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আন্তর্জাতিক ইসলামী বিশ্ববিদ্যালয় চট্টগ্রাম
الجامعة الإسلامية العالمية شيتاغونغ
International Islamic University Chittagong
Department of Civil Engineering (CE), FSE

END-OF-SEMESTER EXAMINATION
SEMESTER SPRING 2022 SESSION

Programme : BSc. in Civil Engineering Level of Study : UG

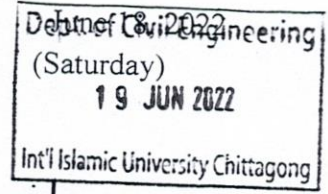
Time : ~~8:30-11:00am~~
2:00 - 4:30 pm Date

Duration : Two hours and thirty minutes

Course Code : MATH-1105

Section(s)

Course Title : Differential & Integral Calculus



This Question Paper consists of **Four (4)** Printed Pages (Including Cover Page) with **Five (5)** Questions in two parts (there are two Questions in **Part A** and three Questions in **Part B**, respectively).

USE SEPARATE ANSWER SCRIPT FOR EACH SECTION.

INSTRUCTION(S) TO CANDIDATES

DO NOT OPEN UNTIL YOU ARE ASKED TO DO SO

- Total mark of this examination is **100**.
- This examination is worth **50%** of the total course assessment.
- Answer **ALL Questions**.
- Only approved calculator with 'CE- approved' sticker is allowed (non-programmable and non-graphical).
- Marks assigned to each question are listed in the margin.

Any form of cheating or attempt to cheat is a serious offence, which may lead to dismissal.

All electronics gadgets are prohibited in the exam hall/venue.

(e.g. mobile/smart phones, smart watches, and smart glasses)

Part A: 40 Marks
Answer All Two (2) Questions

QUESTION 1 (20 Marks)

- a) Discuss critical point and saddle point. (02)
- Calculate the maximum and minimum values of the following functions: (08)
- i) $f(x) = 6x^3 - 4x^2 + 5x + 10$ (4 marks)
- ii) $f(x) = 4x^3 - 15x^2 + 12x - 30$ (4 marks)
- b) For the function $f(x, y) = 4x^2 + 9y^2 + 8x - 36y + 24$, find the critical points (10)
and classify them as minima, maxima, or saddle points.

QUESTION 2 (20 Marks)

- a) Discuss Partial Derivatives. If $U = 2x^5 - 3x^2y^3 + 7y^5z^3 + 3z^3 + 20$, evaluate the (10)
followings: $\frac{\delta^2 u}{\delta x^2}$, $\frac{\delta^2 u}{\delta y^2}$, $\frac{\delta^2 u}{\delta z^2}$
- b) If $Z = x^2 \tan^{-1}\left(\frac{y}{x}\right) - y^2 \tan^{-1}\left(\frac{x}{y}\right)$ show that $\frac{\partial^2 z}{\partial y \partial x} = \frac{x^2 - y^2}{x^2 + y^2}$ (10)

OR

QUESTION 2 (20 Marks)

- a) Discuss homogenous function with example. State and prove Euler's theorem on (08)
homogeneous function.
- b) Show that, $u(x, y) = 2x^3 + 5xy^2 + 4y^3$ is equation of 3rd degree by using Euler's (06)
theorem on homogeneous function.
- c) If $U = e^{xyz}$, then show that $\frac{\partial^3 u}{\partial x \partial y \partial z} = e^{xyz}(1 + 3xyz + x^2y^2z^2)$ (06)

Please turn over

Part B: 60 Marks
Answer All Three (3) Questions

QUESTION 3 (20 Marks)

- a) Discuss Integration with examples. Discuss different types of integral. (05)
- b) Evaluate the following Integrals: (15)
- (i) $\int \ln(x) dx$ (5 marks)
- (ii) $\int \tan^{-1}x dx$ (5 marks)
- (iii) $\int x^2 \sin x dx$ (5 marks)

QUESTION 4 (20 Marks)

- a) Discuss Multiple Integral. Evaluate the double integral (10)
- $$I = \int_2^4 \int_{x^2}^{x^2+1} xy dx dy$$
- b) Evaluate the triple integral, $I = \int_1^3 \int_2^4 \int_0^2 (2xyz + 3y^2z + 5) dz dy dx$ (10)

QUESTION 5 (20 Marks)

- a) Discuss Gamma function and Beta function with examples (04)
- b) Evaluate the followings:
- i) $\int_0^{\infty} x^5 e^{-6x} dx$ (8 marks) (16)
- ii) $\int_0^2 x^4 (8 - x^3)^{-1/3} dx$ (8 marks)

OR

Please turn over

QUESTION 5 (20 Marks)**a)** Evaluate the followings:

(i) $\int_3^5 x e^x dx$ (6 marks) (12)

(ii) $\int_1^3 e^{2x^3+4x-10} (6x^2 + 4) dx$ (6 marks)

b) Evaluate

$$\int_0^{\pi/2} \sin^7 \theta \cos^9 \theta d\theta$$

END OF PAPER