform depth of 2 m in a trapezoidal channel having a bottom width of 6 m, side slopes 2H to 1V. If it has to carry a discharge of 65 m^3/s, compute the bottom slope required to be provided. Take Manning's $n = 0.025$.

Or

12. A uniform flow of 300 cfs occurs at a depth of 5 ft in a long rectangular channel 10 ft. wide. Compute the minimum height of a flat-top hump that can be built on the floor of the channel in order to produce a critical depth. What will result if the hump is lower or higher than the computed minimum height ?

13. A trapezoidal channel having bottom width 6m, side slope 2H : 1V, Manning's roughness coefficient 0.025 and bottom slope 0.0015, carries a discharge of $10 m^3/s$. Compute the back water profile created by a dam which backs up the water to a depth of 2.0 m immediately behind the dam. Use the direct step method for computation.

Or

14. A river 100m wide and 4m deep has stable bed and vertical banks with a surface slope of 1 in 2500. Estimate the length of the backwater curve produced by an afflun of 2m. Assume Manning's $n = 0.035$. Adopt step method.

15. With usual notations show that in the case of rectangular channel the relation between the depth before the jump and depth after the jump can be expressed as $Y_2 = \frac{Y_1}{2}\left[-1 + \sqrt{1 + 8\,F_1^2}\right]$.

Or

16. A rectangular channel carrying super critical flow is provided with a hydraulic jump type of energy dissipater. If it is expected to dissipate 5 m of head of water in the formation of the jump and if inlet Froude's number is 8.2, find the subsequent depths.

17. (a) Prove that the force exerted by a jet of water on a fixed semi-circular plate in the direction of the jet when the jet strikes at the centre of the semi-circular plate is two times the force exerted by the jet on a fixed vertical plate.

    (b) What is a draft tube ? Explain briefly different types of draft tubes ?

Or

18. (a) Derive an expression for specific speed of a turbine ?

    (b) A Pelton turbine is having a mean runner diameter of 1. 0 m and is running at 1000 r.p.m. The net head is 100 m. If the side clearance is 20° and the discharge is 0.1 m^3/s, find the power available at the nozzle and hydraulic efficiency of the turbine.

19. A single stage reciprocating pump has a piston are 0.185 m^2 and stroke is 0.3 m. Delivery pipe cross-sectional area is 0.37 m^2 and water is lifted to a height of 12 m. Find the percentage slip, coefficient of discharge and theoretical power required to drive the pump if it is running at 60 r.p.m. and actual discharge is 50 litres per sec.

Or

20. A centrifugal pump works at a speed of 1000 r.p.m. and manometric head is 14.5 m. The vane angle at outlet is 30° with the periphery. The diameters of the impeller at outlet is 30 cm and the width is 5 cm. Find the discharge of the pump if the manometric efficiency is 95 %.

(5 × 12 = 60 marks)