Shahjalal University of Science and Technology, Sylhet
1st Year 1st Semester Final Examination, 2015 (Session: 2014-2015)
Subject: Mathematics; Course No.: MAT 103I; Course Title: Calculus and differential equation.
Marks: 70                        Credits: 3.0                        Time: 3 Hours
Answer any FIVE questions.Taking at least TWO from each of the following groups.All questions carry equal marks.

## Group-A

**Question 1** Marks: 5+5+4=14

a) Define a function of real variable. Find the domain, range and sketch the graph of the following functions: (any two)

(i)   $f(x) = \frac{|x|}{x}$;  (ii)  $f(x) = \tan x$;   (iii) $f(x) = 2 + \sqrt{x-1}$.

b) Define continuity of a function f(x) at a point. Test the continuity of the function f(x) at $x = \frac{3}{2}$, where

$$f(x) = \begin{cases} 3 + 2x & when -\frac{3}{2} \le x < 0 \\ 3 - 2x & when\ 0 \le x \le \frac{3}{2} \\ -3 - 2x & when\ x \ge \frac{3}{2}. \end{cases}$$

c) Let $f(x) = \frac{x^2 - 16}{x - 4}$ and g(x) = x+4. Are the functions identical? Give reasons for your answer.

**Question 2** Marks: 5+5+4=14

a) Define differentiability of a function f(x) at apoint. Determined whether the function f(x) is differentiable at x=1 or not. where

$$f(x) = \begin{cases} x^2 + 1 & when\ x \le 1 \\ 2x & when\ x > 1. \end{cases}$$

b) If $y = ax \sin x$, then show that $x^2 y_2 - 2xy_1 + (x^2 + 2)y = 0$.

c) Find the nth derivative of the function $f(x) = x^2 e^{2x}$ using Leibnitz Theorem of derivative.

**Question 3** Marks: 5+5+4=14

a) State Rolle's Theorem. Verify Rolle's Theorem for the function $f(x) = x^3 - x^2 - 4x + 4$.

b) Expand $f(x) = e^x \cos x$ in a finite series in power of x with the remainder in Lagrange's form.

c) If $u = \log r$ and $r^2 = x^2 + y^2 + z^2$, then prove that $r^2(u_{xx} + u_{yy} + u_{zz}) = 1$

Question 4. Marks: 5+5+4=14

a) Define the definite integral as the limit of a sum. Use it to evaluate $\int_a^b x^3\ dx$.

b) Evaluate $\lim_{n \to \infty} \left\{ \left(1 + \frac{1}{n^2}\right)^{\frac{1}{n^2}} \left(1 + \frac{1}{n^2}\right)^{\frac{4}{n^2}} \left(1 + \frac{1}{n^2}\right)^{\frac{6}{n^2}} \cdots \left(1 + \frac{1}{n^2}\right)^{\frac{2n}{n^2}} \right\}$

c) Obtain a reduction formulafor $\int (\sin x)^n\ dx$.

# Group-B

Question 5 Marks: 9+5= 14

a) Evaluate any three of the following integrals:

(i) $\int \frac{7x-9}{x^2-2x+35} dx$; (ii) $\int \frac{2\sin x+3\cos x}{3\sin x+4\cos x} dx$

(iii) $\int e^{ax} \sin bx \, dx$ ; (iv) $\int \frac{(x+1)}{(x-1)^2(x+2)^2} dx$.

b) Define improper integral. Show that $\int_0^\infty \frac{x}{(x^2+a^2)(x^2+b^2)} dx = \frac{1}{a^2-b^2} \log \frac{a}{b}$ ; $(a, b > 0)$

Question 6. Marks: 5+5+4=14

a) Define gamma and beta function. Show that:

(i) $\lceil(n+1) = n\lceil(n)$;

(ii) $\beta(m,n) = 2\int_0^{\frac{\pi}{2}}(\sin x)^{2m-1}(\cos x)^{2n-1} dx$.

b) Find the area of the region between the curve $y = 4 - x^2$ , $0 \le x \le 3$ and the x-axis.

c) Find the length of the curve $= \frac{4\sqrt{2}}{3}x^{3/2} - 1$, $0 \le x \le 1$.

Question 7. Marks: 5+5+4=14

a) Define order and degree of a differential equation. Form the differential equation for the curve y= $A\cos x + B \sin x$. What is order and degree of obtained differential equation?

b) Define integrating factor. Solve the initial value problem $x \sin y \, dx + (x^2 + 1)\cos y \, dy = 0, y(1) = \frac{\pi}{2}$.

c) Define homogeneous differential equation. Solve the initial value problem $(y+\sqrt{x + y^2})dx - x \, dy = 0 , y(1) = 0$.

Question 8. Marks: 7+7=14

a) Using the method of undetermined co-efficient solve:

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3y = 2e^x \quad 10 \sin x.$$

b) Using the method of variation of parameters solve:

$$\frac{d^2y}{dx^2} + y = \cot x .$$

END

Shahjalal University of Science & Technology, Sylhet
**Department of Biochemistry and Molecular Biology**
4<sup>th</sup> **Year 2<sup>nd</sup> Semester** B. Sc. (Hons) Final Examination, 2014
Course No: **BMB-430** Course Title: **Virology**
Credit: **3.0** Total Marks: **70** Time: **3** Hours

*Instructions:*
- *Number in the right side indicates the marks of the question.*
- *Marks for each question are same.*
- *Answer any two (2) questions from each Part (A and B).*

## Part-A

1. a) What is a virus? How does a virus differ from a normal cell? — 1+2
   b) What are the possible reasons behind the low infectivity of virus? — 3
   c) Define- Multiplicity of infection. Briefly explain the time dependent appearance of different viral components after infection, with figure. — 1+4.5
   d) Explain the "Baltimore classification" of virus based on the nature of viral genome and the pathway leading to the early messenger RNAs. — 6

2. a) Draw a genetic and transcriptional map of the T7 genome with the positions of major gene classes. — 4
   b) What the basic functions do bacteriophage T7 class I-III genes perform? — 6
   c) Explain the transcription dependent T7 DNA entry into the host cytoplasm, with figure. — 5
   d) Write down the difference between Lytic and Lysogenic cycles of bacteriophage? — 2.5

3. a) What is an IRES element? Write some essential features of picornavirus IRES element. What is the role of these conserved elements in picornavirus infection? — 1+3+3
   b) Illustrate the capsid structure of polyomavirus, with figure. — 4.5
   c) Describe the synergism between E6 and E7 protein of papilomavirus in the predisposition of cancer. — 6

4.  a)  What is a reassortant virus? How does the genomic organization of reovirus facilitate reassortant virus formation.   2+3

    b)  Briefly describe the pathway involves in the conversion of double-stranded DNA from retroviral RNA, with figure.   6.5

    c)  Describe the bidirectional DNA replication of herpes virus.   6

5.  a)  What are the different mechanisms of host cell to sense virus infection?   5

    b)  How recognition of virus infection trigger death of the infected cells?   4

    c)  Justify the statement-"Innate immune responses are rapid but non-specific; while adaptive immune responses are long-lasting and highly specific".   4

    d)  Describe the Typically pathogenesis curve of virus infection.   4.5

6.  a)  What are interferons? Why are they considered as the first line of defense against viral infection.   1+2

    b)  Briefly explain the role of Double-stranded RNA-dependent protein kinase in resisting viral multiplication.   3

    c)  Write short note on the following types of vaccines-   1.5X3
        i. Subunit vaccine  ii. Chimeric vaccine   iii. VLP vaccine

    d)  Define- IC50 and SI. Describe the mechanism of action of acyclovir. Despite the same mode of action, why does ganciclovir have a lower SI than acyclovir?   2+3+2

**Shahjalal University of Science & Technology, Sylhet**
**Department of Biochemistry and Molecular Biology**
B. Sc. (Hons) 4th Year 2nd Semester Final Examination, 2014
**Course No. : BMB -432 Course Title: Nutritional Biochemistry**
Credit: **3** Total marks: **70** Time: **3** hours

*Instructions: Answer any two (2) questions from each Part (A and B).*

## Part –A

1. a) What are the physiological energy value of carbohydrate, protein, fat and alcohol?  2.0
   b) Define BMR. Discuss the factors affecting BMR.  5.0
   c) What do you understand by SDA (specific dynamic action)? What are the factors responsible for high SDA of protein?  3.5
   d) What is Respiratory quotient (RQ)? Show RQ of different types of food stuff.  4.0
   e) Name down some equipments used for indirect colorimetric and non-colorimetric methods of measuring energy expenditure.  3.0

2. a) How can you measure the energy value of food by using Bomb Calorimeter? Discuss it with figure.  5.0
   b) Describe the acute phase management of severe malnutrition.  3.5
   c) Write down 2 features of oedematous malnutrition.  2.0
   d) Although cow's milk is high in protein and several minerals still for a child, mother's milk is superior over cow's milk. Why?  5.0
   e) What are the main difference between human milk fat and animal milk fat?  2.0

3. a) Shortly write about some common weight-loss surgeries to treat severe obesity.  5.0
   b) The biggest risk factor for developing diabetes is being overweight, but not all body fat is created equal. So why are "apple" shaped people more at risk than "pears"?  2.0
   c) How edible fat should be chosen to maintain a healthy life?  2.5
   d) Recommend a diet and nutrition chart for the patients of following diseases—  5.0
      i) Atherosclerosis
      ii) Liver diseases.
   e) Give some tips to avoid consuming carcinogens while cooking.  3.0

## Part-B

4. a) What are the metabolic changes occur in our body during fasting sate? Show with a figure.  5.0
   b) What is the relation between protein phosphatase and well feed state? What are the types of fuel your body use during aerobic and anaerobic exercise?  2.5+3.0
   c) How fetal requirement do changes the metabolism during pregnancy period?  3.0
   d) What are the importances of growth monitoring? How different shapes of growth curve act as an indicator of child health condition?  4.0

5. a) Explain that the thiamin, biotin, folic acid and niacin serve as coenzyme.  4.0
   b) Briefly discuss the role of vitamins as antioxidant.  3.0
   c) What are the fat soluble and water soluble vitamins? What are the differences between them?  3.0
   d) Doctor suggest low-protein containing food intake for kidney patients, why?  3.0
   e) Describe the role of Vitamin A on vision. What is the effect of Vitamin D absorption on calcium metabolism in our body?  2.0+ 2.5

6. a) Write down the functions and deficiency symptoms of Ca, Mg and Se.  6.0
   b) How omega 3 fatty acids reduce the risk of cardiovascular disease?  3.0
   c) Write short note on Marasmus and Kwashiorkor.  4.5
   d) What do you mean by mutual supplementation of a protein? Explain it with an  4.0