University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2018
Program: B.Sc. Engineering (Civil)

Course Title: Engineering Mechanics II | Course Code: CE 103
Time: 3.0 hours | Full Marks:100(=10×10)

[Answer any 10 (Ten) of the following 14 (Fourteen) questions]

1. Block A and B are connected to each other with an inextensible weightless cord as shown in ***Figure 1***. When Q= 70 lb is applied, block B is in impending motion upward. Calculate coefficient of friction, μ, assuming μ is same for all contact surfaces except the smooth pulley. Given: Weight of A= 50 lb; Weight of B= 60 lb.

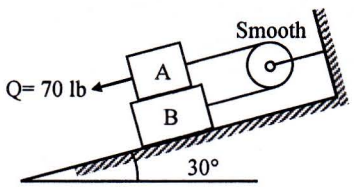


Figure 1

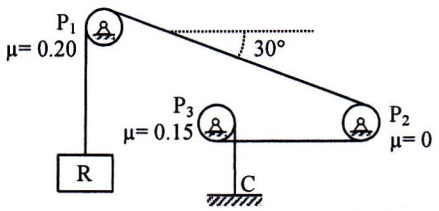


Figure 2

2. Block R, weighing 50 lb, is supported by an inextensible weightless cord wrapped around three pulleys P_1, P_2 and P_3 as shown in ***Figure 2***. Calculate reaction at C if coefficient of friction at P_1, P_2 & P_3 are 0.2, 0 and 0.15 respectively.

3. Solid ball A is released from rest at the position θ = 0°, as shown in ***Figure 3***. After falling to θ = 90°, it strikes a box B. If the block starts moving towards the right due to direct impact with the ball, how far will the block move before it comes to rest due to friction?
Given: Coefficient of restitution, e = 0.5; Coefficient of friction between Block B and surface = 0.3; Weight of A= 5 lb; Weight of B= 15 lb.

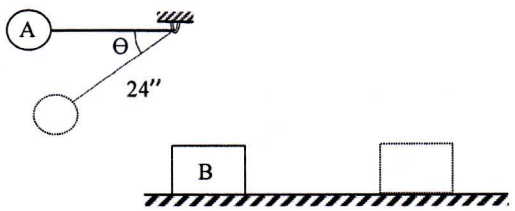


Figure 3

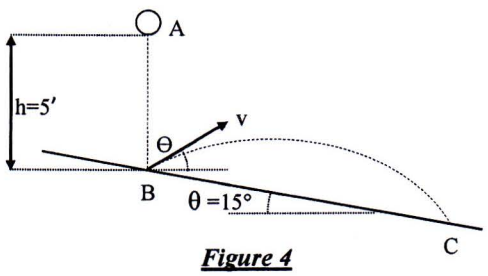
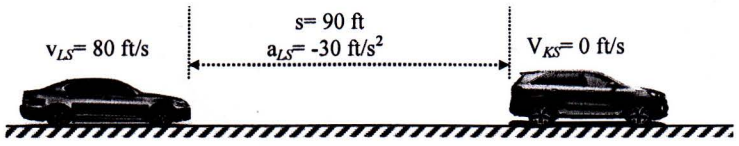


Figure 4

4. Ball A weighing 2 lb is dropped from h = 5 ft height on a smooth inclined plane, θ=15°, as shown in ***Figure 4***. If coefficient of restitution e= 0.5, calculate velocity of the ball just after impact at point B.

5. Velocity of a ball just after an oblique impact, as shown in ***Figure 4*** , is 20 ft/s with an angle of θ= 25° with the horizontal. Calculate the time required for the ball to hit the ground again at C.

6. A Lexus Sedan (LS) car weighing 4200 lb is decelerating at 30 ft/s^2 so that it can park behind another car Kia Sorento (KS) weighing 4000 lb, as shown in ***Figure 5***. But, due to miscalculation of speed and distance, LS could not stop in time, hence hits KS.
Calculate combined velocity of the cars just after impact, assuming there is no rebound.



7. A Leguna weighs 6000 lb with seated 13 passengers and a driver. While it is moving up an inclined plane with an acceleration of 6 ft/s^2 , it has 4 people, weighing 700 lbs, standing at back as shown in ***Figure 6***. Calculate the minimum inclination that may cause the leguna to overturn about rear wheel.

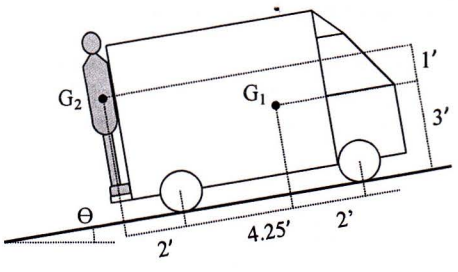


Figure 6

8. Block D weighing 60 N slides down on the smooth inclined ramp as shown in ***Figure 7***. At the end of the ramp, spring A , with spring constant k_A = 20 kN/m, is attached to stop motion of D. If a second spring B, having a stiffness k_B = 15 kN/m, is "nested" in A, determine the maximum displacement of A needed to stop the downward motion. Neglect the mass of the springs.

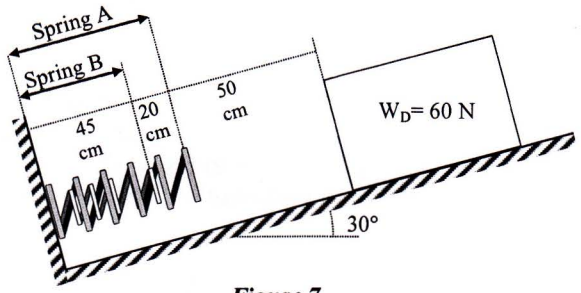
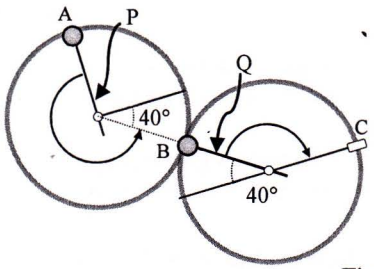


Figure 7

9. Initial positions of two rotatable bodies P and Q are shown in ***Figure 7***. The bodies are arranged such that, when P accelerates at $\alpha = 2.35\,t + 0.435$ (anti-clockwise, measured in radian) starting from A and reaches B, Q starts to rotate at constant angular velocity of 0.8 rad/s (clockwise). Calculate how much time it takes for Q to hit C, starting from Initial position of P.



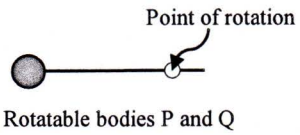


Figure 8

10. A 2-in.-diameter water jet having a velocity of 25 ft/s impacts on a single moving blade, as shown in ***Figure 9***. If the blade moves with a constant a velocity of 5 ft/s away from the jet, determine the horizontal and vertical components of force which the blade is exerting on the water.
Given, unit weight of Water = 62.4 lb/ft^3.

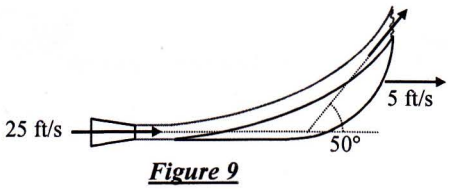


Figure 9

11. The wheel shown in ***Figure 10*** weighs 40 lb and has a radius of gyration k_G = 0.6 ft about its mass center G. If it is subjected to a clockwise couple moment of 15 lb-ft and rolls from rest without slipping, calculate its angular velocity after its center G moves 0.5 ft leftward. The spring has a stiffness k = 10 lb/ft and is initially unstretched when the moment is applied.

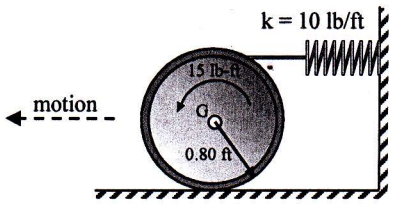


Figure 10

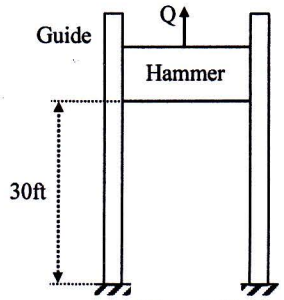
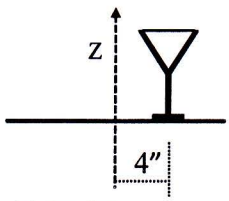


Figure 11

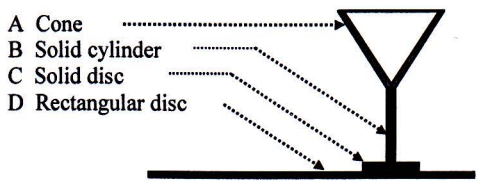
12. A pile driver hammer is to fall from rest due to self-weight from a 30 ft height through a rough guide having total friction of 100 lb. An upward variable force Q is acting on the hammer, as shown in ***Figure 11***, so that velocity of the hammer can be controlled.

Calculate the weight of the driver hammer if its velocity at the bottom of the guide is 40 ft/s.
Given: Q = 5*s*, *s* is the displacement from initial position.

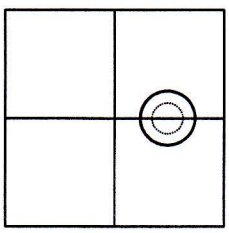
13. Calculate radius of gyration of the composite body ABCD shown in ***Figure 12*** with respect to given Z axis.



(a) Section



(b) Composition



(c) Plan view

Units:	Length/ Radius in	Width in	Height in	Density x10^{-3} Slug/in^3
A Cone: Outer	2.5	-	6	3
Inner	2.25	-	5.4	
B Solid cylinder	0.5	-	5	3
C Solid cylindrical disc	2	-	0.5	3
D Rectangular disc	20	20	0.5	9

Figure 12

14. Joint O of a space truss is shown in ***Figure 13***. Calculate F_{OB}, F_{OC} and F_{OD} using the following information.

Given, OA (50, 4, 3, -3)
OB (F_{OB}, 4, 0, -3)
OC (F_{OC}, 0, 3, 0)
OD (F_{OD}, -2, 0, 0)
OE (40, 0, 0, -3)
OF (-30, 0, 0, 2)

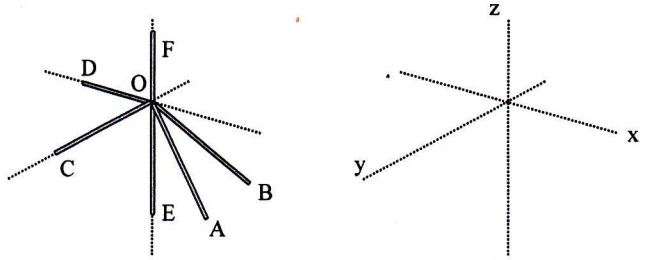


Figure 13

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2018
Program: B. Sc. Engineering (Civil)

Course Title: Surveying | Course Code: CE 105
Time: 3 (Three) hours | Full Marks: 100

[Assume Reasonable Values for Any Missing Data]

PART – A

There are **NINE** questions in this section. Answer any **EIGHT**. **8 x (5) = 40**

1. Explain with sketches the Intersection method (Plane Table Survey) of locating a point.
2. Define with neat sketches: i) Compound Curve, and ii) Reverse Curve
3. List five characteristics of contour in surveying
4. Define: i) Sensible Horizon, ii) Vertical Circle
5. Explain the importance of horizontal curve.
6. **(a)** What is local attraction? How is it detected and eliminated?
   (b) What are the functions of plumb bob in case of chain surveying?
7. **(a)** Compare between 'Active Remote Sensing' and 'Passive Remote Sensing'.
   (b) Write down the wavelength region of Remote Sensing.
8. How GIS is linked to remote sensing? Explain.
9. Differentiate between Plain Surveying and Geodetic Surveying.

PART – B

There are **SIX** questions in this section. Answer any **FIVE**. **5 x (12) = 60**

10. A closed traverse was conducted round an obstacle and the following observations were made. **Work out the missing quantities.**

Side	Length (m)	Azimuth
AB	500	98°30′
BC	620	30°20′
CD	468	298°30′
DE	?	230°00′
EA	?	150°10′

11. The following bearings were observed while traversing with a compass.

Line	F.B.	B.B.	Line	F.B.	B.B.
AB	45° 45′	226° 10′	CD	29° 45′	209° 10′
BC	96° 55′	277° 5′	DE	324° 48′	144° 48′

Mention which stations were affected by local attraction and determine the corrected bearings.

12. A series of offsets were taken from a chain line to an irregular boundary line at intervals of *10* metres: *3.25, 5.60, 4.20, 6.65, 8.75, 6.20, 3.25, 4.20* and *5.65m.* **Compute the area between the chain line, the curved boundary and the end offsets by (i) Average Ordinate Rule, (ii) Trapezoidal Rule and (c) Simpson's Rule**

13. Two tangents intersect at chainage 59 + 60, the deflection angle being 51° 30′. Calculate the necessary data for setting out a curve of 15 chains radius to connect the two tangents if it is intended to set out the curve by offsets from chords. Take peg interval equal to 100 links, Length of the chain being equal to 20 metres (100 links).

14. A railway embankment *400 m* long is *15 m* wide at the formation level and has the side slope *2 to 1*. The ground level at every *100 m* along the centre line are as below:

Distance	*0*	*100*	*200*	*300*	*400*
R.L.	*201.7*	*202.9*	*202.4*	*204.70*	*205.9*

The formation level at zero chainage is *202.30* and the embankment has a rising gradient of *1 in 100*. The ground is level across the centre line. **Calculate the volume of earthwork.**

15. The following consecutive readings were taken with a level:
0.875, 1.235, 2.310, 1.385, 2.930, 3.125, 4.125, 0.120, 1.875, 2.030 and *3.765ft*
The level was shifted after 2nd, 4th, and 8th readings. The reduced level at first point was *132.13 ft.* Rule out a page of your answer- book as a level field book and fill all the columns.
Use Rise and Fall method and apply the usual arithmetical check. Indicate the highest and lowest points.

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2018
Program : B.Sc. Engineering (Civil)

Course Title: Chemistry | Course Code: CHEM111
Time: 3 hours | Full Marks: 150

Assume any missing data (if any) for both sections

Section: A

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

1. (a) Explain what happens to the boiling point and freezing point of water upon addition of a solute by sketching the phase diagram of pure water and solution. What is the boiling point of a solution of 0.150 g of glycerol, $C_3H_8O_3$, in 20.0 g of water? What is the freezing point? Given that the K_b and K_f of water are 0.512 °C/m and 1.86 °C/m, respectively. [8+7=15]
   (b) Define colloid. Explain the Tyndall effect to distinguish solutions and colloids. Give examples of hydrophilic colloids and hydrophobic colloids. [10]

2. (a) Define σ and π bonds. Explain how these bonds are formed between two p orbitals. Explain the bonding in N_2F_2, XeF_2 and NH_3 molecules using VBT. [13]
   (b) Illustrate the electron pair arrangements in IF_3, H_2O, NH_3 and NF_3 molecules. Explain why NH_3 is more polar than NF_3. [12]

3. (a) Define hydration and lattice energy of an ionic crystal. Using the concept of hydration, describe the process of dissolving a sodium chloride (NaCl) crystal in water. What would be the molarity of solution containing 5.85 g of NaCl in 250.0 mL of the solution? [13]
   (b) What are the colligative properties? Describe the osmosis process and explain how osmotic pressure depends on the concentration of the solution. Calculate the osmotic pressure at 20°C of an aqueous solution containing 5.0 g of sucrose, $C_{12}H_{22}O_{11}$, in 100.0 mL of solution. [12]

4. (a) Sketch a graph to explain instantaneous rate and average rate of a reaction. List the four factors that influence the rate of the reactions. The reaction $3I^-(aq) + H_3AsO_4(aq) + 2H^+(aq) \rightarrow I_3^-(aq) + H_3AsO_3(aq) + H_2O(l)$ is found to be first order with respect to each of the reactants. Write the rate law. What is the overall order? [13]
   (b) In a kinetic study of the reaction: $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$, the following data were obtained for the initial rates of disappearance of NO.

	Initial Concentrations		*Initial Rate of Reaction of NO*
	NO	O_2	
Exp. 1	0.0125 *M*	0.0253 *M*	0.0281 *M/s*
Exp. 2	0.0250 *M*	0.0253 *M*	0.112 *M/s*
Exp. 3	0.0125 *M*	0.0506 *M*	0.0561 *M/s*

Obtain the rate law. What is the value of the rate constant? [12]

Section: B

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

5. (a) Describe the equilibrium constants K_c and K_p; indicate how K_p and K_c are related. Define homogeneous equilibrium and heterogeneous equilibrium. Which of the following reactions involve homogeneous equilibria and which involve heterogeneous equilibria? Write down the expressions for K_c.

$$2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$$
$$2Cu(NO_3)_2(s) \rightleftharpoons 2CuO(s) + 4NO_2(g) + O_2(g)$$
$$2N_2O(g) \rightleftharpoons 2N_2(g) + O_2(g)$$

[6+9=15]

(b) The equilibrium constant *Kc* for the reaction

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

at 450 °C is 0.159. Calculate the equilibrium composition when 1.00 mol N_2 is mixed with 3.00 mol H_2 in a 5.00-L vessel. [10]

6. (a) What qualitative information can you get from the magnitude of the equilibrium constant? What is the reaction quotient? How is it useful? [13]

(b) The following reaction has an equilibrium constant K_c equal to 3.59 at 900°C.

$$CH_4(g) + 2H_2S(g) \rightleftharpoons CS_2(g) + 4H_2(g)$$

For each of the following compositions: $[CH_4] = 1.25\ M$, $[H_2S] = 1.52\ M$, $[CS_2] = 1.15\ M$, $[H_2] = 1.73\ M$, decide whether the reaction mixture is at equilibrium. If not, decide which direction the reaction should go. [12]

7. (a) Define internal energy, enthalpy and pressure-volume work. How are they related? Explain why enthalpy is an extensive property and why it is a state function. Give two examples of intensive and extensive property. [13]

(b) Calculate the kinetic energy of a person whose mass is 59.0 kg and whose speed is 26.8 m/s in joule and in cal. What would be the potential energy of the same person at an altitude of 1 km? [12]

8. (a) Describe the Le Chatelier's principle in your own words. Explain the effect of temperature on an exothermic and an endothermic reaction based on this principle. [13]

(b) Define exothermic and endothermic reaction. Ethanol generates heat according to the following reaction when it burns.

$$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O;\ \Delta H = 1235\ kJ$$

How many grams of ethanol do you need to burn if you want to raise the temperature of 5 L (density of water is 1 kg/L) of water from 25°C to its boiling point using ethanol as a fuel? Assume 100% combustion efficiency. [12]

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2018
Program: B.Sc in Civil Engineering

Course Title: English II: Language Composition Skill Course Code: HSS-103

Time: 3 hours Full Marks: 50

Read the following passage and answer question 1.

The first recorded case of an airline passenger turning seriously violent during a flight, a phenomenon now widely known as "air rage", happened in 1947 on a flight from Havana to Miami. A drunken man assaulted another passenger and bit a flight attendant. However, the man escaped punishment because it was not then clear under whose legal control a crime committed on plane was the country where the plane was registered or the country where the crime was committed. In 1963, at the Tokyo convention, it was decided that the laws of the country where the plane is registered take precedence.

The frequency of air rage has expanded out of proportion to the growth of air travel. Until recently few statistic were gathered about air rage, but those that have been indicate that passengers are increasingly likely to cause trouble or engage in violent acts. For example, in 1998 there were 266 air rage incidents out of approximately four million passengers, a 400% increase from 1995. In the same period American Airlines showed a 200% rise. Air travel is predicted to rise by 5% internationally by 2010 leading to increased airport congestion. This, coupled with the flying public's increased aggression, means that air rage may become a major issue in coming years.

Aside from discomfort and disruption, air rage poses some very real dangers to flying. The most extreme of these is when out of control passengers enter the cockpit. This has actually happened on a number of occasions, the worst of which have resulted in the death and injury of pilots or the intruder taking control of the plane, almost resulting in crashes. In addition, berserk passengers sometimes attempt to open the emergency doors while in flight, putting the whole aircraft in danger. These are extreme examples and cases of air rage more commonly result in physical assaults on fellow passengers and crew such as throwing objects, punching, stabbing or scalding with hot coffee.

1. Fill in the gaps by using appropriate words from the passage. 1×6=6

The first time that an **(a)** _____ of air rage was recorded was in the 1940's, but the passenger was never actually charged for an offence because there were no clear rules in place to specify where to prosecute. It was later **(b)** _____ that it would be the country where the plane is registered. Air rage has **(c)** _____ significantly since this time, growing by a

staggering 400% from 1995 to 1998. Air rage is **(d)** to be a major problem in the future as air travel increases, as do levels of aggression. Angry **(e)** can put everyone in danger including the pilots, the crew and the other passengers, with some form of **(f)** being the most common consequence.

2. Fill in the blanks using modal verbs: 1×6=6

a) She ..... be very pleased with herself. She got the best grades.
b) You ..... tired. You've only just got out of bed!
c) The test starts at 10.30. You ..... be late.
d) You ..... eat so much chocolate. It's not good for you.
e) ..... you help me move this table?
f) I..... help if I knew.

3. Replace the common underlined word in the sentence with a synonym or antonym as instructed: .5×10=5

a) After cleaning his dirty room for two hours, it was finally spotless. (Synonym)
b) Eric wrote false for every question on the test. (Antonym)
c) That antique was valuable to him, but it was priceless to his mother. (Synonym)
d) Laura always disobeyed her mother. (Antonym)
e) The snow is thawing and the ice is melting on this unusual warm winter day. (Synonym)
f) Kevin was very careless with his toys. (Antonym)
g) Kelly was acting childish in school. (Antonym)
h) After having concealed the painting for a long time, it was finally exhibited. (Synonym)
i) She wore casual attire to the party when it was supposed to be a formal affair. (Antonym)
j) Her mother allowed her to go on the trip and let her ride the bus with her friends. (Synonym)

4. Join each pair of the following sentences: 1×5=5

a) The director selected Reza. He will take care of the house.
b) I went to the mall. I bought some clothes.
c) He was moving the door. The door was green.
d) He must be tired. He has been occupied since daybreak.
e) She had lost much blood. She became unconscious.

5. Write a memo to all the employees notifying the monthly meeting. 8

6. Write minutes of the meeting of the academic committee of the department of Civil Engineering. Agendas of the meeting are: 10

i. Question submission and moderation of semester final exam.
ii. Supervision of the Rag Day program.

iii. Organising workshop on career counseling.

iv. Recruitment of new faculty member.

7. Complete the following story adding a suitable title (150-180 words): 10

Shortly after my education at college was finished, I happened to be staying at Paris with an English friend. We were both young men then,…

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Spring -2018
Program: B. Sc. in Civil Engineering

Course Title: Mathematics-II | Course Code: MTH 103
Time: 3.00 Hours. | Full Marks: 150

There are **Eight** questions. Answer any **Six**. All questions are of equal value. Figures in the right margin indicate marks.

1. **(a)** Prove that $21x^2 - 21y^2 + 40xy + 44x + 122y - 17 = 0$ represents a pair of straight lines. Find the point of intersection and the angle between them. **9**

   (b) Reduce the equation of the conic $x^2 - 4xy + y^2 + 8x + 2y - 5 = 0$ to its standard form. **12**

   (c) Find the center of the conic $14x^2 - 4xy + 11y^2 - 44x - 58y + 71 = 0$. **4**

2. **(a)** Define direction cosines and direction ratios of a line. **6**

   (b) Show that the lines whose direction cosines are proportional to **9**

   $$2, 1, 1 \; ; \; 4, \sqrt{3} - 1, -\sqrt{3} - 1 \; ; \; 4, -\sqrt{3} - 1, \sqrt{3} - 1$$

   are inclined to one another at angle $\frac{\pi}{3}$.

   (c) Show that equation of the plane through the point $(-1, 3, 2)$ and perpendicular to the planes $x + 2y + 2z = 5$ and $3x + 3y + 2z = 8$ is $2x - 4y + 3z = -8$. **10**

3. **(a)** Find the equation of the plane through the points $(2, 3, 1)$, $(1, 1, 3)$ and $(2, 2, 3)$. **7**

   (b) Find the equation of the plane through the points $(-1, 1, 1)$ and $(1, -1, 1)$ and perpendicular to the plane $x + 2y + 2z = 5$. **8**

   (c) Find the direction cosines of two lines are connected by the relations **10**

   $$l + m + n = 0 \quad \text{and} \quad 2lm + 2ln - mn = 0.$$

4. **(a)** Find the equation of the straight line that intersect the lines **12**
   $4x + y - 10 = 0 = y + 2z + 6$ and $3x - 4y + 5z + 5 = 0 = x + 2y - 4z + 7$ and passing through the point $(-1, 2, 2)$.

(b) Show that the lines $\frac{x-5}{4} = \frac{y-7}{4} = \frac{z+3}{-5}$ and $\frac{x-8}{7} = \frac{y-4}{1} = \frac{z-5}{3}$ are coplanar. Find their intersection point and the equation of the plane in which they lie. 13

5. (a) If $\vec{A} = \cos xy\ \hat{\imath} + (3xy - 2x^2)\ \hat{\jmath} - (3x + 2y)\ \hat{k}$, then show that the order of differentiation is immaterial, i.e. $\frac{\partial^2 \vec{A}}{\partial y\, \partial x} = \frac{\partial^2 \vec{A}}{\partial x\, \partial y}$. 5

(b) If $\emptyset(x, y, z) = xy^2z$ and $\vec{A} = xz\,\hat{\imath} - xy^2\,\hat{\jmath} + yz^2\,\hat{k}$, find $\frac{\partial^3}{\partial x^2 \partial z}(\emptyset \vec{A})$ at $(2, -1, 1)$. 10

(c) Prove that (i) curl grad $\emptyset = \vec{0}$, (ii) div curl $\vec{A} = 0$. Where $\emptyset$ and $\vec{A}$ are scalar and vector function of position (x, y, z) respectively. 10

6. (a) Define the Gradient, Divergence and Curl. 6

(b) Prove that $\vec{\nabla}^2(\ln|\vec{r}|) = \frac{1}{r^2}$. 9

(c) If $\vec{A} = A_1\hat{\imath} + A_2\,\hat{\jmath} + A_3\hat{k}$, $\vec{B} = B_1\hat{\imath} + B_2\,\hat{\jmath} + B_3\hat{k}$ and $\vec{C} = C_1\hat{\imath} + C_2\,\hat{\jmath} + C_3\hat{k}$ prove that $\vec{A} \cdot (\vec{B} \times \vec{C}) = \vec{B} \cdot (\vec{C} \times \vec{A}) = \vec{C} \cdot (\vec{A} \times \vec{B})$. 10

7. (a) Evaluate $\iint_S \vec{A} \cdot \hat{n}\, dS$ by taking a projection, where $\vec{A} = (x + y^2)\hat{\imath} - 2x\hat{\jmath} + 2yz\hat{k}$ and S is that part of the plane $2x + y + 2z = 6$ which is located in the first octant. 13

(b) If $\vec{F} = 4xz\,\hat{\imath} - y^2\,\hat{\jmath} + yz\,\hat{k}$, evaluate $\iint_S \vec{F} \cdot \hat{n}\, dS$ where S is the surface of the cube bounded by $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$, $z = 1$. 12

8. (a) State Green's theorem in the plane. Verify Green's theorem in the plane for $\oint_C [(3x^2 - 8y^2)\, dx + (4y - 6xy)\, dy]$, Where C is the closed curve of the region bounded by $y = \sqrt{x}$ and $y = x^2$. 12

(b) State Stoke's theorem. Verify Stoke's theorem for $\vec{A}$, Where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and $\vec{A} = (2x - y)\,\hat{\imath} - yz^2\,\hat{\jmath} - y^2z\,\hat{k}$. Also C is its boundary. 13