

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) The bodies, A (weighs 50 N) and B (weighs 75 N), are connected by a chord and rest on smooth planes as shown in Figure-1. What is the angle θ if the bodies are in equilibrium? Find also the plane reactions and tension in the chord. (15)
- (b) A continuous string ABCDE as shown in Figure-2 passes over smooth pegs at B and D, 10 m on centers. To the ends of the string are attached the weights $W_A = 7$ N and $W_E = 5$ N. A 10 N weight is also attached at C and the three bodies are in equilibrium. Determine the distance 'a' and the angle α . (16 $\frac{2}{3}$)
- (c) A frame structure is shown in Figure-3, find external and internal support reactions. Also determine the force in member CE. (15)
2. (a) A load $F = 6000$ N acts on the boom CB as shown in Figure-4. (i) Determine the components of the reactions at E and G. (ii) What are the components of the force exerted on the pin C by the member CB? (23)
- (b) The three-hinged arch of Figure-5 supports the load as shown. (i) Determine the x and y components of the pin reactions at A, B and C. (ii) Also find the loads on all the members. (23 $\frac{2}{3}$)
3. (a) What is a catenary curve? Derive the equation for the length of a catenary. (15)
- (b) At the point of support of a catenary cable, the tension is 25% greater than the tension at the low point. The cable weighs 1 N/m, and the sag is 20 m. If the points of support are on the same level, find the span. What is the length of the cable? (15)
- (c) A homogeneous block A which weighs 600 pounds as shown in Figure-6. The frictional co-efficient between the surface and the block is 0.3 and at pulley the frictional co-efficient is 0.1. Determine the weight W for the impending motion downward. Will the block A tip over or slip? (16 $\frac{2}{3}$)
4. (a) Two electric cables AC and BC terminate on a pole and exert forces in a horizontal plane at C as shown in Figure-7. The tension in the cables AC and BC are 6000 N and 4000 N respectively. The guy cable makes an angle of 50° with the pole. Find the value of the angle θ , tension in the guy cable CD and force in the pole CE. (23 $\frac{2}{3}$)
- (b) A wedge B is inserted between a fixed surface A and a movable block C which weighs $W_c = 5000$ N as shown in Figure-8. For all slipping surfaces, let $f = 1/3$. If there is a horizontal resistance acting on C of $R = 8000$ N, what force Q will impose impending motion of C? (23)

WRE 101**SECTION – B**

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) State the theorems of Pappus and Guldinus. (5²/₃ +14)

Determine the location of the centroid of the area enclosed by arcs of parabolas $y^2 = 9x$ and $x^2 = 4y$.

- (b) For Figure 9, show that the equation of the trajectory OAB is, (12)

$$y = x \tan \beta - \frac{gx^2}{2u^2 \cos^2 \beta}$$

(c) The area A of Figure 10 is revolved about the y-axis to generate a homogeneous solid. Determine an expression for Moment of Inertia of Mass, I_y and corresponding K_y when the upper boundary line is $y = 8$. (15)

6. (a) What is Radius of Gyration? (2²/₃ +27)

Locate the Principal Axes through cg and hence, determine the least Radius of Gyration for the standard structural steel angle shown in Figure-11.

(b) In Figure 12, the fluid approaching the blade has absolute velocity of 1000 fps and specific weight of 0.5 lb/ft³. The area of the section of the stream is 1 inch², while $\theta = 60^\circ$ and $V_b = 500$ fps. Determine the horsepower being developed. (13+4)

7. (a) Locate the centroid of the wire shown in Figure 13. (12)

(b) Consider only rectilinear motion for the frictionless and weightless cord and pulleys of Figure 14. If W_a is 120 lb and W_b is 80 lb; determine the acceleration of body A and the tension in the cord T. (16)

(c) A 4' cylinder (Figure 15) has a central 2' groove about which is wound a weightless inextensible cord. This cord passes parallel to the 30° incline and over a smooth post D, then vertically downward to a body B which weighs 300 lb the cylinder weighs 500 lb and its radius of gyration about its axis C is $\bar{k} = 1$ ft. The frictional force is sufficient to cause the cylinder to roll. (i) If the system is released, in what direction does the motion occur? (ii) Find the tension in the cord and the velocity of the cylinder after B moves 15 ft from rest. (iii) What is the acceleration of the body B? (18²/₃)

Contd P/3

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8. (a) Find the height of the concrete dam (section is shown in Figure 16) where water is considered to be always at the top, XY. Here the overturning moment of water pressure is one-third of the moment of weight of the dam resisting overturning. Let the weights of water and concrete be 62.5 and 150 lb/ft³ respectively. (15²/₃)
- (b) In Figure 17, the bodies A and B are moving toward the right at 20 fps. Neglect the weight of the cable and pulley, and the friction at pulley. If $W_a = 600$ lb, $W_b = 225$ lb and $f_a = \frac{1}{3}$, what constant force P will bring the bodies to rest in a distance of 30 ft? (14)
- (c) A slender rod (Figure 18) is 3 ft long and weighs 32.2 lb. While it is hung from a fixed, smooth pivot and at rest; it is struck at point G at a distance of 30 inch from the pivot point by B. Object B weighs 2 lb and has a velocity of 25 fps in horizontal direction. If the mass center of A reaches a maximum height of 2.11 inch (measured from its initial position); find the coefficient of restitution. (17)
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NO.	QUESTIONS	MARKS
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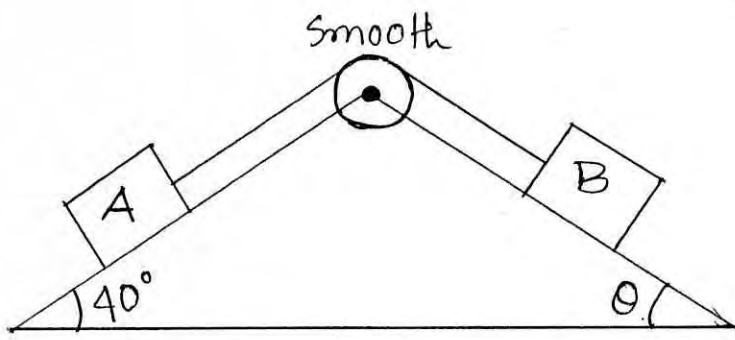


Figure-1 for Q.1(a)

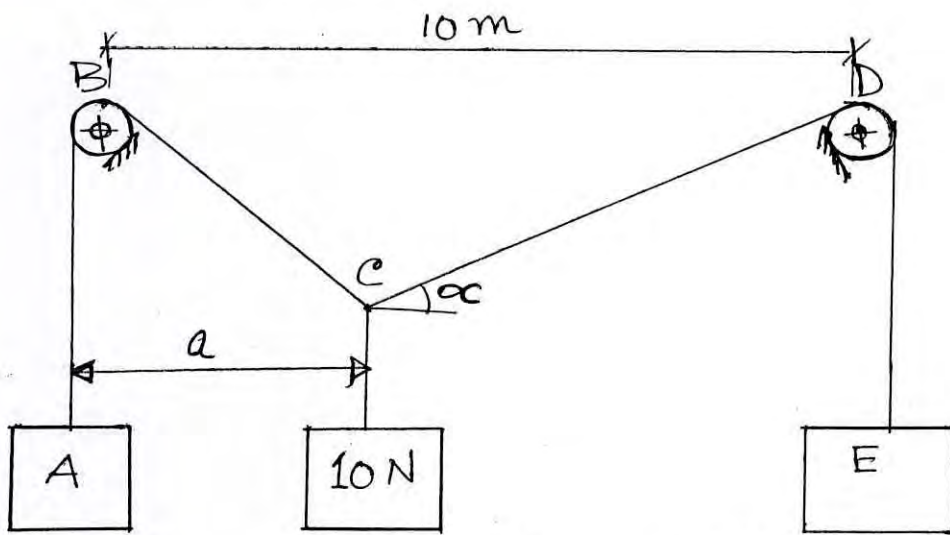


Figure-2 for Q.1(b)

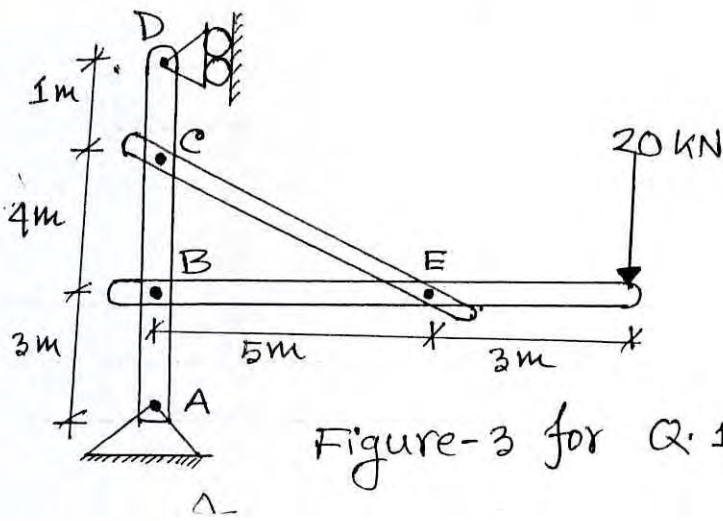
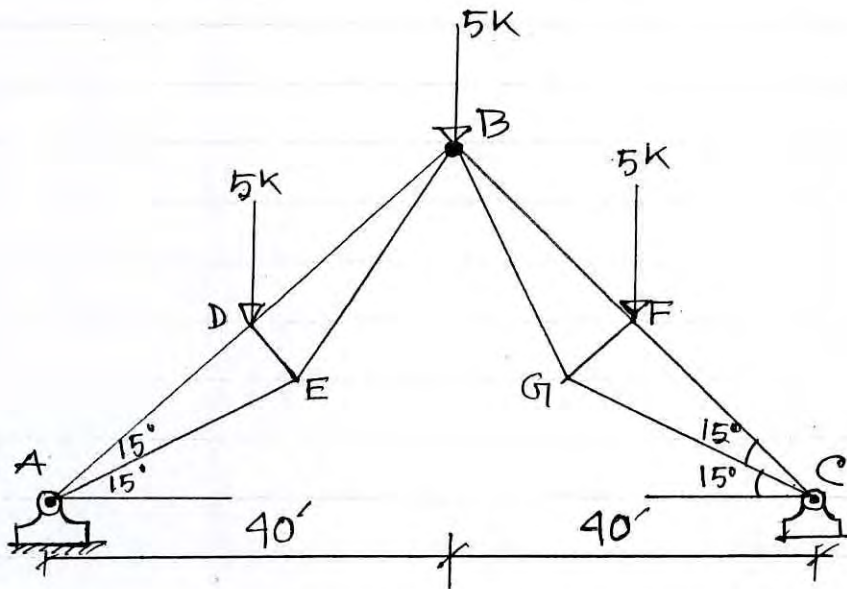
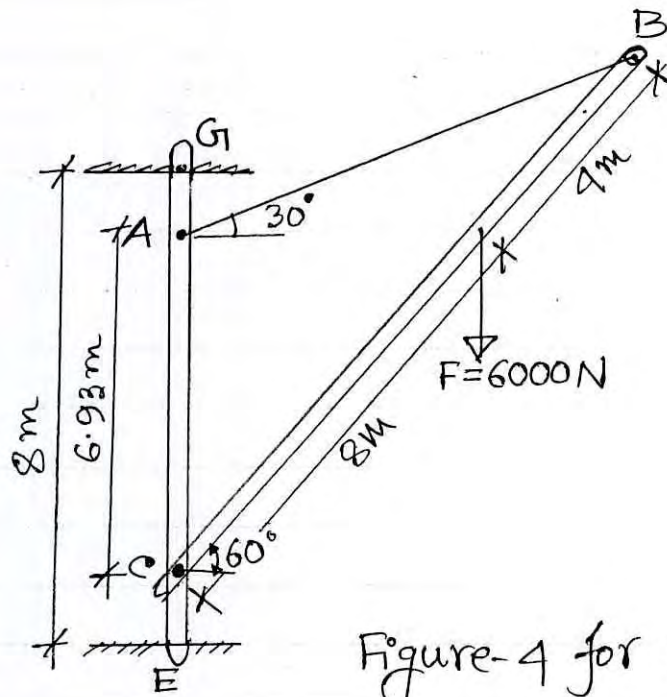


Figure-3 for Q.1(c)



NO.	QUESTIONS	MARKS
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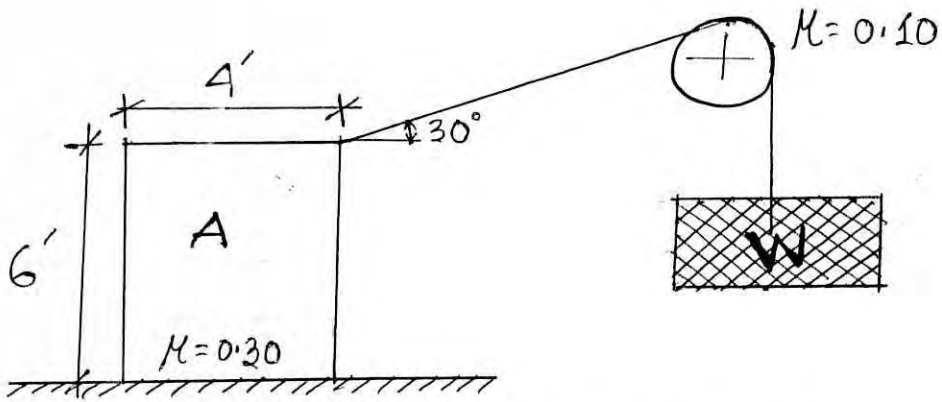


Figure-6 for Q. 3 (c)

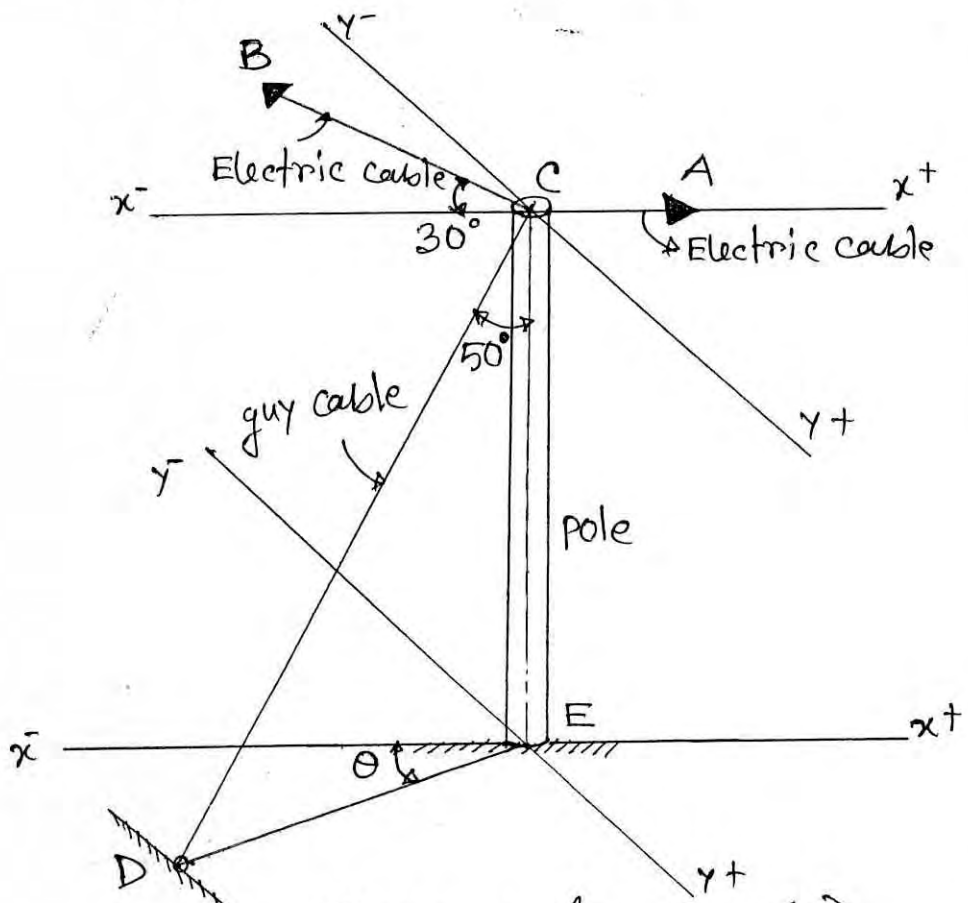


Figure-7 for Q. 4 (a)

NO.	QUESTIONS	MARKS
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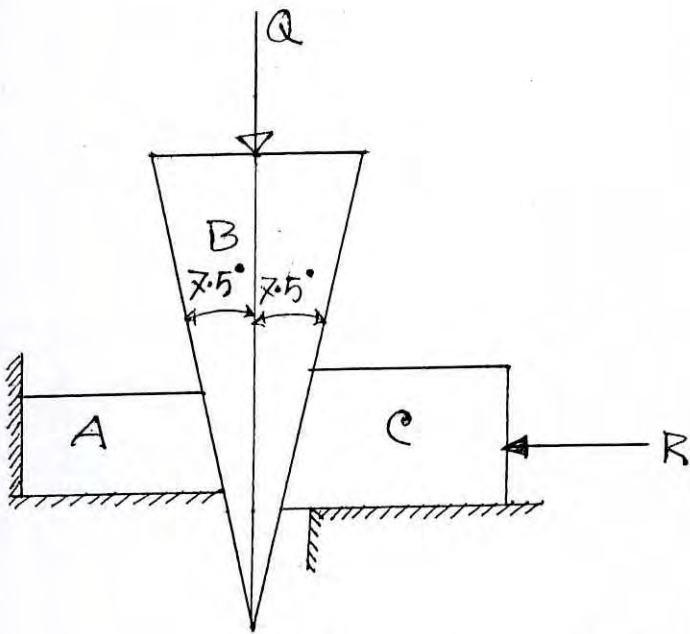


Figure- 8 for Q. 4 (b)

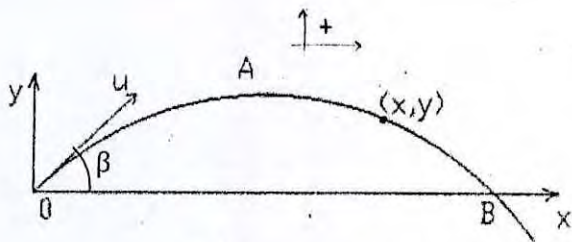


Figure 9 for Q. no. 5 (b)

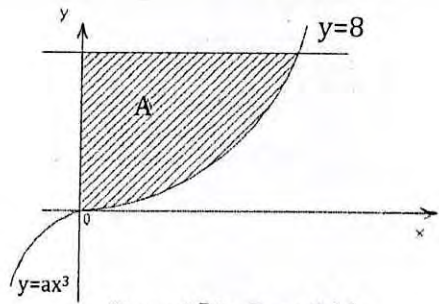


Figure 10 for Q. no. 5 (c)

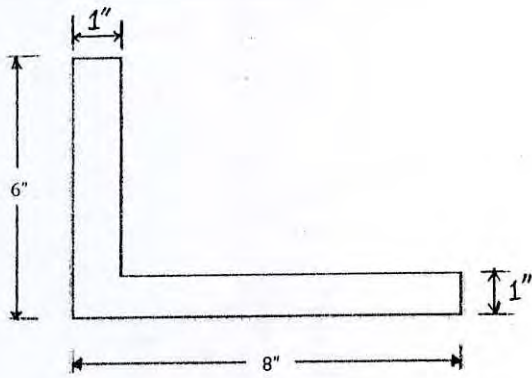


Figure 11 for Q. no. 6 (b)

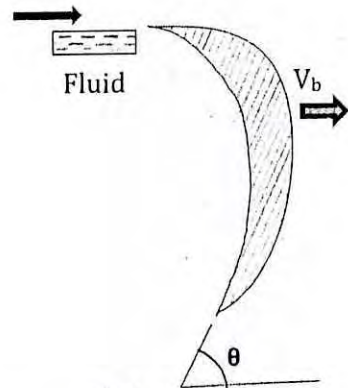


Figure 12 for Q. no. 6 (c)

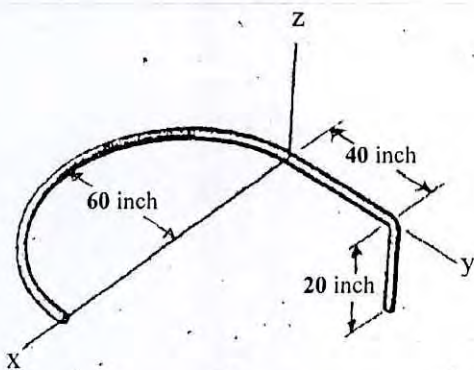


Figure 13 for Q. no. 7 (a)

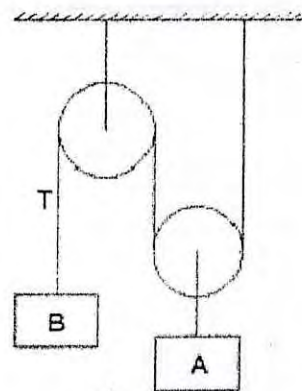


Figure 14 for Q. no. 7 (b)

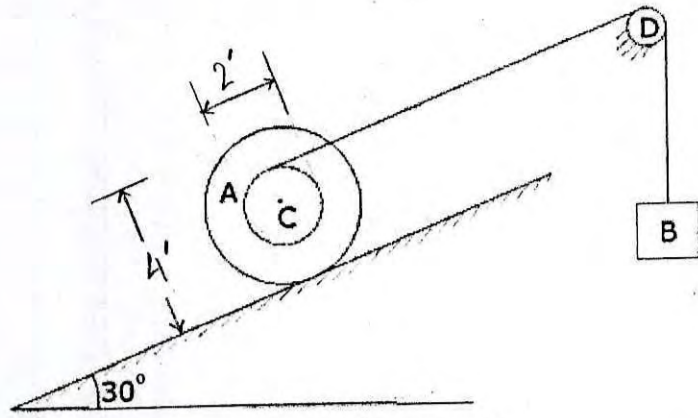


Figure 16 for Q. no. 7 (c)

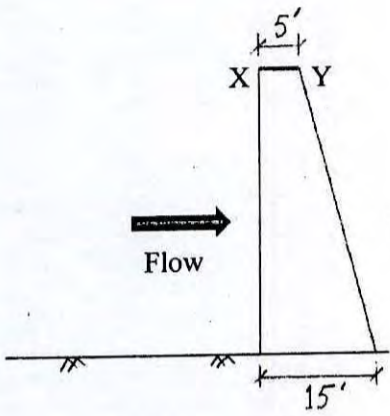


Figure 17 for Q. no. 8 (a)

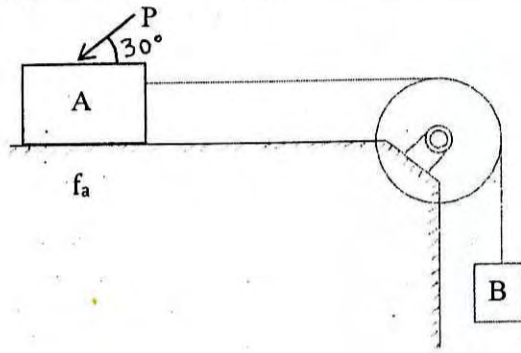


Figure 18 for Q. no. 8 (b)

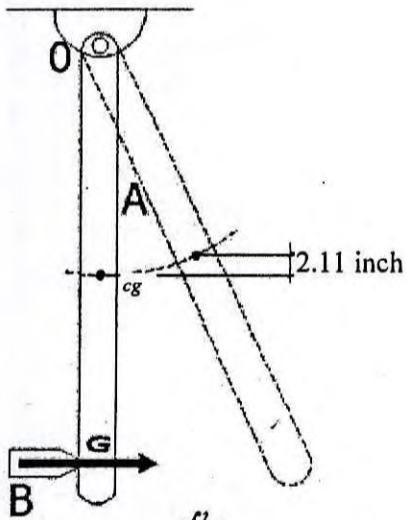


Figure 19 for Q. no. 8 (c)

SECTION – AThere are **FOUR** questions in this section. Answer any **THREE**.

Symbols used have their usual meaning.

1. (a) A function
- $f(x)$
- is defined as follows:
- (15)

$$f(x) = \begin{cases} 4 + x^2 & \text{when } 0 < x \leq 4 \\ 4 & \text{when } -1 \leq x \leq 0 \\ 1 + x & \text{when } -4 \leq x < -1 \end{cases}$$

Discuss the continuity of $f(x)$ at $x = -1$ and the differentiability of $f(x)$ at $x = 0$. Also sketch the graph of $f(x)$.

(b) Evaluate the following:

(i) $\lim_{x \rightarrow 0} (\cos x)^{\cos ec^2 x}$. (8)

(ii) $\lim_{x \rightarrow 0} \left[\frac{1}{x^2} - \frac{1}{\sin^2 x} \right]$. (12)

2. (a) Utilize Leibnitz's theorem to find the value of
- (18)

$$(1 + x^2)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 - m^2)y_n, \text{ if } y = \left[x + \sqrt{1 + x^2} \right]^m.$$

Also find the value of y_n at $x = 0$.(b) Define homogeneous function. If $u = x/r^3$ and $r^2 = x^2 + y^2 + z^2$, then find the value of $u_{xx} + u_{yy} + u_{zz}$. (17)

3. (a) State Lagrange's and Cauchy's Mean value theorem. In the Mean value theorem

$$f(h) = f(0) + h f'(0) + \frac{h^2}{2!} f''(\theta h), 0 < \theta < 1, \text{ find } \theta \text{ when } h = 7 \text{ and } f(x) = \frac{1}{1+x}. \quad (18)$$

(b) Find the radius and height of the right circular cylinder of largest volume that can be inscribed in a sphere with radius 6 inches. (17)

4. (a) Show that in the curve
- $a^2 y^5 = k(bx + c)^4$
- , the cube of the subtangent varies as the fifth power of the subnormal.
- (15)

(b) Find the pedal equation of the cardioid $r = a(1 - \cos\theta)$. (10)(c) Find the radius of curvature of the curve $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$. (10)

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SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. Workout the following integrals: (10+12+13)

(i) $\int \sqrt{\frac{2x+1}{3x+2}} dx$ (ii) $\int \frac{x}{1+\sin x} dx$ (iii) $\int \frac{2}{(2-x)^2} \sqrt[3]{\frac{2-x}{2+x}} dx$

6. (a) Find a reduction formula for $I_n = \int (\log x)^n dx$. (11)

(b) Evaluate the following integrals: (12+12)

(i) $\int_0^{\pi/2} \frac{\sin^2 x}{1+\sin x \cos x} dx$ (ii) $\int_0^{\pi/2} \log(\tan \theta + \cot \theta) d\theta$

7. (a) Evaluate the following improper integrals: (10+10)

(i) $\int_0^{\infty} \frac{x}{(1+x)^3} dx$ (ii) $\int_0^{\infty} e^{-ax} \cos bx dx ; a > 0$

(b) Define Beta function and Gamma function. Show that $\beta(m, n) = \frac{\Gamma(m) \Gamma(n)}{\Gamma(m+n)}$ and derive

a formula for evaluating the integral $\int_0^{\pi/2} \sin^m \theta \cos^n \theta d\theta$. Hence evaluate (15)

$$\int_0^{\pi/6} \cos^4 3\theta \sin^2 6\theta d\theta$$

8. (a) Draw a graph of the curve (15)

$$(a-x)y^2 = (a+x)x^2$$

and find the total area enclosed within the curve and its asymptote.

(b) Draw a graph of $x = 2y - y^2$. Show the area enclosed by the curve and the y-axis in graph. Then find the volume of the solid generated by revolving the above area around the y-axis. (10)

(c) Evaluate the following multiple integral: (10)

$$\int_0^{\sqrt{5}} \int_0^{\sqrt{9-x^2}} \int_0^{\sqrt{(9-x^2-y^2)^2}} \sqrt[3]{9-x^2-y^2} x dz dy dx$$

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Describe the principle, construction and working method of a thermoelectric thermometer. (23)
- (b) Write down the relative merits of thermoelectric and platinum resistance methods of measuring temperature. (4)
- (c) If the platinum temperature corresponding to 60°C on the gas scale is 60.25°C, what will be the temperature on the platinum scale corresponding to 120°C on the gas scale? (8)

2. (a) State the 2nd and 3rd law of thermodynamics in terms of entropy. Deduce the efficiency of the Carnot Engine using T-S diagram. (8)
- (b) Obtain expression for the change in entropy of a gas when it is heated in a general manner. (15)
- (c) 50 gm of water at 0°C is mixed with an equal mass of water at 80°C. Calculate the resultant increase in entropy. (12)

3. (a) Why Maxwell's thermodynamic relations are important. (3)
- (b) Derive Maxwell thermodynamic relations. (24)
- (c) Prove that $c_p - c_v = T \left(\frac{\partial P}{\partial T} \right)_V \left(\frac{\partial V}{\partial T} \right)_P$, where the symbols have their usual meanings. (8)

4. (a) What is Fraunhofer class of diffraction? (3)
- (b) (i) Derive an expression for the intensity at a point on a screen due to Fraunhofer type of diffraction at double slits. (20)
- (ii) What do you mean by missing order spectrum? For diffraction at double slits, determine the condition for missing order when the slit-width is equal to the width of the obstacle. (7)
- (c) In a diffraction phenomenon using double-slit, calculate the distance between central maximum and first minimum of the fringe when a light of wavelength 500 nm, slit-width of 0.02 mm, spacing between two slits of 0.01 mm and slits to screen distance of 100 cm are used. (5)

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SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) What are coherent sources and how are they obtained in practice? (6)
- (b) (i) Light from an extended source falls obliquely on a thin film of an optical medium. Find an expression for the effective path difference between a part of ray reflected externally at the first surface and the part which suffers one reflection internally at the other surface of the film. (23)
- (ii) Why does a film appears black in reflected light when it is extremely thin?
- (c) If a parallel beam of light of wavelength 589.3 nm is incident at an angle of 45° on a glass plate of refractive index 1.5, calculate the smallest thickness of the glass plate for a fringe of minimum intensity. (6)
6. (a) What is meant by polarization of light and what are the process by which light can be polarized? (5)
- (b) (i) Using the elastic theory of Fresnel's law of reflection, derive the expression of perpendicularly polarized amplitude transmitted coefficient in terms of the angle of incidence and the angle of refraction. (24)
- (ii) What is Brewster's law?
- (c) An unpolarized light ray is partly reflected and partly refracted from the surface of a glass. The reflected light is found to be completely plane polarized and the refracted ray makes an angle of 56.4° with the interface. Find the refractive index of the material of glass. (6)
7. (a) What are Lissajous figures? Find the resultant of two simple harmonic motion of equal periods and same amplitude when they act at right angles to one another and hence discuss the case when the phase difference between them is $\frac{\pi}{2}$. (15)
- (b) If the mass of a spring, m_s , is not negligible but is small compared to the mass m of the object suspended from it, then show that the period of motion is $T = 2\pi \sqrt{\left(\frac{m + m_s}{3}\right) / k}$, where k = spring constant. (12)
- (c) A 4 kg block is suspended from a spring of force constant 500 N/m. A 0.05 kg bullet is fired into the block from below with a speed of 150 m/s and comes to rest in the block. If the system executes simple harmonic motion (SHM), (8)
- (i) Find the amplitude of the resulting SHM and
- (ii) What fraction of the original kinetic energy of the bullet appears as mechanical energy in the oscillator?

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8. (a) What are the acoustic requirements of a good auditorium? (4)
- (b) Derive Sabine's reverberation formula for growth and decay of sound intensity in a room. (22)
- (c) Calculate the reverberation time of a class room of width 10 m, length 20 m and height 3 m. The ceiling of the room is acoustic, the walls are plaster, the floor is concrete and there are 60 students in the room. Given that the speed of sound is 340 m/s and the sound absorption coefficients for acoustic ceiling, plaster and concrete are 0.60, 0.03 and 0.02 respectively. Absorbing power of each student is 0.5 Sabine. (9)
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SECTION – A

There are **FOUR** questions in this section. Answer **Q. No. 1** and any **TWO** from the rest.

1. (a) Read the following passage carefully and answer the questions that follow: (30)

Education ought to teach us how to be in love always and what to be in love with. The great things of history have been done by the great lovers, saints, men of science and artists, and the problem of civilization is to give every man a chance of being a saint, a man of science or an artist. But the problem cannot be solved unless men desire to be saints, man of science or the artists, if not of the saint as a being with peculiar gifts, not as one who exercise more precisely and incessantly perhaps activities which we all ought to exercise. It is commonplace now that art has ebbed away out of our ordinary life, out of all things we use and that it is practised no longer by workmen but only by a few painters and sculptors. That has happened because we no longer recognize the aesthetic activity as an activity of the spirit and common to all men. We do not know that when a man makes anything he ought to make it beautiful for the sake of doing so and that when man buys anything he ought to demand beauty in it for the sake of that beauty. We think of beauty if we think of it at all as mere source of pleasure and therefore it means to us an ornament added to things for which we can pay extra as we choose. But beauty is not an ornament to life or the life or the things made by men. It is an essential part of both.

Questions:

- (i) What should be the objective of education?
- (ii) What is the problem of civilization?
- (iii) How could you define beauty according to the passage?
- (iv) According to the passage what is the commonplace view about art?
- (v) What message does the author want to convey through this passage?
- (v) Give the meaning of the following words/phrase as used in the passage:

incessantly, commonplace, ebb away, aesthetic, recognize

2. (a) Suppose you are the chief engineer of a firm. You have purchased some equipment for your organisation. After receiving the delivery of the equipment you find some pieces of equipment are sub-standard. Now write a letter of complaint to the supply of those products. (10)
- (b) Write phonetic transcription of the following words: (Any five) (10)
- abstract, say, world, stone, basic, vat

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3. (a) Write a dialogue between two resident students of BUET about the unhygienic condition of the footpaths in Palashi. (10)
- (b) Write a short essay on any one of the following topics: (10)
- (i) Green Earth Fresh Heart
 - (ii) Online Education
 - (iii) Modern Man and Alienation
4. (a) Transform the following sentences as directed: (Any five) (10)
- (i) Be diligent and you will succeed. (Complex)
 - (ii) I must finish the letter now to catch the post. (Compound)
 - (iii) Being a cripple, he cannot ride a horse. (Compound)
 - (iv) Father desired that I must go. (Simple)
 - (v) His failure is almost certain. (Complex)
 - (vi) Resign or you will be dismissed. (Simple)
- (b) Write short notes on any two of the following: (10)
- (i) The Diphthongs
 - (ii) Components of a formal report
 - (iii) Process of Communication

SECTION – B

There are **FOUR** questions in this section. Answer **Q. No. 5** and any **TWO** from the rest.

5. (a) Explain with reference to the context any one of the following: (8)
- (i) "We were so moved that we all wept for happiness."
 - (ii) "All these things, which another woman of her station would not have noticed, tortured and angered her."
- (b) Answer any one of the following: (10)
- (i) Trace the changes in the character of the Lawyer during the fifteen years of this confinement in "The Bet".
 - (ii) How did the loss of the necklace change Matilda's life?
- (c) Answer any three of the following: (12)
- (i) Why did Circe fall at Odysseus' knees and burst into tears?
 - (ii) How is Matilda received at the party?
 - (iii) How did Circe turn Eurylochus' men into pigs?
 - (iv) Give a brief description of the party arranged by the banker.
 - (v) When and does Matilda come to know about the loss of the necklace?

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6. Recast and correct any ten of the following sentences: (20)
- (i) You should take the medicine every alternative day.
 - (ii) We were not impressed by him speaking softly.
 - (iii) I enjoyed during the holidays.
 - (iv) Erosion is where the soil is washed away.
 - (v) She could not think up an answer.
 - (vi) They walked further down the street.
 - (vii) Needless to tell, mother was not pleased.
 - (viii) He is sick of all these types of reading.
 - (ix) If I were him, I should not accept the post.
 - (x) The jury is arguing among itself.
 - (xi) The plane began to loose altitude when the motor began to miss and sputter.
 - (xii) Prior to the rainy season, they repaired the road.

7. (a) Write down meaning of any ten of the following words: (10)
- Astray, Benchmark, Castigate, Drench, Flounder, Hubbub, Impromptu, Lustrous, Munch, Outrageous, Posterity, Ratify

- (b) Make sentences with any ten of the following words: (10)
- Acrid, Blithe, Culpable, Denigrate, Entice, Flicker, Gust, Incisive, Malign, Obstinate, Straddle, Prevalent

8. Write a précis of the following passage with a suitable title: (20)

Littler by little, belated efforts are being made to address the humanitarian crisis of thousands of people from Bangladesh and Myanmar stranded on the high seas by human traffickers. We hope the global media attention which has been attracted will help highlight the plight of the Rohingya people. Most of the migrants at sea, presently, are from Myanmar's Rohingya minority. It is the deprivation of their rights as citizens and persecution which has pushed them into the hands of smugglers. Bangladesh has a major interest in this matter as it has long hosted some 300,000 people who have fled communal violence and discrimination in Myanmar. While many Bangladeshi citizens have also been trapped on these boats as illegal migrants, and the Bangladesh government can directly help repatriate them and work with other government to fight people traffickers, we need international community's help in addressing Myanmar's policy towards its Rohingya citizens. The world must unite to put more pressure on the Myanmar government to end its discriminatory policies and allow for the safe return of Rohingya refugees to their homeland. Democratic politicians within Myanmar, such as Aung San Suu Kyi, must show more leadership in demanding that the Myanmar government reverses its apartheid-like policies. The Rohingyas have lived as one of Myanmar's many ethnic communities for centuries. It is unconscionable that the Myanmar government should be pressing with discriminatory policies that drive many Rohingyas to flee their homeland. All countries in our region should support efforts to end the injustice suffered by the Rohingyas.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2014-2015

Sub : **CHEM 115** (Chemistry I)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – AThere are **FOUR** questions in this section. Answer any **THREE**.

- Explain Heisenberg's uncertainty principle. Show that this principle is valid only for small particles and not for large particles. (3+6=9)
 - Derive an expression for the energy and radius of the n^{th} orbit of H-atom. (6+6=12)
 - What do you understand by electron probability function? Explain radial probability distribution curve for 2s electron. (3+6=9)
 - The threshold frequency of cesium metal is 4.55×10^4 Hz. What is the kinetic energy of an electron ejected from cesium by shining light with frequency 6.00×10^{14} Hz on the metal. (5)
- What is screening constant? How does it affect the value at ionisation potential of an element? (3+7=10)
 - Define atomic radius. Arrange the following ions in the increasing order of their size. Justify your answer with reasons: N^{3-} , O_2^- , F^- , C^{4-} . (3+2+4=9)
 - What is inert pair effect? Discuss this effect with special reference to IVA group elements. (3+7=10)
 - Draw Lewis structures of BCl_3 , NH_3 and ICl_3 and show their geometry. (6)
- Which factors must consider for writing an equilibrium constant expression for a reaction? Explain these factors with example. (3+12=15)
 - Define thermodynamic equilibrium constant and show that, $\Delta G^0 = -RT \ln K_a$. The symbols have their usual meaning. (2+8=10)
 - Describe how you would prepare a phosphate buffer with a pH of about 7.45. Three ionization constants of H_3PO_4 are given as: (10)

$$\text{H}_3\text{PO}_4(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{H}_2\text{PO}_4^-(\text{aq}); K_{a1} = 7.5 \times 10^{-3}$$

$$\text{H}_2\text{PO}_4^-(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{HPO}_4^{2-}(\text{aq}); K_{a2} = 6.2 \times 10^{-8}$$

$$\text{HPO}_4^{2-}(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{PO}_4^{3-}(\text{aq}); K_{a3} = 4.8 \times 10^{-13}$$
- Write the reaction of water with some metals, nonmetals and oxides. (9)
 - What is permanent hardness of water? Describe the boiling and liming process for softening of hard water. (8)

Contd P/2

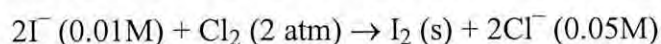
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- (c) Draw molecular orbital configurations of the species O_2 , O_2^+ , O_2^- and O_2^{2-} and calculate their bond order. Explain why O_2 is paramagnetic whereas O_2^{2-} is diamagnetic. (4+4+2=10)
- (d) What is hybridisation? Discuss sp^3d^2 hybridisation with suitable example. (2+6=8)

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Why is the freezing point of a solution of a nonvolatile solute higher than that of the pure solvent. (4)
- (b) Derive an expression relating the freezing point depression of a solution with the mole fraction of the solute. (14)
- (c) Establish the relation between osmotic pressure of the solution and the molar mass of the solute. (9)
- (d) Calculate the osmotic pressure of a 5% solution of cane sugar at 288 K [Molar mass of cane sugar = 342]. (8)
6. (a) What are sols? Describe two methods for the purification of sols. (15)
- (b) Define electro-osmosis. Describe Hardy-Schulze rule. (10)
- (c) A solution containing 0.2 mg/L of a suspended material whose density is 2.2 g/cm^3 is observed under the microscope in a field view of 0.04 mm in diameter and 0.03 mm in depth. On the average the field view was found to contain 8.5 particles. Assuming them to be spherical, calculate the diameter of the particles. (10)
7. (a) Define heat of reaction. Discuss the effect of temperature on heat of reaction. (9)
- (b) Define cement. Show the flow chart and briefly describe the manufacturing process of Portland cement. (11)
- (c) Derive Nerst equation. How can this equation be used for the determination of pH of a test solution? (15)
8. (a) Describe the working principle of a lead storage battery during charging and discharging. (10)
- (b) Describe rust formation mechanism of iron metal and cathodic protection process to save it. (13)
- (c) Find the ΔG and K_c for the following redox reaction at 25°C . (12)



given that $E_{I_2/2I^-}^0 = +0.54 \text{ V}$ and $E_{Cl_2/2Cl^-}^0 = +1.36 \text{ V}$

The symbols have their usual meaning.
