Uva Wellassa University, Sri Lanka.
End Semester Examination - June 2010
SCT 201-2 Mathematics II

Time : Two (2) hours

Answer all questions.
Calculators are allowed.
Total three (3) pages.

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1) State elementary row operations.

(2 marks)

Use matrix raw operations to solve following problems.

a) A university student wishes to take courses from three degree programs (Science and Technology (SCT), Computer Science and Technology (CST) and Industrial Information Technology (IIT)) for his 2nd year 1st semester academic work. Each SCT course contains one examination, two field visits and three assignments. Each CST course constrains two examinations, one field visit and one assignment and each IIT course contains three examinations , one field visit and two assignments. In his past experience he knows that he will be comfortable to do 10 Examinations, 9 field visits and 13 assignments for a semester.

Use Matrix calculations to determine how many courses in each area to be taken to fulfill his necessity.
(Note:- Students can select or do not select any course as their choice)

(17 marks)

b) A car is running on a circular track, Find the equation of the track if the car passes through the points $(3,-1)$, $(-2,4)$ and $(6,8)$.

(Hints:- 01 The standard equation of a circle is $x^2 + y^2 + Ax + By + C = 0$
02 Derive simple set of linear equations)

(13 marks)

P.T.O

2) In Linear Programming (LP), Explain the word "Linear ".

(2 marks)

a) Agri farm must determine how many acres of strawberry and grapes to plant this year in Nuwara Eliya. An acre of grapes yield 25 tons of grapes and requires 10 hours of labor per week. An acre of strawberry yield 10 tons of strawberry and requires 4 hours of labor per week. All grapes can be sold at 4 million rupees per ton and all strawberry can be sold at 3 million rupees per ton. Seven acres of land and 40 hours per week labors are available. Agriculture department regulations require that at least 30 tones of Strawberry be produced during current year.

How many acres of plant in each type to be farmed in order to maximize the profit.

(15 marks)

b) A farm uses at least 1000kg of special feed daily. It is a mixture of corn and soybean with the following composition.

Feed stuff	Protein	Fiber	Cost(Rs)
Corn	0.15	0.25	5
soybean	0.50	0.10	10

The dietary requirement of the special feed stipulate at least 30% protein and 5% fiber. The farm wishes to determine the daily minimum cost of feed mix.

(15 marks)

P.T.O

3) What is meant by a homogeneous equation.

(2 marks)

a) A tank contains L liters of water and Q_0 kilograms of salt. Water containing a salt concentration of $C\ kgl^{-1}$ flows into the tank at a rate of $r\ ls^{-1}$, and the mixture in the tank flows out at the same rate.

Find $Q(t)$ in terms of L, Q_0, C and r.

If $L = 400\,l$, $Q_0 = 2\,kg$, $C = \frac{1}{100}\left(1 + \frac{1}{2}\sin t\right)\ kgl^{-1}$ and $r = \frac{1}{8}\ ls^{-1}$

i. Find amount of the salt in the tank at any time.
ii. Find the limiting amount of salt in the tank as $t \to \infty$.
iii. Find the long time behavior of the solution is an oscillation about a certain constant level.
iv. Find the oscillation level and the amplitude of the oscillation.

(18 marks)

b) Consider a vibrating system described by the initial value problem

$$u'' + \frac{1}{4}u' + 2u = 0 \quad ; \quad u(0) = 0 \ \text{and} \ u'(0) = 2$$

Find $u(t)$ for any time t.

(16 marks)

P.T.O