

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics II
Time: 3 hours

Course Code: CE 103
Full Marks: 100 (= 10 × 10)

Answer **any 10 (TEN)** of the following 14 questions.
Assume reasonable values for missing data only, if any.

1. Derive the expression for the mass moment of inertia of the cone about X-X axis shown in Figure 1.

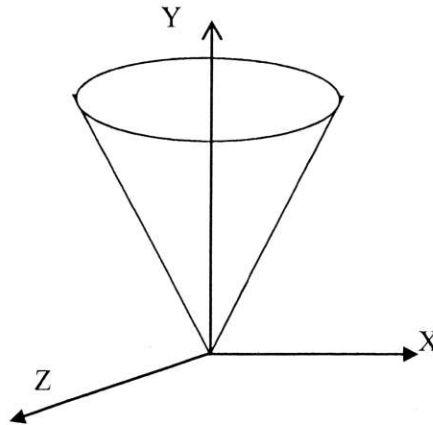


Figure 1

2. Three concrete cylinders are arranged in a way shown in Figure 2. Determine the mass moment inertia of the composite body with respect to X axis. Given, unit weight of concrete = 150 lb/ft³.

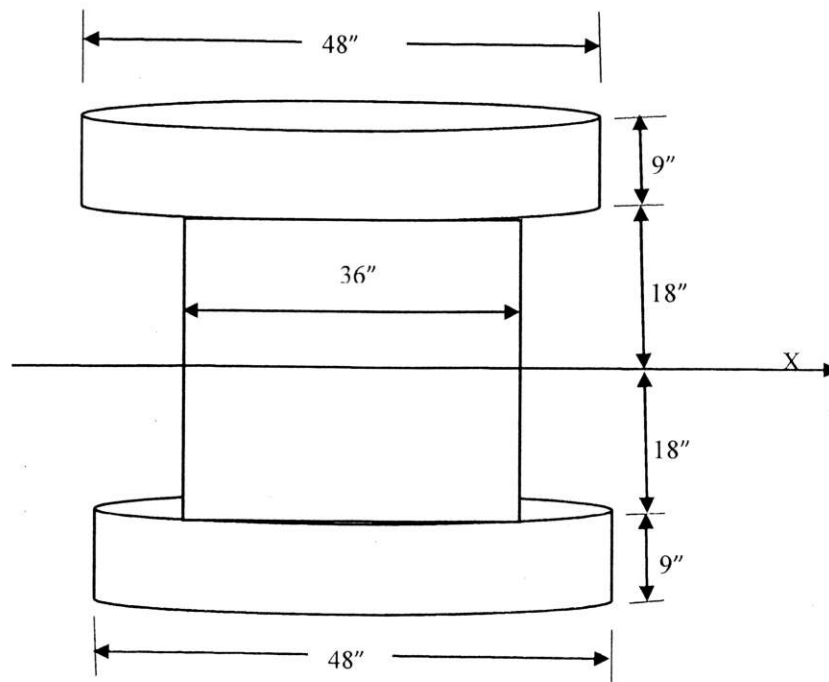


Figure 2

3. If wedge A in Figure 3 is weightless, what load W_B may be raised by a force 2000 lb? Coefficient of friction for all slipping surface = 0.25.

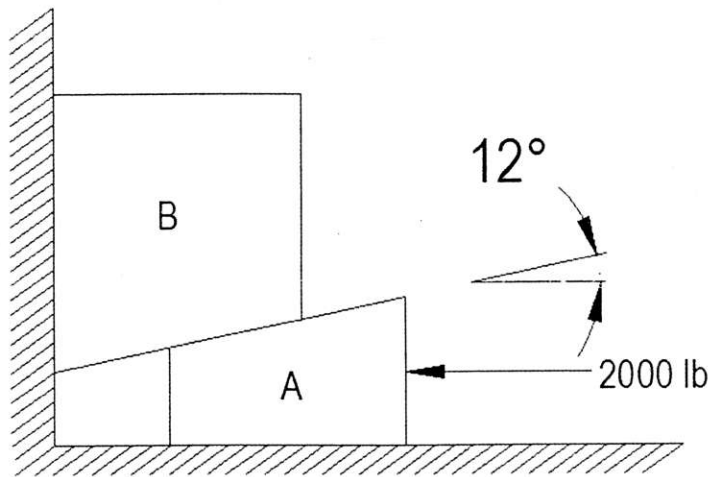


Figure 3

4. The body A in Figure 4 weighs 200 lb. The coefficient of static friction are 0.3 between the body A and the inclined plane and 0.2 between the rope and the drums. What value of W will cause motion of the body A to impend up the plane?

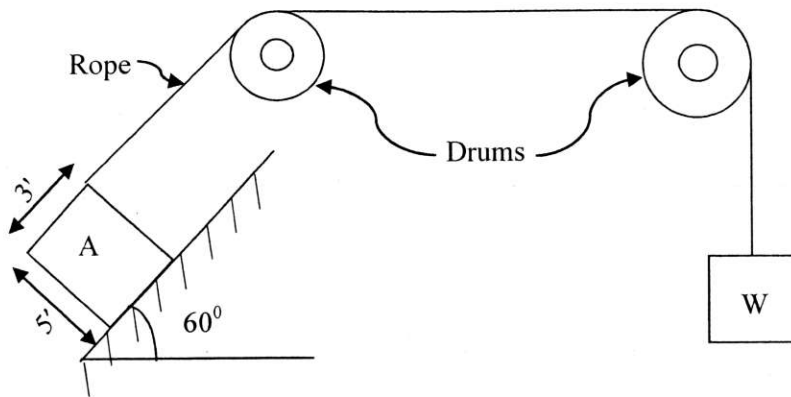


Figure 4

5. For a short time, the path of the plane in Figure 5 is described by $y=0.001x^2$, where x and y are in meter. If the plane is rising with a constant upward velocity of 10 m/s, determine the magnitude of the velocity and acceleration of the plane when it reaches an altitude of 100m.

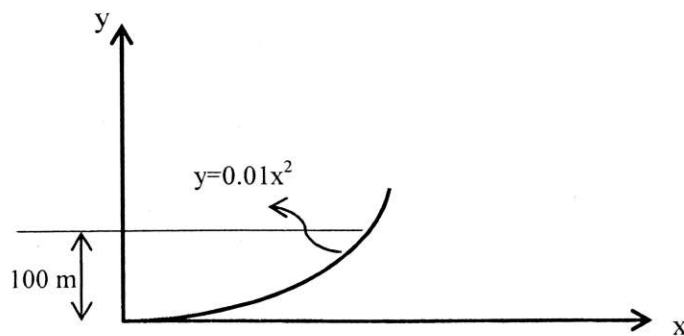


Figure 5

6. A spring in Figure 6 is compressed by 3 inch against the ball and then it is released from the rest. Determine the horizontal distance measured from B to where it strikes the horizontal plane at C. The ball weight is given by 5 lb and friction is neglected.

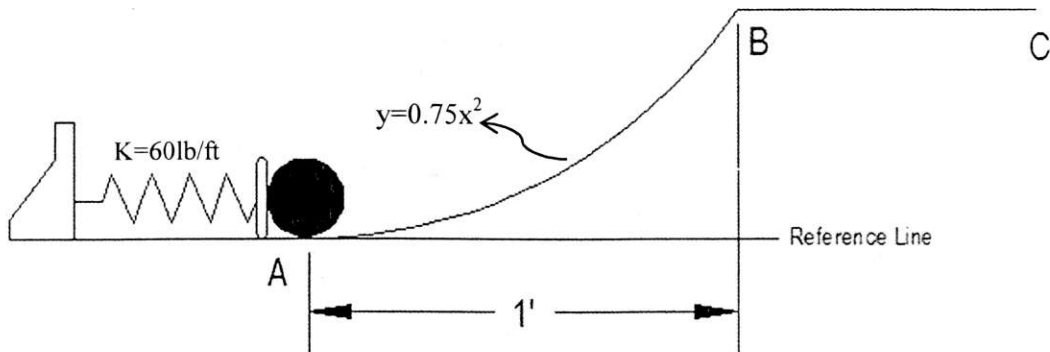


Figure 6

7. A toy car as shown in Figure 7 starts from point A and travels along a horizontal track. During its motion, the increase in speed is given by $a=0.3t^2\text{ m/s}^2$. After the straight path AB, the car enters into a circular path BC. Determine the car's acceleration when it is at point C.

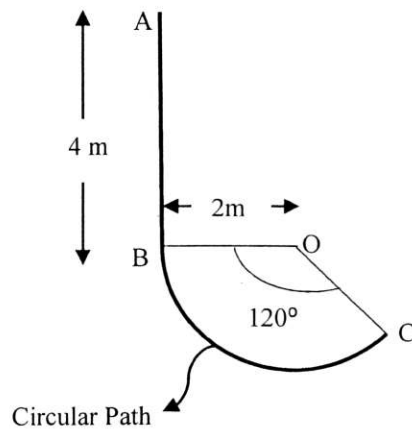


Figure 7

8. The a - s graph (Figure 8) for a rocket moving along a straight horizontal track has been experimentally determined. If the rocket starts from rest, determine its speed at the instants, $s=50\text{ ft}$, 150 ft and 200 ft , respectively.

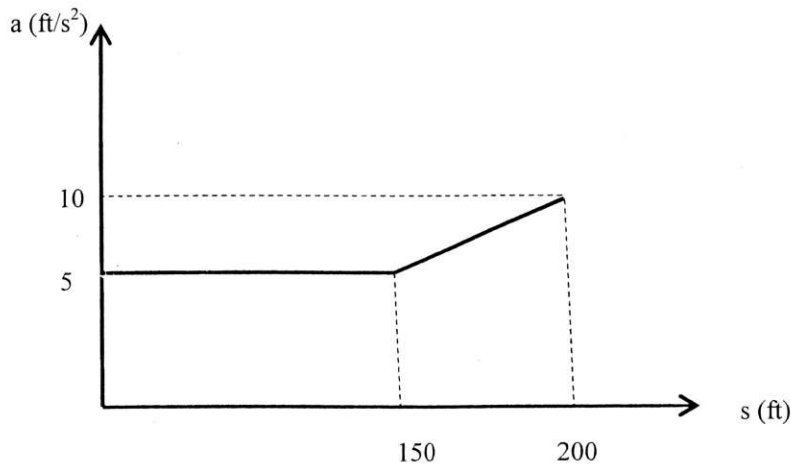


Figure 8

9. A 2000 lb body is connected to a 3000 lb body by a weightless rigid rod C and they are on a 30° inclined plane as shown in Figure 9. The coefficient of friction are $f_A=0.1$ and $f_B=0.2$. If the bodies start from rest, how long it will take for them to acquire a speed of 30 fps? What is the force on the rod C?

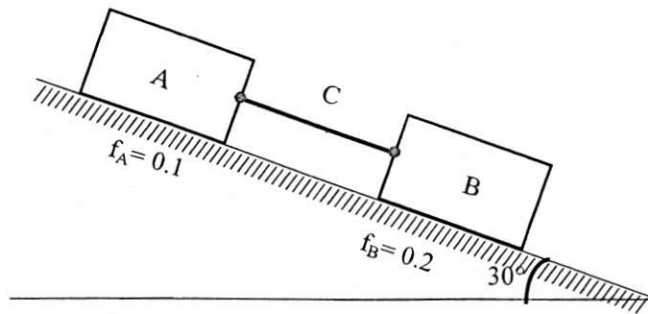


Figure 9

10. A 50 N block is released from rest on an inclined plane (Figure 12) which is making an angle 35° to the horizontal. The block starts from A, slides down a distance of 1.2 m and strikes a spring with stiffness of 8 KN/m. The coefficient of friction between the inclined plane and the block is 0.25. Determine:
- the maximum deformation of the spring in bringing the block to the rest position.
 - the distance, the block will rebound up the plane from the compressed position.

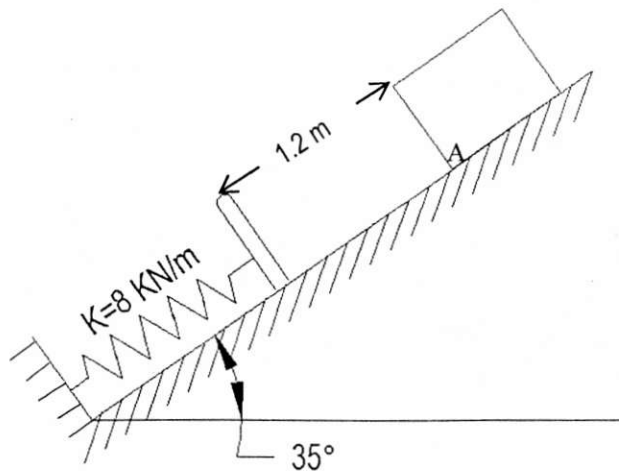


Figure 10

11. A ball is dropped from a height of 60 ft on a smooth horizontal floor. After bouncing on to the floor, the ball rises to a height of 35 ft and falls back. The ball again strikes the floor and rebounds to an unknown height. Determine the unknown height.
12. A 200 lb body is moving towards the left with a velocity of 50 ft/s at the instant that a force $Q=50$ lb acting toward the right (Figure 12) is applied. There is a constant response to motion $F=50$ lb. What is the body's velocity after 15 s?

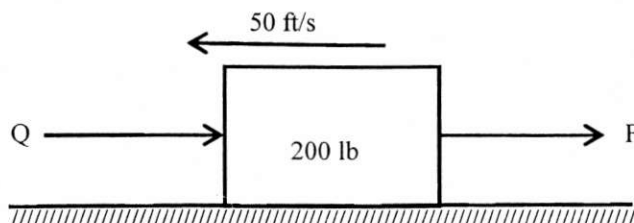


Figure 11

13. The 200 g projectile, shown in Figure 12, is fired with a velocity of 900 m/s towards the center of 15 kg wooden block, which rests on a rough surface. If the projectile penetrates and emerges from the block with a velocity of 300 m/s, determine the velocity of the block just after the projectile emerges. How long will the block slide on the rough surface, after the projectile emerges from the rough surface, before it comes to rest again? The coefficient of kinetic friction between the block and the surface is 0.2.

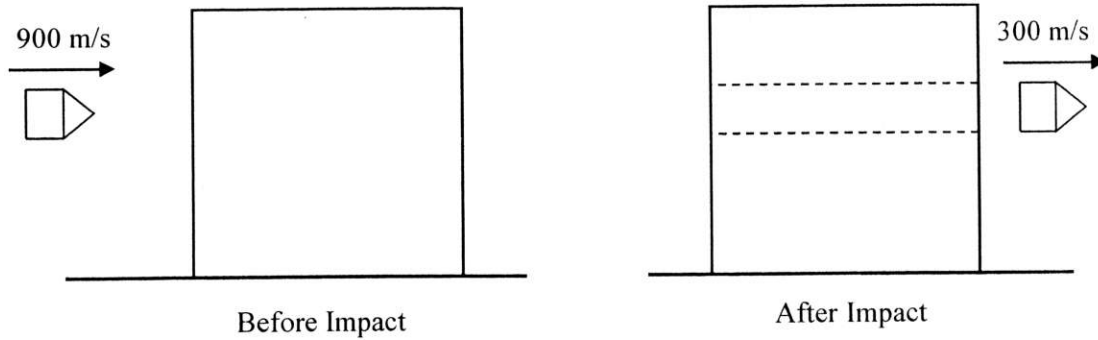


Figure 12

14. Determine the force in member AE and tension in wire AB and AD when the weight of the block is 100 lb as shown in Figure 13.

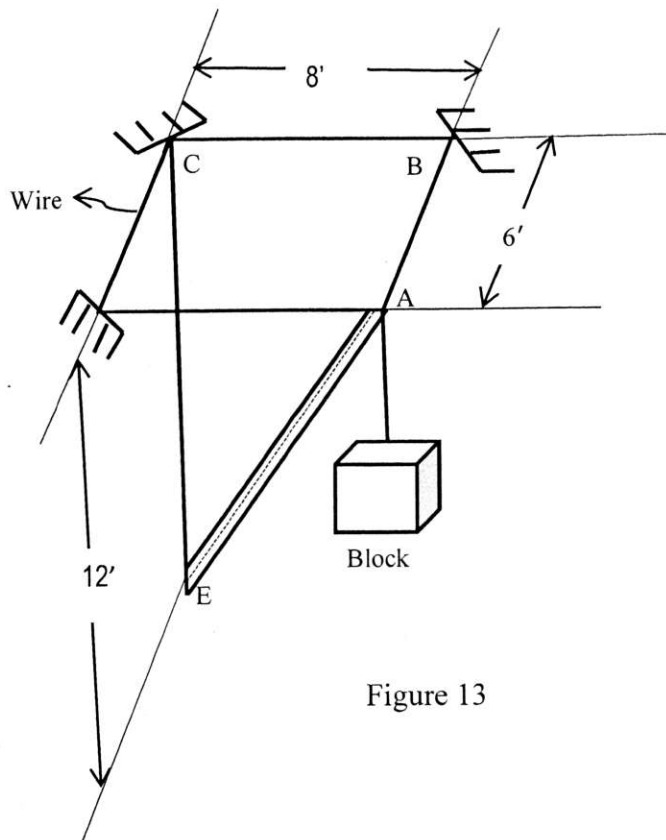


Figure 13

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
Program: B.Sc. Engineering (Civil)

Course Title: Surveying
Time: 3 Hours

Course Code: CE 105 (B)
Full Marks: 120

Section- A: Answer any 3 (Three) out of 4 (Four)

1. (a) Name the methods of setting out of simple curves. How can you set out a curve by offsets from the tangents? Show both offsets in sketch with calculation. (08)
- (b) Two roads meet at an angle of 127° . Calculate the necessary data for setting out a curve of 15 chains radius to connect the two straight portions of the road if it is intended to set out the curve by drawing offsets from long chord. Assume that the length of the chain is 20 m. (08)
- (c) Two broad gauge lines meet at an angle of $122^\circ 30'$. It is proposed to insert a circular curve of 8 chains radius with transition curves at ends. The super elevation is 15 cm and the rate of super elevation is 1 in 300. Calculate the necessary data to set the transition curve only. Given that chainage at the point of intersection is (12+30) and length of the chain is 30 m. (04)
2. (a) Define: (06)
 - i. Zenith and Nadir
 - ii. Latitude and Longitude
 - iii. Hour Angle and Right Ascension
- (b) What is Spherical Triangle? Write down the properties of spherical triangle. (04)
- (c) How many systems are used for measuring time? (2+8)

One of your friend, A is staying in New york (longitude 74°W) and he can join you in Skype chat at 10 PM local time. Calculate the time in Dhaka (longitude 90°E) at which you have to sign in Skype. Also, at what local time your friend B has to sign in for group chat if he is staying in Tokyo (longitude 36°N).
3. (a) Photographs of a certain area were taken from A and B, two camera stations 150 m apart. The focal length of camera is 150 mm. the image of a point, P appears 20 mm to the right and 16.5 mm above the hair lines on the photograph taken at A and 35 mm to the left on the photograph taken at B. The distance AP and BP are 46 m and 80 m respectively. If camera axis makes 45° with base line at B, calculate the angle that camera axis makes with the base line at station A? (04)

- (b) In a terrestrial photogrammetry, a photo theodolite was set up at A and B of a base line AB which is 100 m. the camera axis of the photo theodolite at A and B are inclined at angles $52^{\circ}32'$ and $40^{\circ}38'$ to the base line. The photograph taken from A shows a point P 4.56 cm to the left of the vertical wire and 2.5 cm above the horizontal wire. The photograph taken from B shows the same point 5.8 cm to the right of the vertical wire. The focal length of the camera is 12.5 cm and the elevation of the instrument axis at A is 105.05 m. calculate the distance and the direction of P and the level of P. (06)
- (c) Define: (06)
- i. Vertical photograph
 - ii. Crab
 - iii. Drift
- (d) Why is it recommended to keep overlaps in photographs? (04)
4. (a) What are the stages of an idealized remote sensing system? (04)
- (b) List some major applications of remote sensing. (04)
- (c) Show different types of triangulation system/figure with neat sketch. (04)
- (d) What are the criteria for selecting triangulation system/figure and triangulation station? (08)

Section- B: Answer all the questions

1. (a) The following figures were extracted from a level field book, some of the entries being illegible owing to exposure to rain. Insert the missing figures and calculate RL values. (07)

Station	B.S.	I.S.	F.S.	Rise	Fall	RL (m)	Remark
A	1.625					232.170	B.M. 1
B	2.050		?		0.300		
C		?		?		232.255	B.M. 2
D	1.690		?	0.340			
E	2.865		2.10		?		
F			?	?		233.425	B.M. 3

- (b) An excavation is to be made for a reservoir 30 m long and 20 m wide at the bottom, having the side slope at 2 horizontal to 1 vertical. Calculate the volume of excavation if the depth is 6 meters. Ground surface is level before the excavation. (05)

- (c) A distance was measured using a 100 m chain to be 1650 m. Standard pull and standard temperature for the chain was 30 lb and 85°F. However, the chain was pulled with pull of 40 lb and field temperature was 75°F. Calculate the correct distance. Provided that $A = 0.05 \text{ cm}^2$; $E = 2.109 \times 10^6 \text{ kg/cm}^2$; weight of tape = 0.8 kg; $\alpha = 6.2 \times 10^{-6} / \text{m}^\circ\text{F}$. (8)

2. (a) Calculate the volume of earthwork for an embankment. Formation level width = 12 ft. Side slope = 2 horizontal to 1 vertical. (10)

Chainage (ft)	0	100	200	300
Ground Level (ft)	8.4	13	20.5	19
Formation Level (ft)	16	16	16	16

- (b) A tachometer was set up at A. The following observations were made on vertically held staff: (10)

Instrument Station	Staff Point	R.L.(ft)	Vertical Angle, Θ	Stadia Reading		
A	P	110	+4°12'	3.22	4.82	6.42
A	Q	?	-7°36'	2	4.12	6.24

$K=100$ and $C=1$

Determine: (i) R.L. of Q

(ii) Horizontal distance between P and Q

3. (a) In an old map, a line AB was drawn to a magnetic bearing of 5° (WCB), the magnetic declination at the time being 1° East. To what magnetic bearing should the line be set now if the present magnetic declination is 9° West. (5)

- (b) The following interior angles were measured with a sextant in a closed traverse. The bearing of the line AB was measured as 75° with prismatic compass. Calculate the bearings of all other lines with neat sketch if $\angle A = 110^\circ$; $\angle B = 100^\circ$; $\angle C = 70^\circ$ and $\angle D = 80^\circ$. (15)

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
Program: B.Sc. Engineering (Civil)

Course Title: Chemistry
Time: 3 hours

Course Code: CHEM111
Full Marks: 150

Section: A

There are FOUR questions in this section. Answer any THREE

1. (a) Define saturated, unsaturated and supersaturated solutions. [8]
(b) Explain the behavior of ideal and non-ideal solutions based on Raoult's law. [8]
(c) What are the two factors involved in solubility? Explain briefly. [9]
2. (a) Which of the following compounds is likely to be more soluble in water: C_4H_9OH or C_4H_9SH ? Explain. [7]
(b) Describe the temperature dependence of the solubility of O_2 gas in water. [8]
(c) Define osmosis. The formula for low-molecular-mass starch is $(C_6H_{10}O_5)_n$, where n averages 200. If 0.798 g of starch is dissolved in 100.0 mL of water solution, what is the osmotic pressure, in mmHg, at 25 °C? [10]
3. (a) Briefly describe the colligative properties. Explain the boiling point elevation and freezing point depression using appropriate graph. [12]
(b) An aqueous solution of glucose is prepared by dissolving 0.4 g of glucose ($C_6H_{12}O_6$) in 100 mL water. What are the boiling point and the freezing point of this solution? Boiling-point-elevation constant (K_b) and freezing-point-depression constant (K_f) of water are 0.512 and 1.858°C/m, respectively. [13]
4. (a) Define phase, component and degrees of freedom. Sketch the phase diagram of water. [10]
(b) What is *Clausius-Clapeyron* equation? Estimate the vapor pressure of water at 80°C. Note that the normal boiling point of water is 100°C and its heat of vaporization is 40.7 kJ/mol. [9]
(c) The pH of human blood is 7.4. Calculate the concentration of hydronium (H_3O^+) ion. [6]

Section: B

There are FOUR questions in this section. Answer any THREE

5. (a) Define instantaneous rate of reaction. What are the variables that affect the reaction rate? [8]
(b) What is meant by reaction order? Can it be zero? Give an example. [8]
(c) What is average rate of reaction? Calculate the average rate of decomposition of N_2O_5 , $-\Delta[N_2O_5]/\Delta t$, by the reaction
 $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$
during the time interval from $t = 200$ s to $t = 600$ s (Consider all time figures as significant). Use the following data:

Time	$[N_2O_5]$
200 s	$1.56 \times 10^{-2} M$
600 s	$0.98 \times 10^{-2} M$

[9]
6. (a) What is chemical equilibrium? How does a reaction approach equilibrium? [8]
(b) Define equilibrium constants K_c and K_p . How are they related? [8]
(c) Hydrogen sulfide dissociates on heating: $2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$

When 0.100 mol H_2S was put into a 10.0-L vessel and heated to 1132°C , it gave an equilibrium mixture containing 0.0285 mol H_2 . What is the value of K_c at this temperature? [9]

7. (a) Define homogeneous and heterogeneous chemical equilibria. Give examples. [10]

(b) Calculate the K_p for the methanation reaction if $K_c = 3.92$ at 25°C . The reaction is:

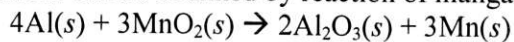


(c) What do you mean by exothermic and endothermic reactions? [8]

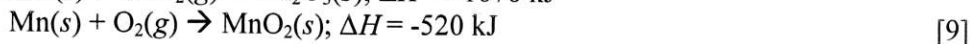
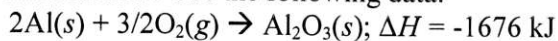
8. (a) What is pressure-volume work? Derive a relationship between enthalpy, internal energy, and pressure-volume work. [9]

(b) What is calorimeter? What are the uses of calorimeter? [7]

(c) Manganese metal can be obtained by reaction of manganese dioxide with aluminum.



What is ΔH for this reaction? Use the following data:



University of Asia Pacific
Department of Civil Engineering
Final Examination Spring-2015
Program: B. Sc Engineering

Course Code: HSS 103

Course Title: English Language II

Credit: 3 .00

Time: 3.00 Hours

Full Mark: 50

*Marks are indicated in the right margin.

Read the passage carefully and then answer the corresponding questions:

TINY VOICES GO UNHEARD

Good laws are meaningless if those are not properly enforced. As in other countries of the world, there are also numerous laws in Bangladesh, but the problem is they are hardly practiced. There is a law, for example, against early marriage in the country. Even then child marriage thrives in Bangladesh, pushing girls into a cycle of poverty, illiteracy and serious health problems. This is not only a problem of culture, but also a quandary of political will.

According to several studies, poverty, superstition and lack of awareness are the main reasons behind the increasing number of early marriages in developing countries, particular in Bangladesh.

There are cultural reasons, too, for child marriage, whether religious, ethnic or local, but the overriding, universal fact about sex, marriage and reproduction is that economic considerations are paramount. Families give away their daughters because they cannot afford them, and because education is unavailable or unaffordable. As everywhere, the less education a young woman has, the earlier she tends to fall pregnant and generally the worse her life is.

A UNICEF article on child marriage says ‘parents choose to marry off their daughters early for a number of reasons. Poor families may regard a young girl as an economic burden and her marriage as a necessary survival strategy for her family. Some parents in developing countries think that an early marriage is the best protection against sexual assault and a way to ensure that their daughters will be cared for. (An early) marriage may also be seen as a strategy to avoid girls becoming pregnant outside marriage’.

“The state of the world children 2011” reveals that rural women marry earlier than their urban counterparts, that premature marriage rate being 70 percent and 53 present respectively.

The government occasionally carries out a campaign against that traditional practice of child marriage and has amended the relevant law many consider it a failed, halfhearted effort.

Experts have identified number of measures they think the government needs to focus on to curb the practice. They include waging a social movement; making the existing law more stringent; ensuring effective enforcement of the law; greater emphasis on women’s education, allied with greater legal assistance, all eventually leading to broader goal of women’s emancipation.

1. Answer the questions using not more than three sentences:

5×1=5

a. Parents think that an early marriage is a way to ensure that their daughters will be cared for’.

Comment on the statement above.

b. The premature marriage rate in villages is more than that of the urban areas. What are the reasons behind this?

c. How can early marriages be stopped?

d. What are the consequences of early marriages?

e. Justify the title of the text.

2. Rewrite any eight (08) of the following sentences using appropriate modal verbs:

8 × 1=8

- a) Perhaps I left my mobile in the Internet café.
- b) I am sure they are enjoying their vacation.
- c) It sounds like it was a terrible accident.
- d) The museum is free. You do not pay to get in.
- e) Shawlin is a millionaire. He does not want to go to work.
- f) Perhaps my mother called me when I was busy.
- g) I think I am obliged to attend the meeting.
- h) I am inviting you to have a dinner with us.
- i) It is advised that you maintain time sincerely.
- j) This is library. You are requested to be silent.

3. UAP has decided to give 'Waiver' for students who are skilled in sports. As the convener of UAP Sports Club, write a memorandum to this effect. (100 words) 05

4. University of Asia Pacific recently organized Farewell program for the outgoing batch. As a reporter of a national daily, write a news-report on the event for publication in newspaper. (100 words) 05

5. Write a review on a movie that you have watched/enjoyed recently. (150 words) 07

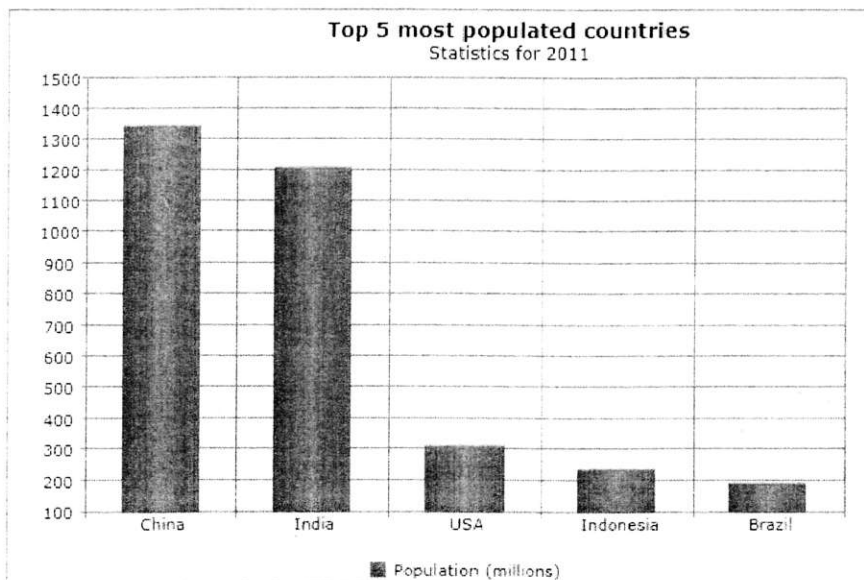
6. Consider the title and narrate a story on any one of the following. (150 words) 07

The Lost Treasure or The Hidden Truth

7. Write an essay on any one (1) of the following topic (word limit 200) 08

- a) Money can buy happiness b) The moment of success

8. The bar chart shows information about the top five most populated countries in 2011. Describe and analyze the information available in the chart in your own words. (100 words) 05



University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring - 2015
Program: B.Sc. Engineering (Civil Engineering)
1st Year / 2nd Semester

Course Title: Mathematics II
Time: 3 hr

Credit: 3.00

Course Code: MTH 103
Full Marks: 150

There are **EIGHT** questions. Answer any **SIX**

1. (a) Define direction cosines and direction ratios of a line. 6
- (b) If l, m, n be the direction cosines of any line then prove that $l^2 + m^2 + n^2 = 1$. 9
- (c) Show that the lines from $A(5, 2, -3)$ to $B(6, 1, 4)$ and from $C(-3, -2, -1)$ to $D(-1, -4, 13)$ are parallel. 10
2. (a) Find the equation of the plane through the points $(2, 3, 1)$, $(1, 1, 3)$ and $(2, 2, 3)$. Find also the perpendicular distance from the point $(5, 6, 7)$ to this plane. 10
- (b) Find the equation of the plane through the point $(2, 3, -1)$ parallel to the plane $3x - 4y + 7z = 0$ and find the distance between the two planes. Find also the angle between this plane and the plane $8x + 3y - z = 2$. 15
3. (a) Find the coordinates of the point where the joining of two points $(2, -3, 1)$ and $(3, -4, -5)$ cuts the plane $3x + 4y + 5z = 5$. 9
- (b) Find the distance of the point $(-1, -5, -10)$ from the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $x - y + z = 5$. 9
- (c) Prove that equation to the line of intersection of the planes $4x + 4y - 5z = 12$ and $8x + 12y - 13z = 32$ can be written as $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z}{4}$. 7
4. (a) Define cross product of two vectors. Find the sine of the angle between the vectors $\mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$ and $3\mathbf{i} - 4\mathbf{j} + 2\mathbf{k}$. 10
- (b) Show that scalar product of three vectors, $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c})$ represents volume of the parallelepiped. Hence find the volume of the parallelepiped whose edges are represented by $\mathbf{a} = 2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$, $\mathbf{b} = \mathbf{i} + 2\mathbf{j} - \mathbf{k}$ and $\mathbf{c} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$. 15

5. (a) Prove that $2\mathbf{i}-\mathbf{j}+\mathbf{k}$, $\mathbf{i}-3\mathbf{j}-5\mathbf{k}$, $3\mathbf{i}-4\mathbf{j}-4\mathbf{k}$ form the sides of a right angled triangle. 10
- (b) Find the perpendicular distance of the vector $(7, 6, 7)$ from the line 8
- $$\frac{x-2}{2} = \frac{y-1}{3} = \frac{z-3}{6}.$$
- (c) If $\phi(x, y, z) = xy^2z$ and $\mathbf{A} = xz\mathbf{i} - xy^2\mathbf{j} + yz^2\mathbf{k}$, 7
- find $\frac{\partial^3}{\partial x^2 \partial z}(\phi\mathbf{A})$ at the point $(2, -1, 1)$.
6. (a) Define gradient of a scalar function. 3
- (b) Show that 15
- $\nabla r^n = nr^{n-2}\mathbf{r}$
 - $\nabla^2\left(\frac{1}{r}\right) = 0$
 - $\nabla\left(\frac{1}{r}\right) = -\frac{\mathbf{r}}{r^3}$
- Where $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$
- (c) Define curl of a vector function. If $\mathbf{A} = x^2y\mathbf{i} - 2xz\mathbf{j} + 2yz\mathbf{k}$ find $\text{curl curl } \mathbf{A}$. 7
7. (a) Evaluate $\nabla \cdot (\mathbf{A} \times \mathbf{r})$ if $\nabla \times \mathbf{A} = 0$. 10
- (b) State Stokes's theorem. Verify Stokes's theorem for $\mathbf{A} = (2x-y)\mathbf{i} - yz^2\mathbf{j} - y^2z\mathbf{k}$, 15
where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and C is its boundary.
8. (a) If $\phi = 2xyz^2$, $\mathbf{F} = xy\mathbf{i} - z\mathbf{j} + x^2\mathbf{k}$ and c is the curve $x=t^2$, $y=2t$, $z=t^3$ from $t=0$ to $t=1$, 10
evaluate the line integrals
- $\int_c \phi d\mathbf{r}$
 - $\int_c \mathbf{F} \times d\mathbf{r}$
- (b) State Green's theorem. Verify Green's theorem in the plane for 15
 $\oint_c (xy + y^2)dx + x^2dy$ where c is the closed curve of the region bounded by $y=x$ and $y=x^2$.