The Open University of Sri Lanka
Faculty of Engineering Technology
Bachelor of Industrial Studies Honours (Agriculture) Programme
Final Examination- 2016/2017
AEZ3238 Mathematics for Agriculture

Date   : 13.11.2017
Time   : 1330-1630
Duration   : Three (03) hours

Instructions

- Contains **eight** (08) questions.
- Answer any **six** (06) questions.
- All questions carry equal marks.

Question 01

a) Find the quotient and remainder of following expression:

$$\frac{x^3+3x+20}{x+1}.$$ [10%]

b) Simplify each of the following algebraic expressions and state whether the simplified expressions are monomial, binomial or multinomial.

I. $6ab + 10ab^2 + 3a^2b - 6ab + 3a^2b - 6a^2b$, [05%]

II. $3y^3 + 2y^2y - 3yy^2 + 5y^2 + 3y$. [05%]

c) Factorize each of the following expressions:

I. $4x^2y + 8xy + 6xy^2$, [10%]

II. $3x^2 - 12y^2$. [10%]

d) Solve the following equations for the indicated variable.

    I. $\dfrac{25x+2}{3} = 4x + 5$ $for\ x$ **[10%]**

    II. $R = \dfrac{u+aR}{a+3t}$ $for\ R$ **[10%]**

e) Solve the following system of linear equations.

$$3x + 5y - z = 3$$

$$5x + 3y + z = 2$$

$$x + 2y + 5z = 1$$

[30%]

f) The value of 3 apples and 5 oranges is 370 rupees. A customer can buy 7 apples and 10 oranges for 780 rupees. Find the value, a customer has to pay when he/she buying two apples and an orange.

[10%]

Question 02

a) Simplify each of the following expressions:

    I. $\dfrac{x}{3x+6} + \dfrac{2}{x+2} + \dfrac{2x+1}{x^2-4}$,   **[10%]**

    II. $\dfrac{x^2-25}{5} \times \dfrac{3x}{x-5} \div \dfrac{x(x+5)}{3x+1}$.   **[10%]**

b) Solve the following quadratic equations.

    I. $3x^2 + 4x + 1 = 0$ use factorizing method,   **[10%]**

    II. $8x^2 + 6x - 5 = 0$ use completing the square method,   **[10%]**

    III. $2x^2 + 9x + 10 = 0$ use quadratic formula .   **[10%]**

c) The equation $f(x) = 3x^2 + 3(k-1)x + 3 = 0$ has real roots.
Find the range of values of k.
If the value of $= 4$, find the values of x when the function $y = f(x)$ intersect the x axis. [30%]

d) A car needs to reach a hospital immediately. The displacement *(d)* of the car is given as $d = 6t^2 + 30t + 5$, where *t is* the time in minutes and the *d* is given in meters. How long does the car taken to reach the nearest hospital which is *305m* away from the car?

[20%]

Question 03

a) Prove the following trigonometric relationships.

    I. $(\sin x - cosec\, x).sinx \,.\,(se\,c^2 x\,) \equiv -1$ [10%]

    II. $(1 - \sin^2 x\,).\tan^2 x \,\equiv \dfrac{1}{cosec^2 x}$ [10%]

    III. $\dfrac{\tan x + \cot x}{cosec\, x.sec x} \equiv 1$ [10%]

b) Convert the following angles given in degrees to radians.

    I. 540^0 [05%]

    II. 20^0 [05%]

    III. 180^0 [05%]

c) Convert the following angles given in radians to degrees.(answer should be rounded to the first decimal place)

    I. $\dfrac{3\pi}{20}$ [05%]

    II. 2π [05%]

    III. $\dfrac{13\pi}{22}$ [05%]

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d) If $\sin \theta = \frac{3}{5}$, find the values of $\tan \theta, \cot \theta, cosec\ \theta\ and\ sec\theta.$ [20%]

e) Evaluate the following values using trigonometric addition formulas.

    I. $\sin 120^0$ [10%]

    II. $cos\ 105^0$ [10%]

Question 04

a) Evaluate each of the limits of the following functions:

    I. $\lim\limits_{x \to \frac{2}{3}} x + 3,$ [10%]

    II. $\lim\limits_{x \to 0} \dfrac{x^7 - x^6 - 5x^4 + 3x^2 + 8x}{5x},$ [10%]

    III. $\lim\limits_{x \to 2} \dfrac{x^2 + 2x - 8}{x - 2}.$
    [10%]

b) Differentiate each of the following functions with respect to x.

    I. $y = 5x^2 + 3$. [05%]

    II. $y = \dfrac{3}{x^3}$. [05%]

    III. $y = (5x + 10)(3x + 3)$. [10%]

    IV. $y = (20x^2 + 5x + 20)^9.$ [10%]

    V. $y = \dfrac{\cos x}{7x + 1}.$ [10%]

    VI. $y = (\sin x + \cos x)(15x^2 + 3).$ [10%]

c) Find the turning point(s) of the function $y = 5x^2 - 2x + 2$ and prove the nature of the turning point(s). [30%]
(Whether a maximum point or a minimum point)

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Question 05

a) Evaluate each of the following integrals:

    I. $\int (5x^2 + 7x + 1)dx,$ [05%]

    II. $\int \left(sin\, x + \frac{1}{x} \right) dx,$ [05%]

    III. $\int (3x + 5)^8\, dx,$ [10%]

    IV. $\int \frac{x-3}{x^2-4}\, dx,$ [10%]

    V. $\int cos\, x(8x + 20)dx,$ [10%]

    VI. $\int_0^2 (x + 20)\, dx.$ [10%]

b) Find the area between the curve $f(x) = 5x^3 + 3x^2 + 2$ and the x- axis over the interval $0 \le x \le 4$.

                                                                  [20%]

c) The current *(i)* in an electric circuit equal to the rate of change of *charge (q)*.
$$i = \frac{dq}{dt}$$
The current in the circuit given as a function of time is $i = 0.2 - 0.5t$,where t is in seconds and i is in amperes .Find the total charge passes in the circuit after 0.1 seconds of time.

                                                                  [30%]

Question 06

a) The mass of a box is 50kg on a planet A. Its gravitational field is 3 times of the earth. Find the weight of the box on the earth.

                                                                  [05%]

After finding the new planet, the box is moved to that planet. Its gravitational field is 2 times of the earth. Find the weight of the box on new planet.
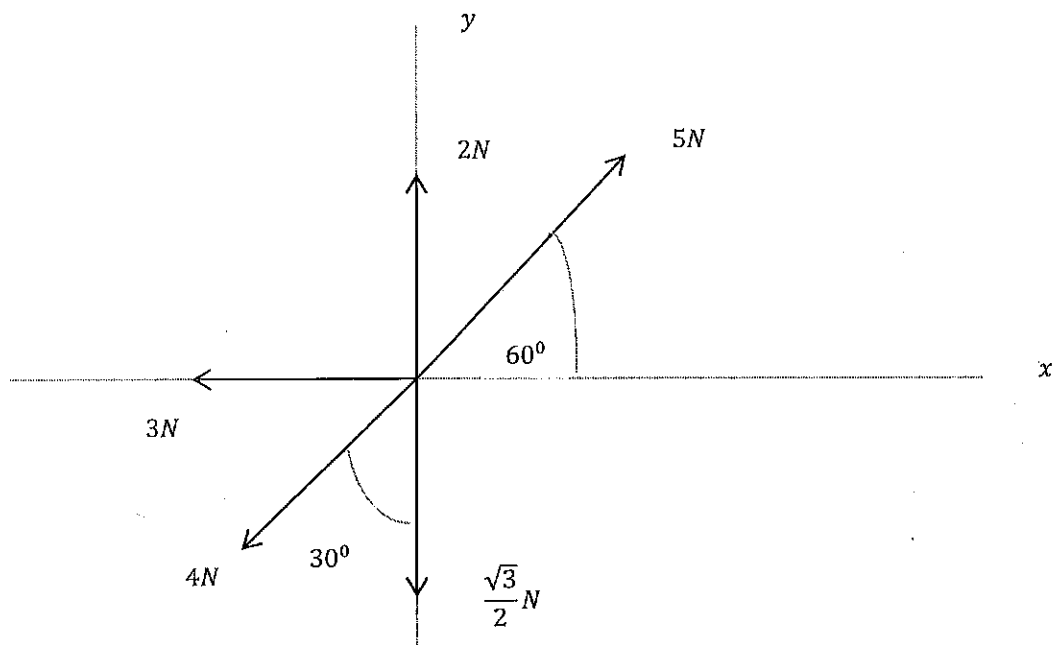(Take gravitational field of the earth as 10ms^{-2})

                                                                   [10%]

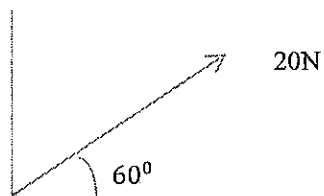b) Force 2N and 3N act on a box have resultant of 6N.Find the angle between the two forces.

[10%]

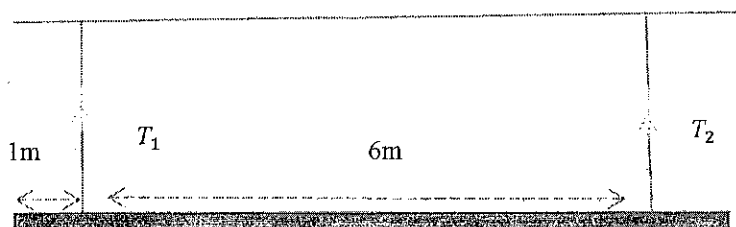c) Find the resultant force of following series of coplanar forces.

[35%]

d) A force of 20N acts on a body as follows.

Find the components in east and north directions.

[10%]

e) A uniform rod of length is 8m and mass is 2kg hung by two threads as shown in the following figure. (take gravitational field of the earth as 10ms^{-2})
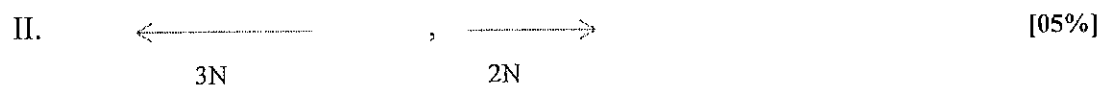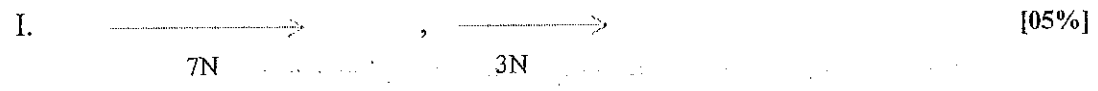

Find the tensions of two threads, T_1 and T_2.

[30%]

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Question 07

a) Find the resultant force of followings.

I. $\xrightarrow{\hspace{2cm}}$, $\xrightarrow{\hspace{1.5cm}}$ [05%]

7N   3N

II. $\xleftarrow{\hspace{2cm}}$, $\xrightarrow{\hspace{1.5cm}}$ [05%]

3N   2N

III. $\xrightarrow{\hspace{2cm}}$, $\xleftarrow{\hspace{2cm}}$ [05%]

10N   10N

b) A uniform beam of 3kg mass and 2m length rests on a horizontal position with support of A and B supporters which are 1m apart. Supporter A gives 10N force upward. Find the length of x. (take gravitational field of the earth as $10ms^{-2}$)
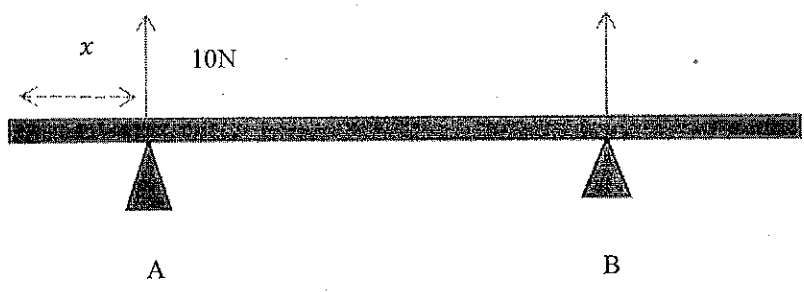
[20%]

c) A 200N force pulls a box along a 5 meter distance of level floor in 5 seconds.

   I.   Find the work done.
   II. Find the power use for the work.
   III. Find the velocity of the box.
   IV. If the momentum of the box is $50kgms^{-1}$ then find the mass of the box.

[40%]

d) A man of mass 80kg is in a lift. What is the contact force between the man and the lifts floor when lift goes upward with $2ms^{-2}$ acceleration? Then what happen to the contact force when lift goes upward with steady speed of $2ms^{-1}$.
(Take gravitational field of the earth as $10ms^{-2}$)

[25%]

Question 08

a) A force acts on a 50kg mass and reduces its velocity from 20ms^{-1} to 5ms^{-1} in 5 seconds. Find the acting force.

[20%]

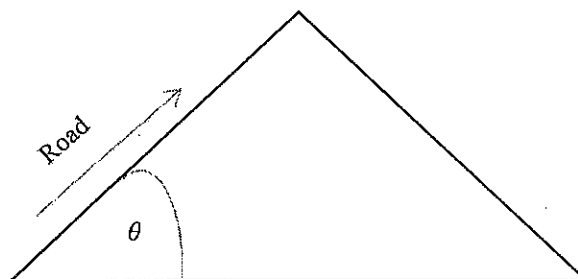b) A box of mass 20kg lifting by a cable. Find the tension of the cable,

    I.   When it is lifted at a steady speed of 5ms^{-1}.

    II.   When it is lifted at an acceleration of 0.2 ms^{-2}.
        (Take gravitational field of the earth as 10ms^{-2})

[30%]

c) A car of mass 500kg has broken down on a road. The coefficient of friction between the car and the road is 0.6. A truck can use only maximum 3800N force to pull it. Will the truck able to pull it? Prove your answer. (take gravitational field of the earth as 10ms^{-2})

[20%]

d) A car of 500kg mass travelling with 60ms^{-1} speed to the top of a hill. The road is θ angle to the horizontal. After travelling 600m its speed has reduced to 40ms^{-1}. How much energy lost on the hill? (Take gravitational field of the earth as 10ms^{-2} and $\sin \theta = \frac{1}{10}$)

[30%]

............END............

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