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17 SEP 2020

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EXAMINATION

THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF HEALTH SCIENCES
DEPARTMENT OF PHARMACY
ACADEMIC YEAR 2019/2020 – SEMESTER I

BACHELOR OF PHARMACY HONOURS
FMU3206 – ESSENTIAL MATHEMATICS FOR PHARMACY
FINAL EXAMINATION
DURATION: TWO HOURS

Date: 17.09.2020	**Time: 1.30 p.m. – 3.30 p.m.**

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IMPORTANT INSTRUCTIONS/ INFORMATION TO CANDIDATES

- **Formula Sheet** Attached (page 2)
- This question paper (09 pages) consists **04 Structured Essay Questions;**
  total marks awarded = **200**
- Write answers **ONLY** within the space provided
- Write your Index Number in the space provided.
- Do not remove any page/part of this question paper from the examination hall.
- Mobile phones and any other electronic equipment are **NOT** allowed. Leave them outside.
- Write down all relevant steps; marks will be awarded accordingly
- Non – programmable calculator is allowed.

Formula Sheet

Trigonometry

$\sin(A+B) = \sin A \cdot \cos B + \cos A \cdot \sin B$ ------(1)

$\cos(A+B) = \cos A \cdot \cos B - \sin A \cdot \sin B$ ------(2)

$\sin 2A = 2\sin A.\cos A$; $\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$

$\sin(-\theta) = -\sin\theta$; $\cos(-\theta) = \cos\theta$

Logarithms

(i) $\log_m A + \log_m B = \log_m AB$ *(ii)* $\log_m A - \log_m B = \log_m A/B$

(ii) $\log_m A^n = n \log_m A$ *(iii)* $\log_m m = 1$

(v) $ln_a\, b = \frac{ln_m\, b}{ln_m\, a}$ *(vi)* $ln_b a = \frac{1}{ln_a b}$

Differentiation

(i) $y = ax^{n-1}$; $\frac{dy}{dx} = anx^{n-1}$; *(ii)* $y = \sin ax$; $\frac{dy}{dx} = a\cos ax$

(iii) $y = \cos ax$; $\frac{dy}{dx} = -a\sin ax$ (iv) $y = e^{ax}$; $\frac{dy}{dx} = ae^{ax}$

(v) $y = \ln ax$; $\frac{dy}{dx} = \frac{1}{x}$ (vi) $y = a(b+cx)^n$ $\frac{dy}{dx} = n.a(b+cx)^{n-1}\frac{d}{dx}(b+cx)$

(vii) product; $y = uv$; $\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$; (viii) quotient; $y = \frac{u}{v}$; $\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

Integration

(i) $\int \sin a\theta d\theta = -\frac{\cos a\theta}{a}$ (ii) $\int \cos a\theta d\theta = \frac{\sin a\theta}{a}$ (iii) $\int e^{ax}\, dx = -\frac{e^{ax}}{a}$

(iv) $\int \frac{1}{x} dx = \ln x$ (v) $\int \frac{f^1(x)}{f(x)} dx = \ln f(x)$ (vi) $\int ax^{n+1} = a\frac{x^{n+1}}{n+1}$

(vii) $\int udv = uv - \int vdu$ (by parts) (viii) $\int \frac{c}{(a-x)(b-x)} dx$ an example involving partial fractions

Definite Integration

$$\int_a^b f^1(x) = [f(x)]_a^b = f(a) - f(b)$$

Answer all questions.

1. (a) Simplify and express your answer in the complex number $a + ib$ form,

$$(3i)^2 + i(2 + i) - (2 - i)^2$$

(12 marks)

(b) Solve for x if

(i) $\log_4 64 = x$

(ii) $\log_4 x = 3$

(iii) $5^{x+1} = 625$

(iv) S (distance), is a function of time, expressed as $S = f(t) = ut + \frac{1}{2}ft^2$ where u is the initial velocity and f is the acceleration. If $u = 20$ km / h, $f = 8$ km / h^2, calculate S after 30 minutes.

(18 marks)

(c) (i) Prove that $\log_a b = \dfrac{1}{\log_b a}$

(ii) Evaluate (using $\log_{10}$ features ONLY) $log_5 8 + log_8 5$

(iii) **Without the aid of a calculator or log tables**, evaluate the following:

$$\frac{log_3 81 + log_5 125}{log_4 \sqrt{64}} - [\log_{10}(0.01)^2]$$

(24 marks)

(d) Solve for x:

(i) $2x^2 + x + 1 = 0$

(ii) $49x^2 - 9 = 0$

(iii) Simplify $(a + b)^2 - (a - b)^2 - 4ab$

(iv) Given $\frac{x-3}{(x-2)^2} = \frac{A}{x-2} + \frac{B}{(x-2)^2}$ determine A and B using your knowledge of partial fractions.

(20 marks)

(e) (i) Given that cos (A+B) = cosAcosB – sinAsinB, **show that**

$$\cos 2A = 1 - 2\sin^2 A$$

(ii) Prove that $\sec\theta - \tan\theta = \dfrac{\cos\theta}{1+\sin\theta}$

(16 marks)

2. The concentration of a KOH solution is given as 1.5×10^{-5} mol cm^{-3}

(i) Express the above concentration in SI units

(ii) Express the concentration in terms of molarity (M)

(iii) Determine the mass of KOH required to prepare 100 cm^3 of this solution (K = 39, O = 16; H = 1)

(iv) Determine the number of moles of a substance, A, present in 250.0 ml of a solution of A whose strength is 4.0 mol dm^{-3}

(v) 250 ml of a 10% V/V solution of methyl salicylate in alcohol is diluted to 750 ml. Calculate the strength of the resulting solution in %V/V

(36 marks)

(b) A student prepares an aqueous solution of salt by dissolving 120 g of salt in 360 g of water.

(i) Determine the water: salt ratio in this solution

(ii) If the above ratio is to be altered such that the new ratio is 5:2, determine the amount of salt to be added to the same amount of water

(20 marks)

3. (a) Find the limit of $\frac{x^2-4x+3}{x-1}$ as x --> 1

(06 marks)

(b) Find the first differential:

(i) $y = \sin 3\theta$

(ii) $u = e^{-3x} + \ln 2x$

(iii) $y = \frac{2-x}{2+x}$

(iv) $y = \sqrt{x} + \frac{1}{\sqrt{x}}$

(v) $y = (3-2x)^9$

(30 marks)

4. Integrate:

(i) $\int \frac{2x-3}{(x-1)(x-2)} dx$

(ii) $\int \left(\sqrt{x} + \frac{1}{2x}\right) dx$

(iii) $\int [e^{2x} + sin2x] dx$

(18 marks)