

Khulna University of Engineering & Technology
 Department of Building Engineering & Construction Management
 B. Sc. Engineering 1st Year 2nd Term Regular Examination, 2015
CE 1201
 (Engineering Mechanics)

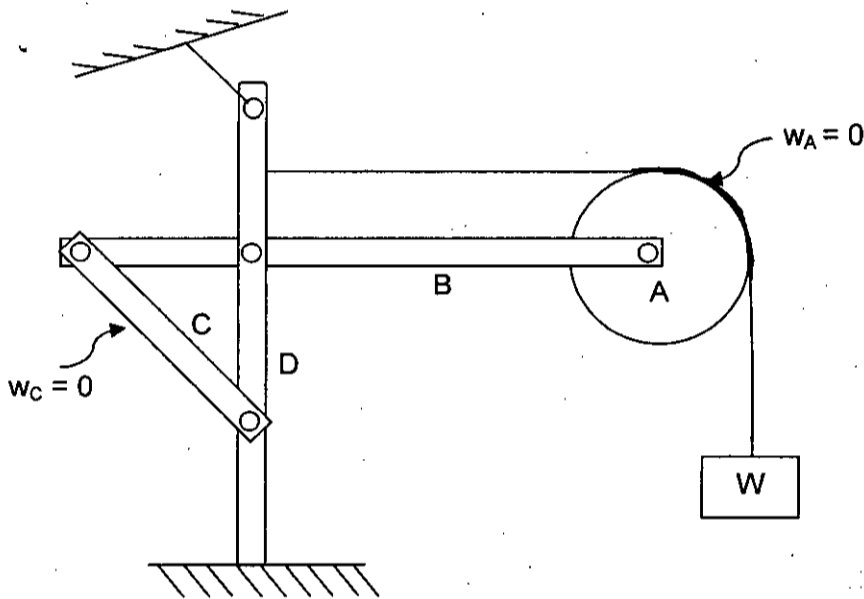
Full Marks: 210

Time: 3 hrs

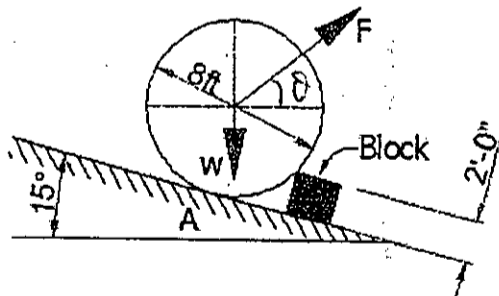
- N.B.**
- i) Answer any three questions from each section in separate script.
 - ii) Figures in the right margin indicate full marks.
 - iii) Assume reasonable value for any missing data.
 - iv) All figures are not drawn in scale.

Section – A

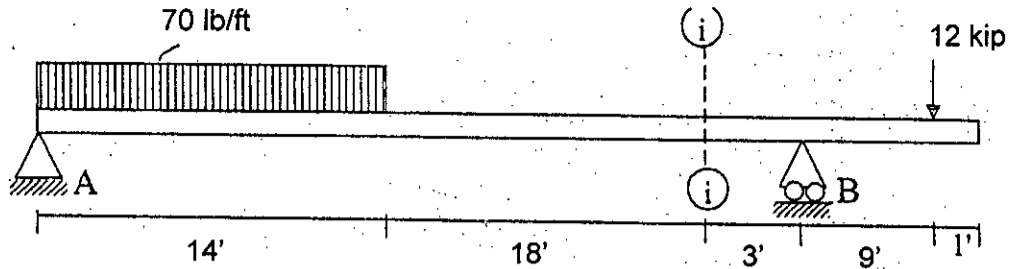
1. (a) Define free body diagram. Draw free body diagram of different members in the following figure. (15)



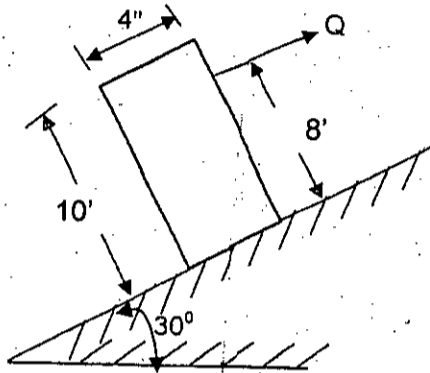
- (b) The wheel shown in the figure given below is on the point of rolling over the block. If $W = 1000$ lb, what is the magnitude and sense of the least force F that will produce this condition. (20)



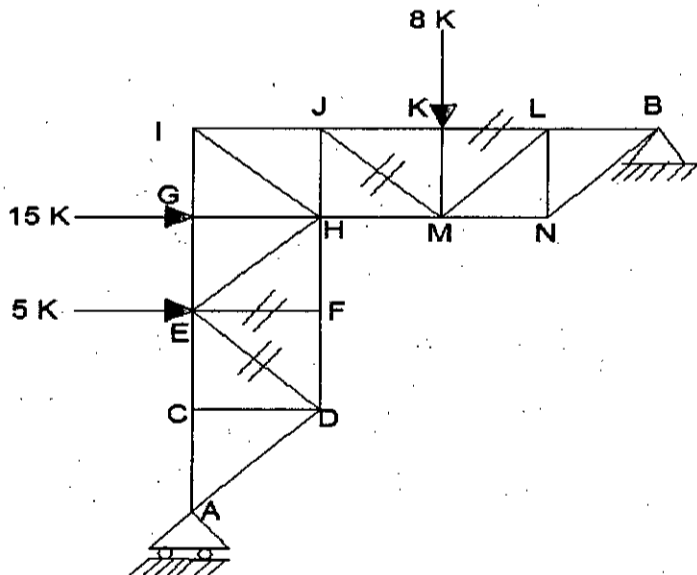
2. (a) Write down the conditions for which a flexible chord is curved to form either a parabola or a catenary? For the catenary prove that $y = k \cosh\left(\frac{x}{k}\right)$, where the symbols bear their usual meanings. (15)
- (b) A beam is loaded as shown in figure below. Self-weight of the beam is 29 lb/ft. Find the reactions at the supports and also calculate the shear force and bending moment at section (i) - (i). (20)



3. (a) Distinguish between angle of friction and angle of repose. (05)
- (b) For belt friction prove that $T_1 = T_2 e^{f\theta}$, where the symbols have their usual meanings. (15)
- (c) If a body "A" is relatively tall and slender, it may tip over instead of sliding. If the weight of the body is 105 lb and $f = 0.35$ and the inclination of the plane is 30° with the horizontal shown in the figure below. Will the body slide or tip over when a gradually increasing force Q is applied to it? (15)



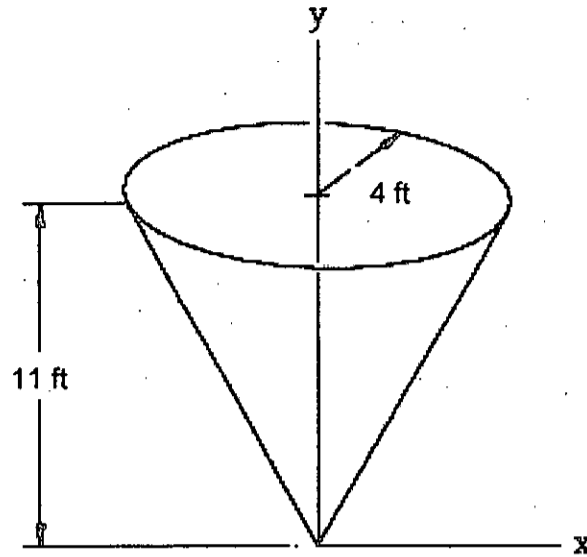
4. (a) Define truss couple and torque. State the assumptions for solving a truss system. (10)
- (b) Determining the reactions and forces of the members DE, EF, MJ and KL of the following truss. (25)



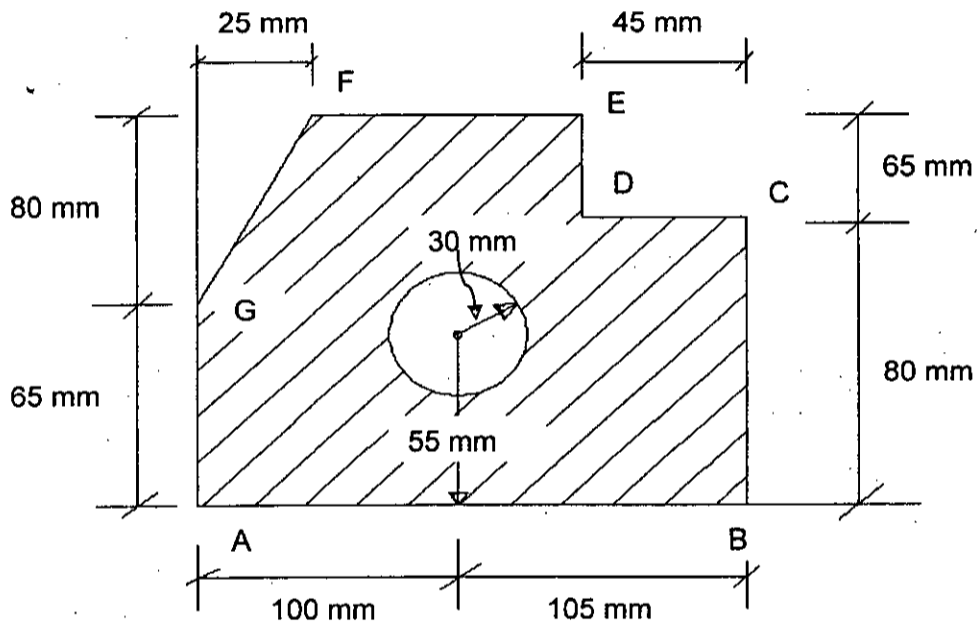
Section - B

5. (a) Define centroid. State the theorems of Pappus-Guldinus. Determine the amount of paint required to paint the inside and outside surfaces of the cone shaped monument, if one gallon of paint covers 305 ft^2 using Pappus- (15)

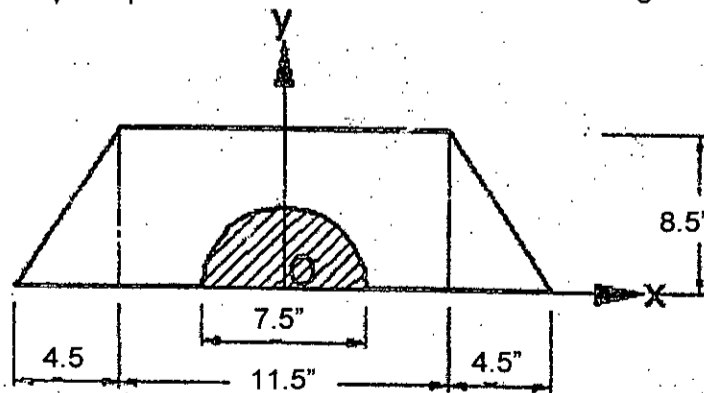
Guldinus's theorem.



- (b) Calculate \bar{x} and \bar{y} for the shaded area as shown in figure below. (20)

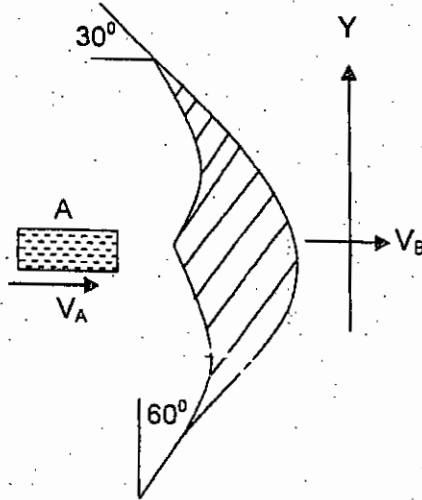


6. (a) Define moment of inertia and product of inertia. Prove $I = \bar{I} + Ad^2$, where the (15)
 symbols bear their usual meanings.
- (b) For the unshaded area of the following figure: (20)
 (i) Compute I_x and I_y .
 (ii) Determine the moment of inertia about a centroidal axis parallel to the x-axis.
 (iii) Determine I_y and polar moment of inertia of an axis through O.

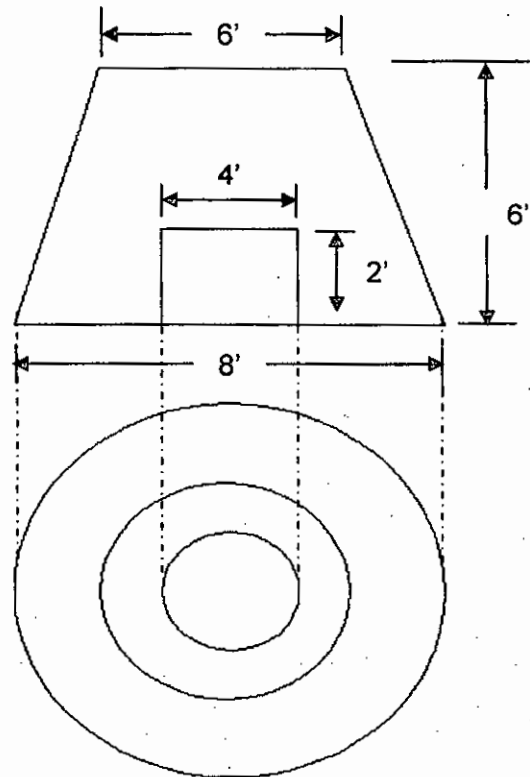


7. (a) State the principle of linear impulse and momentum. A jet of water A, whose (20)

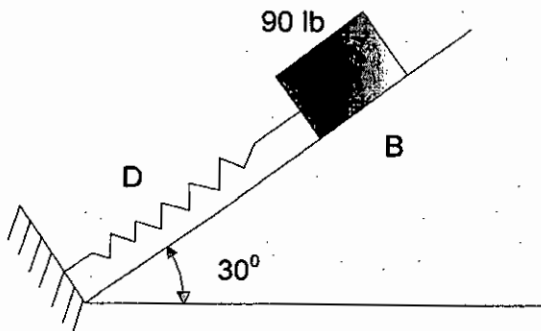
velocity is $V_A = 55$ fps, strikes a blade B, which is moving at $V_B = 22$ fps in the same direction as A, shown in figure. 7 lb/s of water strike the blade, half-passing without friction along the upper part and half-passing across the lower. What force in the y-direction is needed to prevent the movement of the blade in that direction? What is the horizontal thrust on the blade?



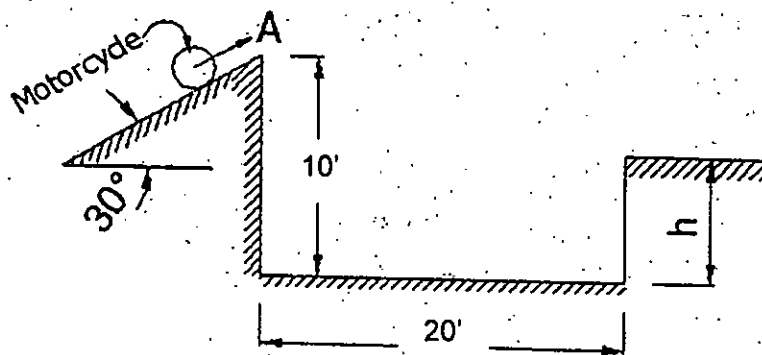
- (b) Find the moment of inertia of mass about the geometric axis of the cast-iron frustum of a cone as shown in figure, which has a short 4' X 2' cylindrical hole in the base. (15)



8. (a) A spring D, as shown in figure, whose scale is 30 lb/in, is compressed 12" against a fixed surface with a 90 lb body at the free end. Take $f = 0.2$ and $\theta = 30^\circ$. When it is released, the spring acts on the body until the free length is reached. How far up the incline from the point of release does the body go? During this moment, what is the maximum kinetic energy of B? (18)



- (b) A motorcycle stunt rider passes point A, in the following figure at a speed of 70 mph. What is the maximum value of "h", if the motorcycle is to jump the 20 ft ditch? (17)



Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 1st Year 2nd Term Regular Examination, 2015
CE 1213
(Building & Construction Materials)

Full Marks: 210

Time: 3 hrs

- N.B.** i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) What are the factors that affect the quality of good bricks? What are the constituents of good brick clay? State their functions. (12)
- (b) What are the harmful constituents of brick clay? Explain why they are termed harmful? (10)
- (c) What are the characteristics of good bricks? How can you identify good bricks in field? (08)
- (d) What are the uses of bricks in the field of building engineering? Why it is widely used in Bangladesh? (05)

2. (a) What is mortar? Name different types of mortar used in engineering constructions. (05)
- (b) State the functions of sand and surki in mortars. Enumerate the uses of mortars. (07)
- (c) Distinguish between mortar and plaster. What are the different types of plasters? Give specification of good plaster. (10)
- (d) What is pointing? Explain various types of pointing with neat sketches. (07)
- (e) Write short notes on: (06)
(a) Mosaic Plaster, (b) Sand Rubbing, (c) Plaster of Paris.

3. (a) Write down the assumptions behind the concrete mix design by ACI method. (06)
- (b) Explain the following terms: (i) Bleeding (ii) Segregation (iii) Creep of concrete. (09)
- (c) Design a concrete mix to suit the following data: (20)
Concrete is required to cast the foundation of a building which is exposed to severe atmosphere. The average cylinder compressive strength required is 280 kg/m^2 at 28 days. The coarse aggregate locally available is well graded having a maximum size of 20 mm and dry rodded bulk density is 1600 kg/m^3 . The specific gravity of fine aggregate and coarse aggregate are 2.64 and 2.68 respectively. Fineness modulus of fine aggregate is 2.80. Ordinary Portland cement of specific gravity 3.10 is used. A slump of 50 mm is required. Given,
(i) w/c ratio = 0.48 for 280 kg/m^2 cylinder compressive strength at 28 days.
(ii) Approximate mixing water = 160 kg/m^3 , for the known slump 50 mm and aggregate size 20 mm.
(iii) Volume of dry rodded coarse aggregate per unit volume of concrete = 0.60 m^3 for aggregate size 20 mm and FM of sand is 2.80.
(iv) Recommended average total air content = 5%.

(v) Moisture content of coarse and fine aggregate are 1% and 5% respectively.

4. (a) What is concrete? Describe the functions of aggregate in concrete. (07)
(b) Define workability of concrete. Write down the name of the factors governing workability of concrete. (13)
(c) Write explanatory notes on the following: (15)
(i) Precast concrete (ii) Prestressed concrete (iii) Lightweight concrete (iv) Swelling of concrete (v) Laitance.

Section – B

5. (a) Why the study of building and construction materials is important in construction point of view? (06)
(b) Why cement is more used as a binding material than lime? (06)
(c) Define the following terms: (i) Hydration of cement (ii) Fineness of cement (iii) Soundness of cement (iv) Quick lime (v) Slaking (vi) Hydraulicity. (15)
(d) What is ferrocement? What are the advantages of ferrocement? (08)
6. (a) What is the difference between false setting and flash setting? Write a short description on bulking of sand. (07)
(b) Define the term 'grading'. "One should prefer well graded sample of aggregate to a uniformly graded one" - Justify. (08)
(c) What is fineness modulus? Sieve analysis of two different varieties of sands, one from Sylhet and other from Kushtia are given below. Weight of each sample is 500 grams. Calculate the amount of each variety of sand in a mixture of 10 kg to obtain the combined fineness modulus of 2.50. (15)

Sieve Size	Sylhet Sand Weight Retained (grams)	Kushtia Sand Weight Retained (grams)
No. 4	21	3
No. 8	58	11
No. 10	25	15
No. 16	80	20
No. 30	111	52
No. 40	15	112
No. 50	100	150
No. 100	90	137
No. 200	12	8

- (d) Write down the properties of a good sand. (05)
7. (a) What do you mean by seasoning of timber? Describe any two methods of seasoning of timber. (10)
(b) What are the advantages of timber over other construction materials? (06)
(c) Write down the properties of the following materials: (i) Rubber (ii) Glass (iii) Bitumen. (12)
(d) What is the difference between destructive test and non-destructive test? For (07)

what information the impact test, fatigue test and creep test are carried out in the laboratory?

8. (a) Write short notes on: (i) Geotextiles (ii) FRP (iii) Distemper (iv) White wash (v) Color wash (vi) Slacking. (15)
- (b) What is corrosion? How to prevent corrosion of steel in concrete? (07)
- (c) What is admixture? What are the benefits of using admixture in concrete? (07)
- (d) Write down the characteristics of a good paint. (06)
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Khulna University of Engineering & Technology
 Department of Building Engineering & Construction Management
 B. Sc. Engineering 1st Year 2nd Term Regular Examination, 2015
Math 1223
 (Mathematics - II)

Full Marks: 210

Time: 3 hrs

- N.B.** i) Answer any three questions from each section in separate script.
 ii) Figures in the right margin indicate full marks.

Section – A

1. (a) Find the Cartesian and Spherical co-ordinates for a point, whose cylindrical co-ordinates are $(3, \frac{2\pi}{3}, 4)$. (11)
- (b) Define direction cosines of a line. Find the value of the angle θ between any two diagonals of a cube. (12)
- (c) Find the symmetrical form of the equation of a line $x + y + z + 1 = 0 = 4x + y - 2z + 2$ and find its direction cosines. (12)

2. (a) Examine the four points $(0, 1, 2)$, $(3, 0, 1)$, $(4, 3, 6)$ and $(2, 3, 2)$ are coplaner or not. If they are non-coplaner, then find the volume of the tetrahedron, whose vertices are those four points. (12)
- (b) Find the condition for which the two lines $x = ay + b$, $z = cy + d$ and $x = a'y + b'$, $z = c'y + d'$ are mutually perpendicular each other. (11)
- (c) Find the distance of the point $(2, -4, 5)$ from the plane $2x + 5y + 6z = 11$ measured parallel to the line $\frac{x}{2} = \frac{y}{1} = \frac{z}{-2}$. (12)

3. (a) Find the length and equation of the shortest distance between the lines $\frac{x-1}{2} = \frac{y-1}{3} = \frac{z-4}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$. (14)
- (b) Find the angle between the line $\frac{x-3}{6} = \frac{y-2}{3} = \frac{z+1}{-2}$ and the plane $2x + y + 2z + 5 = 0$. (10)
- (c) Obtain the equations of the tangent planes to the sphere $x^2 + y^2 + z^2 + 6x - 2z + 1 = 0$ which passes through the line $\frac{16-x}{2} = \frac{z}{2} = \frac{y+15}{3}$. (11)

4. (a) Define great circle. Find the equation of Sphere in which the circle, $x^2 + y^2 + z^2 + 10y - 4z - 8 = 0$, $x + y + z - 3 = 0$ is a great circle. (14)

- (b) Find the three angles of a triangle ABC, whose vertices are A(2,3,5), B(-1,3,2) (10) and C(3,5,-2).
- (c) Find the direction cosines and length of the normal to the plane (11) $9x + 6y - 2z - 7 = 0$.

Section - B

5. (a) Form the differential equation of the family of curves $y = Ae^{2x} + Be^{-2x} + e^{3x}$, (10) for different values of A and B. Finally write down order and degree of your differential equation.

(b) Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 4y = x \sin(\ln x)$. (13)

(c) Solve $(1 + x^2) \frac{dy}{dx} + y = \tan^{-1} x$. (12)

6. Solve any three of the followings: (35)

(a) Solve $\frac{dy}{dx} = e^{(2x+3y)}$.

(b) Solve $(x^2 + y^2)dy - xydx = 0$.

(c) Solve $(2x + y + 3) \frac{dy}{dx} = x + 2y + 3$.

(d) Solve $y(1 + xy)dx + x(1 + xy + x^2y^2)dy = 0$.

7. Answer any three questions of the followings: (35)

(a) Solve $(D^4 - 6D^3 + 13D^2 - 12D + 4)y = 0$, where $D = \frac{d}{dx}$.

(b) Solve $(D^2 + 1)y = \sec x$.

(c) Solve $(D^2 + 2D + 1)y = 2x + x^3$.

(d) Solve $(D^2 + 6D + 9)y = \frac{e^{-3x}}{x^3}$ by using the methods of variation of parameter.

8. (a) Solve the initial value problem $(x^2 D^2 + 2xD - 6)y = 10x^2$ with the conditions (17) $y(1) = 1$ and $y'(1) = 6$.

(b) Solve the boundary value problem $\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$, where $u(0, t) = 0$, (18)

$u(1, t) = 0$, $u(x, 0) = \lambda \sin \pi x$, $(\frac{\partial u}{\partial t})_{t=0} = 0$.

Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 1st Year 2nd Term Regular Examination, 2015
Ph 1223
(Physics - II)

Full Marks: 210

Time: 3 hrs

- N.B.** i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) What is photo electric effect? Write down the failures of wave theory to explain photoelectric effect. (10)
- (b) What is Compton effect? Explain and derive an expression for Compton shift on the basis of quantum theory. Discuss the results. (15)
- (c) X-ray of wavelength 0.5×10^{-10} m are scattered by free electrons in a block of carbon through 90° . Find the momentum of (i) incident photons, (ii) scattered photons, (iii) recoil electrons, (iv) the energy of the recoil electrons. (10)

2. (a) Define phase velocity and group velocity of de Broglie waves. Show that de Broglie wave group associated with a moving particle travels with the same velocity as the particle. (14)
- (b) State the basic postulates of Bohr regarding his atom model. Obtain an expression for electron energy for n^{th} orbit according to Bohr's atom model. (13)
- (c) Compute the de Broglie wavelength of a proton whose kinetic energy is equal to the rest energy of an electron. Mass of a proton is 1836 times that of the electron. (08)

3. (a) What do you mean by magnetic permeability and magnetic susceptibility? Obtain a relation between magnetic permeability and susceptibility. (10)
- (b) Discuss about the salient features of vector atom model and explain the different quantum numbers associated with this model. (15)
- (c) What are the shortest and longest wavelengths present in the Brackett series of spectral lines? (10)

4. (a) What are Miller indices? Discuss about the procedure of finding Miller indices. Write down the importance of Miller indices. (12)
- (b) Calculate atomic packing factor of a simple cubic, body centered cubic and face centered cubic structure. (13)
- (c) A powder diffraction pattern is obtained for lead with radiations of wavelength 1.54 \AA . The (220) reflection is observed at Bragg angle 32° . What is the lattice parameter of lead? (10)

Section – B

5. (a) What is interference of light? Discuss interference of light analytically and obtain the conditions of maximum and minimum intensities. (10)
- (b) State Huygen's principle of secondary waves. Describe Young's double-slit experiment and show how the result can be explained with the help of wave theory of light. (15)
- (c) In Newton's rings apparatus, the radii of the n^{th} and $(n+20)^{\text{th}}$ dark rings are found to be 0.162 and 0.368 cm respectively, when light of 546 nm is used. Calculate the radius of curvature, R of the lower surface of the lens. (10)
6. (a) A beam of parallel rays passing normally through two slits each of width "a", whose centers are distance "d" apart, produces double slit diffraction pattern. Show that the intensity I of the double slit diffraction pattern at the diffraction angle θ is given by $I = I_m \cos^2 \beta \sin^2 \frac{\alpha}{\alpha^2}$, where the symbols have their usual meanings. (15)
- (b) Find the position of the maxima and minima of the double slit diffraction pattern. (10)
- (c) A rectangular aperture of width 0.0025 cm is illuminated with parallel beam of monochromatic light of wavelength 500 m μ . A converging lens of focal length 50 cm placed close to the aperture collects the light passing through it producing a diffraction pattern on a screen in its focal plane. Calculate the width of the central maxima on the screen. (10)
7. (a) Write short notes on the following: (i) Additive method of color mixing, (ii) Subtractive method of color mixing. (10)
- (b) State and explain Brewster's law. Show that at the polarizing angle of incidence the reflected and refracted ray are mutually perpendicular to each other. (15)
- (c) Light is incident from water ($\mu = 1.33$) on the glass ($\mu = 1.50$). Find the polarizing angle for the boundary separating water and glass. (10)
8. (a) Using the curve for the binding energy per nucleon as a function of mass number A. State clearly how the release in energy in the process of nuclear fission and nuclear fusion can be explained. (10)
- (b) Starting with the definition of radioactivity and the law of radioactive disintegration. Show that for a successive radioactive disintegration, the amount of daughter substance at instance t is given by (15)
- $$N_2 = \frac{\lambda_1 N_1^0}{\lambda_2 - \lambda_1} [e^{-\lambda_1 t} - e^{-\lambda_2 t}].$$
- (c) Calculate the time required for 10% of a sample of thorium to disintegrate. Assume the half-life of thorium to be 1.4×10^{10} years. (10)
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Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 1st Year 2nd Term Regular Examination, 2015
Hum 1223
(Sociology)

Full Marks: 210

Time: 3 hrs

- N.B.** i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) What is sociology? Why do you study it? (10)
(b) What is community and what are the characteristics? (10)
(c) What is society? What are the technological changes in different types of societies? (15)
2. (a) What is socialization? Explain how socialization happens? (10)
(b) What is stratification? Where does class system differ from caste system? (15)
(c) What is group? Define primary and secondary group. (10)
3. (a) What is social structure and what are the basic elements of social structure? (10)
(b) What is family and what are the functions of a family? (10)
(c) Explain the dimension of family structure. (15)
4. (a) Explain the concept of culture and its taxonomy. (15)
(b) Explain the basic elements of culture. (20)

Section – B

5. (a) What is social change? What are causes of social changes? (15)
(b) Discuss the nature and characteristics of social change. (20)
6. (a) What is sub-urban living? (10)
(b) Discuss the sub-urban problems. (10)
(c) Characterize the industrial and post industrial city. (15)
7. (a) What is social deviance? Discuss the functions of deviance in support of organization. (15)
(b) What is urbanization? Explain “urbanism” as a way of life. (10)
(c) What are the empirical consequences of urban living? (10)

8. Write short notes on:

(5X7) = (35)

- (a) Function of social stratification.
 - (b) Purposes of social control.
 - (c) Nature and characteristics of social change in Bangladesh.
 - (d) Different types of deviance.
 - (e) Social structure of Bangladesh.
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