G 1871 (Pages : 2) Reg. No...............................

Name...................................

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Civil Engineering

CE 010 406—CIVIL ENGINEERING DRAWING (CE)

(Regular—2010 Admissions)

Time : Three Hours Maximum :100 Marks

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

Part A

Answer any **one** *question.*

1. A hall 8 m × 24 m is required to be roof over with Mangalore tile on king port truss. The truss are spaced at 3m c/c and are to be supported on 1½ brick thick wall on either side. Draw detailed sketch for the following :
   - (a) Junction of tie beam and principal rafter.
   - (b) Join between the principal rafter and king port.

Or

2. A dog-legged stair-case for a building has the following data :

Staircase room	:	2 × 4.5 m
Width of flight	:	1m, steps : tread 25 cm, rise 15 cm, width of landing 1 m

Design the stair and draw the plan and sectional elevation.

(1 × 30 = 30 marks)

Part B

Answer the following,

3. Design and plan a house with proper ventilation and lighting in order to satisfy the following requirements specified by a client :

(i)	Drawing room	–	about 15 m^2
(ii)	Two bedrooms	–	about 12 m^2 each
(iii)	Kitchen	–	about 9 m^2
(iv)	Bathroom	–	about 2 m^2
(v)	W.C.	–	about 1.5 m^2

Turn over

(vi) About 2.5 m wide front and rear verandah.

Draw to suitable scale :

(a) Detailed plan.

(b) Section showing maximum details.

(c) Front elevation.

(d) Site plan.

Write appropriate specifications for the work.

(70 marks)

G 1836

(Pages : 2)

Reg. No..............................

Name..................................

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Civil Engineering

CE 010 402—CONSTRUCTION ENGINEERING AND MANAGEMENT

(Regular—2010 Admissions)

Time : Three Hours

Maximum : 100 Marks

Part A

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

Write short notes on the following :

1. Curing methods of concrete.
2. Shading of buildings.
3. Milestone charts.
4. Resource smoothing.
5. Industrial safety.

(5 × 3 = 15 marks)

Part B

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

Write notes on the following :

6. Concrete repairs.
7. Mass diagram.
8. Time estimates.
9. Network compression.
10. Social security and welfare of labour.

(5 × 5 = 25 marks)

Part C

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

Module 1

11. Clearly describe the damp proofing methods and materials used for (a) floors ; (b) walls and (c) roofs.

(3 × 4 = 12 marks)

Or

Turn over

12. (a) Explain in detail about application of snowcem for a new building.

(b) Describe the role of admixtures in concrete.

(6 + 6 = 12 marks)

Module 2

13. Describe the various modern automation techniques used in different stages of a building construction.

Or

14. Explain the different machineries used for handling and hoisting materials for building construction, highlighting their merits and demerits.

(12 marks)

Module 3

15. (a) How do you open and control a project ?

(b) What are the purposes of PERT and CPM ?

(c) Explain network analysis. Bring out the similarities and dissimilarities between PERT and CPM.

(3 + 3 + 6 = 12 marks)

Or

16. A project is composed of the following activities whose time estimates are listed as below :

Activity		t_o	t_m	t_p
1–2	...	1	1	7
1–3	...	1	4	7
1–4	...	2	2	9
2–5	...	1	1	1
3–5	...	2	5	13
4–6	...	2	5	8
5–6	...	3	6	15

(a) Draw the project network and identify critical path.

(b) What is the probability that the project will be completed at least three weeks earlier than expected ?

(6 + 6 = 12 marks)

Module 4

17. Explain "Updating a network". When a network need to be updated ? Explain.

Or

18. Explain (a) Crashed critical path and (b) Parallel critical path with appropriate examples.

(12 marks)

Module 5

19. Explain the role of the state in labour welfare. Clearly mention the role of labour welfare officers.

Or

20. Explain Minimum Wages Act. How a labour is protected by this act ?

(12 marks)

(5 × 12 = 60 marks)

G 1842 (Pages : 3) Reg. No.................................

Name.......................................

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Civil Engineering

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

(Regular—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Define elastic constants. Write the relationship between them.
2. Explain the principle of virtual work.
3. Define (a) shear force ; (b) bending moment ; (c) point of contraflexure.
4. Explain Eddy's theorem.
5. Distinguish between symmetrical and unsymmetrical bending.

(5 × 3 = 15 marks)

Part B

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

6. What is conjugate beam ? Draw the conjugate beam for the following cases :
   (a) simply supported beam.
   (b) cantilever beam and
   (c) overhanging beam.
7. Explain Castigliano's first theorem and its applications.
8. Derive the relationship between load intensity, bending moment and shear force.
9. With a neat sketch, explain the three hinged arch.
10. Explain principal stresses and principal planes.

(5 × 5 = 25 marks)

Part C

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

Module 1

11. An uniform beam of length 4 L is simply and symmetrically supported over a span of 2 L. It carries a load W_1 at each end and a total uniformly distributed load of W_2 on the span between the supports. Find the ratio of W_1 to W_2 if the deflection at the mid-span is equal to that at each end.

Or

Turn over

12. A horizontal beam AB of uniform section, 5 m span, is fixed at A and freely supported at B. It carries a load of 10 tonnes at 2 m from A. Calculate the fixed-end moment.

MODULE 2

13. By unit load method, determine the vertical displacement of the joint "E" for the pin-jointed plane truss loaded as shown in Fig.1 The cross-sectional area of all members are 130 mm^2. Consider Young's modulus of elasticity = 200 kN/mm^2.

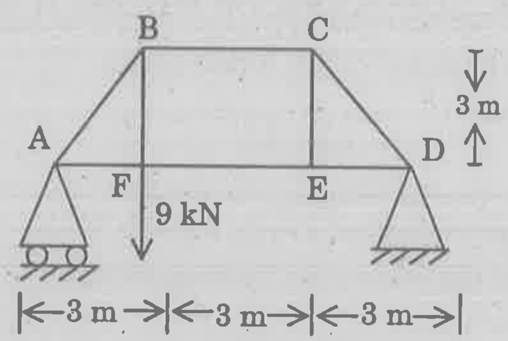

Fig.1

Or

14. Calculate the horizontal deflection at C for the frame loaded as shown in Fig.2 below by strain energy method. Take E = 200 GPa and I = 86 × 10^7 mm^4.

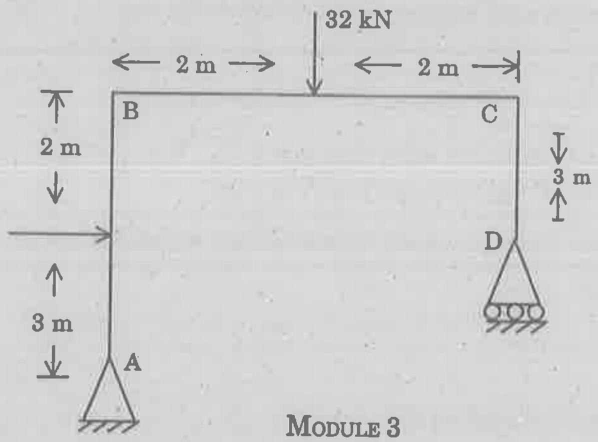

Fig.2

MODULE 3

15. A train of wheel loads crosses a simply supported beam from left to right as shown in Fig. 3. Using influence line concepts determine the maximum bending moment at a section 12 m from LHS. Also find absolute maximum bending moment.

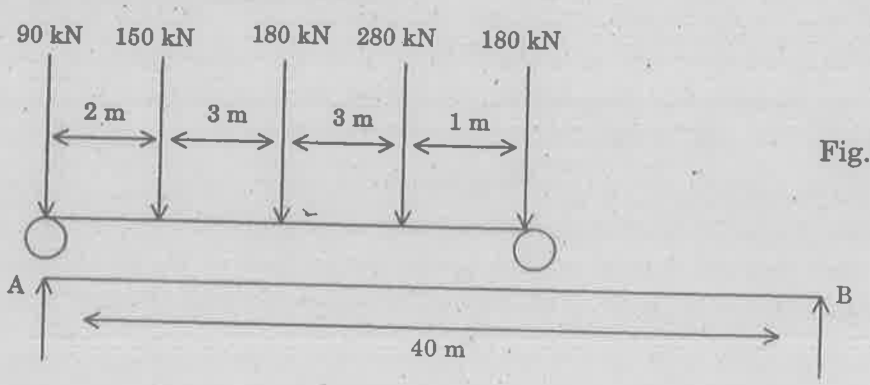

Fig.3

Or

16. Draw the influence lines for the axial forces in the members GH, CD and HC in the truss as shown in Fig. 4. Also determine the maximum axial forces in these members due to a single concentrated load of 100 kN.

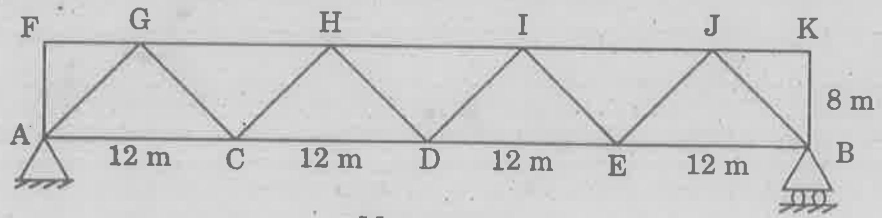

Fig.4

MODULE 4

17. A three-hinged stiffening girder 120 m span is subjected to two point-loads 240 kN and 300 kN at a distance 25 m and 80 m respectively from left hand support. If dip of the cable is 12 m, find the maximum tension in the cable. Also determine SF and BM at 40 m from the left hand support of the girder.

Or

18. A two-hinged parabolic arch of span 36 m has a rise of 8 m. The arch carries UDL of intensity 40 kN/m over the left half of the span. Determine position and magnitude of maximum bending moment and determine the values of normal thrust and radial shear at that section. Assume that moment of inertia at a section varies as secant of slope at the section.

MODULE 5

19. At a point in a stressed body, the normal stresses are 83 N/mm^2 (tensile) on a vertical plane and 27.5 N/mm^2 (compressive) on a horizontal plane. A shearing stress of 41.4 N/mm^2 acts at this point. Determine stresses and their directions. Also, find the maximum shearing stress at this point.

Or

20. An element under two-dimensional stress system is subjected to a tensile stress of 50 N/mm^2 and 30 N/mm^2 compressive stresses on two mutually perpendicular places accompanied by a shear stress of 15 N/mm^2. Determine the principal stresses and principal plane. Also find maximum shear stress and its plane.

(5 × 12 = 60 marks)

G 1851

(Pages : 3)

Reg. No.................................

Name....................................

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Civil Engineering

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

(Regular—2010 Admissions)

Time : Three Hours

Maximum : 100 Marks

Part A

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

1. What are the conditions for the rectangular channel of the best section ?
2. What are the essential differences between gradually varied flow and rapidly varied flow ?
3. Explain hydraulic jump with a neat sketch.
4. How do you classify turbines based on the specific speed ?
5. What is an air vessel ? What are its functions ?

(5 × 3 = 15 marks)

Part B

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

6. Derive the expression for the discharge through a channel by Chezy's formula.
7. Draw and explain the stage discharge rating curve for measuring discharge in a stream.
8. Derive the relationship between initial and sequent depths for hydraulic jump in a rectangular channel.
9. Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.
10. What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump ?

(5 × 5 = 25 markls)

Turn over

Part C

Answer any **one** *full question from each module.*
Each full question carries 12 marks.

Module 1

11. (a) Derive an expression for the critical depth and critical velocity. (8 marks)

(b) Calculate the critical depth and critical velocity of water flowing through a rectangular channel of width 6 m, when the discharge is 16 m^3/s.

(4 marks)

Or

12. A rectangular channel has a bottom width of 6 m. If the depth of flow is 1.5 m. at a discharge of 20 m^2/s, determine.

(a) Specific energy. (b) Alternate depth and

(c) Critical depth.

(12 marks)

Module 2

13. A river 90 m. wide and 3 m. deep has stable bed and vertical banks with a surface slope of 1 in 2500. Estimate the length of backwater curve produced by an afflux of 2m. Take Manning's $n = 0.0325$.

(12 marks)

Or

14. Find the rate of change of depth of water in a rectangular channel of 10 m. wide and 1.5 m. deep, when the water is flowing with a velocity by 1 m/s. The flow of water through the channel of bed slope is 1 in 4,000, is regulated in such a way that energy line is having a slope of 0.00004.

(12 marks)

Module 3

15. A sluice gate discharges water into a horizontal rectangular channel with a velocity of 6 m/s. and depth of flow is 0.4 m. The width of the channel is 8 m. Determine whether a hydraulic jump will occur, and if so, find its height and loss of energy per kg. of water.

(12 marks)

Or

16. If a hydraulic jump occurring in a rectangular channel of width 4 m. the Froude number before the jump is 8.5 and loss of energy is 3m, find :

(a) Conjugate depths.

(b) Discharge in the channel.

(12 marks)

Module 4

17. (a) Show that a jet striking on a series of flat plates mounted on the periphery of a circular wheel has the maximum efficiency when the vane velocity is half the jet velocity.

(9 marks)

(b) Distinguish between turbines and pumps. (3 marks)

Or

18. A peltron wheel has a mean bucket speed of 10 m/s. with a jet of water flowing at the rate of 700 litre/s. under a head of 30 meters. The buckets deflect the jet through an angle of 160°, calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98.

(12 marks)

Module 5

19. A double acting reciprocating pump, running at 40 r.p.m. is discharging 1m^3. of water per minute. The jump has a stroke of 400 mm. The diameter of the piston is 200 mm. The delivery and suction head are 20 m. and 5 m. respectively. Find the slip of the pump and the power required to drive the pump.

(12 marks)

Or

20 A centrifugal pump is to discharge 0.118 m^3/s. at a speed of 1450 r.p.m. against a head of 25 m. The impeller diameter is 250 mm, its width at the outlet is 50 mm. and manometric efficiency is 75 %. Determine the vane angle at the outer periphery of the impeller.

(12 marks)

[5 × 12 = 60 marks]

G 1860 (Pages : 3)

Reg. No.....................................

Name...

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Civil Engineering

CE 010 405—SURVEYING—II (CE)

(Regula—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Define sensible and visible horizon.
2. Differentiate between probable error and most probable value.
3. Write a short note on hydrographic survey.
4. List the various parts of photo theodolite.
5. Explain briefly ideal map projection.

(5 × 3 = 15 marks)

Part B

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

6. Explain intervisibility and height of stations.
7. What are the basic sources of errors ? Explain.
8. Explain the interaction of electromagnetic radiation with atmosphere and earth's surface.
9. Explain the procedure to calculate relief displacement on a vertical photograph with the help of neat sketches.
10. What do you understand by terrestrial longitude and latitude ? Explain.

(5 × 5 = 25 marks)

Part C

*Answer any **one** full question from each module.*
Each full question carries 12 marks.

Module 1

11. List the requirements in selecting the site for a base line. Explain and give equations for the correction for pull and sag on baseline measurements.

Or

Turn over

12. The altitude of two proposed stations A and B, 130 km apart are respectively 220 m and 1160 m. The altitudes of two points C and D on the profile between them are respectively 308 m and 632 m, the distances being AC = 50 km and AD = 90 km. Determine whether A and B are intervisible, and if necessary, find the minimum height of a scaffolding at B, assuming A as the ground station.

MODULE 2

13. Adjust the following angles closing the horizon :—

A =	110°	20′	48″	wt. 4
B =	92°	30′	12″	wt. 1
C =	56°	12′	00″	wt. 2
D =	100°	57′	04″	wt. 3

Or

14. A surveyor carried out levelling operations of a closed circuit ABCDA starting from A and made the following observations :

B was 8.164 m above A, weight 2.

C was 6.284 m above B, weight 2.

D was 5.626 m above C, weight 3 and

D was 19.964 m above A, weight 3.

Determine the probable height of B, C and D above A by method of correlates.

MODULE 3

15. A, B and C are three visible stations in a hydrographic survey. The computed sides of the triangle ABC are : AB, 1130 m ; BC, 1372 m ; and CA, 1889 m. Outside this triangle (and nearer to AC), a station P is established and its position is to be found by three point resection on A, B and C, the angles APB and BPC being respectively 42° 35′ and 54° 20′. Determine the distance PA and PC.

Or

16. In a triangulation survey it becomes necessary to incorporate a station S not in the original net, and its position is determined by angular observations on three visible stations P, Q and R, the total co-ordinates of which are appended, with the two horizontal angles observed from S. Determine analytically the coordinates of the station S.

Station	*Lattitude*	*Departure*	*Angle*
P	+ 18,400	+ 72,800	52° 12′ 20″
Q	+ 18,400	+ 94,600	68° 30′ 15″
R	+ 2,200	+ 107,400	

MODULE 4

17. List the purposes of stereoscope. Explain with the help of neat sketches (i) mirror stereoscope and (ii) lens stereoscope.

Or

18. The coordinates of two points P and Q having ground elevations of 150 m and 250 m above datum respectively, measured on the photoprint taken with a camera having focal length of 25 cm.

Point	*Coordinates* X cm	Y cm
P	+ 2.86	+ 1.13
Q	+ 1.50	+ 2.30

The flying attitude is 2000 m above datum. Determine the length of ground line PQ.

MODULE 5

19. (a) Explain apparent solar time and mean solar time. (4 marks)

(b) Find GMT corresponding to LMT of the following plans :—

(i) 4n 40 m 20 S AM at place in longitude 30° 20′ W.

(ii) 6n 40 m 40 S PM at place in longitude 70° 45′ E.

(8 marks)

Or

20. Write short notes on :

(i) Global positioning system.

(ii) Slope and height correction.

(iii) Geodimeter.

(3 × 4 = 12 marks)

[5 × 12 = 60 marks]

G 1372

(Pages : 3)

Reg. No. Civil

Name.................................

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

ENGINEERING MATHEMATICS—III

(Common to all Branches)

[Improvement/Supplementary/2004 Admissions onwards]

Time : Three Hours

Maximum : 100 Marks

Answer **one** *full question from each module.*
Each full question carries 20 marks.
Use of Statistical tables is permitted.

Module I

1. (a) Find the general solution of $p^2 + 2py \cot x = y^2$. (5 marks)

   (b) Solve $xdx - xdy + \log xdx = 0$. (5 marks)

   (c) Find the orthogonal trajectory of the cardioids

   $$r = a(1 - \cos\theta).$$

   (10 marks)

Or

   (d) Solve $(D^2 + 2D + 1)\,y = 2 + x^2$. (5 marks)

   (e) Solve $(D^2 - 2D + 1)\,y = e^x \log x$ by the method of variation of parameters. (5 marks)

   (f) A bullet enters a board of 0.1 m thickness with a velocity of 200 m/s, pierces it and leaves the board with a velocity of 80 m/s. Assuming that the resistance offered by the board to the bullet is proportional to the square of its velocity, find the time taken by the bullet to pierce the board.

   (10 marks)

Module 2

2. (a) Solve $(pq - p - q)(z - px - qy) = pq$. (5 marks)

   (b) Solve by Charpit's method : $q + xp = p^2$. (8 marks)

   (c) Solve $\dfrac{\partial^2 z}{\partial x^2} - 7\dfrac{\partial^2 z}{\partial x \partial y} + 12\dfrac{\partial^2 z}{\partial y^2} = e^{x-y}$. (7 marks)

Or

Turn over

(d) Find the complete solution of

$$\frac{\partial^2 z}{\partial x^2} - 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = e^{(2x-3y)} + \sin(x-2y).$$

(10 marks)

(e) A bar with insulated sides is initially at temperature 0° C throughout. The end $x = 0$ is kept at 0° C and heat is suddenly applied at the end $x = l$ so that $\frac{\partial u}{\partial x} = A$ for $x = l$, where A is a constant. Find the temperature function $u(x, t)$.

(10 marks)

Module 3

3. (a) Using Fourier integrals, show that

$$\int_0^\infty \frac{\lambda \sin \lambda x}{k^2 + \lambda^2} d\lambda = \frac{\pi}{2} e^{-kx}, x > 0, k > 0$$

(8 marks)

(b) Solve the integral equation $\int_0^\infty F(x)\cos pxdx = \begin{cases} 1-p & 0 \le p \le 1 \\ 0, & p > 1 \end{cases}$ and hence deduce that $\int_0^\infty \frac{\sin t}{t^2} dt = \frac{\pi}{2}$.

(12 marks)

Or

(c) Using Parseval's identity, show that $\int_0^\infty \frac{dx}{(1+x^2)^2} = \frac{\pi}{4}$.

(10 marks)

(d) Find the Fourier cosine transform of $f(x) = \frac{1}{(1+x^2)}$ and hence derive Fourier sine transform of $\phi(x) = \frac{x}{1+x^2}$.

(10 marks)

Module 4

4. (a) In 800 families with 5 children each, how many families would be expected to have (i) 3 boys and 2 girls ; (ii) 2 boys and 3 girls ; (iii) no girl ; (iv) at the most two girls ? Assume probabilities for boys and girls to be equal.

(12 marks)

(b) Suppose a book of 585 pages contains 43 typographical errors. If these errors are randomly distributed throughout the book, what is the probability that 10 pages, selected at random, will be free from errors ?

(8 marks)

Or

(c) The probability that a man aged 40 years will die before reaching the age of 45 years is 0.018. Out of a group of 400 men, now aged 40 years, what is the probability that 2 men will die within the next 5 years ?

(10 marks)

(d) Fit a normal curve to the following distribution :

x :	2	4	6	8	10
f :	1	4	6	4	1

(10 marks)

Module 5

5. (a) In a simple sample of 600 men from a certain city, 400 are found smokers. In one of 900 men from another city, 450 are found to smoke. Do the data indicate that the cities are significantly different with respect to the prevalence of smoking among men ?

(10 marks)

(b) Tests for breaking strength were carried out on two lots of 5 and 9 steel wires respectively. The variance of first lot was 250 and that of the second was 482. Is there a significant difference in their variability ?

(10 marks)

Or

(c) Obtain the equation of the normal curve that may be fitted to the data and test the goodness of fit :

x :	4	6	8	10	12	14	16	18	20	22	24	Total
$f(x)$:	1	7	15	22	35	43	38	20	13	5	1	200

(10 marks)

(b) What is the probability that a correlation coefficient of 0.75 or less can arise in a sample of 30 from a normal population in which the true correlation coefficient is 0.9 ?

(10 marks)

[5 × 20 = 100 marks]

MODULE 5

19. Two independent sample sizes of 7 and 6 has 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)

Or

20. Records taken of the number of male and female births in 800 families having four children are as follows :

No. of male births	:	0	1	2	3	4
No. of female births	:	4	3	2	1	0
No. of families	:	32	178	290	236	94

Test whether the data are consistent with the hypothesis that the binomial law holds and the chance of male birth is equal to that of the female birth, namely, $p = q = \frac{1}{2}$.

(12 marks)

[5 × 12 = 60 marks]

G 1833 (Pages : 4) Reg. No..............................

Name..............................

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

EN 010 401—ENGINEERING MATHEMATICS—III

(Regular—2010 Admissions)

[Common to all Branches]

Time : Three Hours Maximum : 100 Marks

Part A

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

1. Expand $\pi x - x^2$ in a half range sine series in the interval $(0, \pi)$ upto the first three terms.

2. Find the Fourier Transform of $f(x) = \begin{cases} 1 \text{ for } |x| < 1 \\ 0 \text{ for } |x| > 1. \end{cases}$

3. Form the partial differential equation by eliminating the arbitrary functions from

$$f\left(x+y+z, x^2+y^2+z^2\right) = 0.$$

4. During war, one ship out of nine was sunk on an average in a certain voyage. What was the probability that exactly 3 out of a convoy of 6 ships would arrive safely ?

5. A random sample of 900 members has a mean 3.4 cm. Check if it can be reasonably regarded as a sample from a large population of mean 3.2 cm. and SD = 2.3 cm.

(5 × 3 = 15 marks)

Part B

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

6. Obtain Fourier series for the function

$$f(x) = \pi x, \quad 0 \le x \le 1$$
$$= \pi(2-x) \quad 1 \le x \le 2$$

7. Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$ and hence derive Fourier sine Transform of

$$\phi(x) = \frac{x}{1+x^2}$$

8. Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$, given that $\frac{\partial z}{\partial y} = -2\sin y$, when $x = 0$ and $z = 0$, when y is an odd multiple of $\frac{\pi}{2}$.

9. Assume that the probability of an individual coal-miner being killed in a mine accident during an year is $\frac{1}{2400}$. Use Poisson's distribution to calculate the probability that in a mine employing 200 miners, there will be at least one fatal accident in a year.

10. A coin was tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased.

(5 × 5 = 25 marks)

Part C

*Answer any **one** full question from each module.*
Each full question carries 12 marks.

Module 1

11. If $f(x) = x, \quad 0 < x < \pi/2$
$= \pi - x, \quad \pi/2 < x < \pi$, show that

(a) $f(x) = \frac{4}{\pi}\left[\sin x - \frac{\sin 3x}{3^2} + \frac{\sin 5x}{5^2} - \ldots\ldots\right]$. (5 marks)

(b) $f(x) = \frac{\pi}{4} - \frac{2}{\pi}\left[\frac{\cos 2x}{1^2} + \frac{\cos 6x}{3^2} + \frac{\cos 10x}{5^2} + \ldots\ldots\right]$. (7 marks)

Or

12. Obtain the first three coefficients in the Fourier Cosine series for y from the following data :

x :	0	1	2	3	4	5
y :	4	8	15	7	6	2

(12 marks)

Module 2

13. (a) Using Fourier integral representation, show that $\int_0^\infty \frac{\cos \omega x}{1+\omega^2}\, d\omega = \frac{\pi}{2} e^{-x} \,(x \geq 0)$. (6 marks)

(b) Solve for F (x) the integral equation $\int_0^\infty F(x) \sin tx \, dx = \begin{cases} 1, & 0 \leq t < 1 \\ 2, & 1 \leq t < 2 \\ 0, & t \geq 2. \end{cases}$ (6 marks)

14. (a) Using Parseval's identity, prove that $\int_0^\infty \frac{dt}{(a^2+t^2)(b^2+t^2)} = \frac{\pi}{2ab(a+b)}$. (5 marks)

(b) Solve the integral equation $\int_0^\infty F(x) \cos px = dx \begin{cases} 1-p, & 0 \leq p \leq 1 \\ 0, & p > 1 \end{cases}$ and hence deduce that $\int_0^\infty \frac{\sin^2 t}{t^2}\, dt = \frac{\pi}{2}$. (7 marks)

Module 3

15. Solve $2zx - px^2 - 2pxy + pq = 0$. (12 marks)

Or

16. Solve :

(a) $\left(D^2 - 2DD' + D'^2\right) z = e^{(2x+3y)}$. (6 marks)

(b) $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = 12xy$. (6 marks)

Module 4

17. A random variable X has the following probability distribution values of X :

x :	0	1	2	3	4	5	6	7	8	9
$p(x)$:	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$	$19a$

(a) Determine the value of a (3 marks)

(b) Find $P(X < 3), P(X \geq 3), P(2 \leq X < 5)$. (6 marks)

(c) What is the smallest value for which $P(X \leq x) > 0.5$? (3 marks)

Or

18. A sample of 100 button cells tested to find thé length of life, produced the following results : $\bar{x} = 12$ hours, $\sigma = 3$ hours. Assuming the data to be normally distributed, what percentage of button cells are expected to have life

(a) more than 15 hours ; (4 marks)

(b) less than 6 hours ; and (4 marks)

(c) between 10 and 14 hours ? (4 marks)

Turn over