

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) Find values of the constant k and m (if possible), that will make the function $f(x)$ continuous everywhere. (13 $\frac{1}{3}$)

$$f(x) = \begin{cases} x^2 + 5, & x > 2 \\ m(x+1) + k, & -1 < x \leq 2 \\ 2x^3 + x + 7, & x \leq -1 \end{cases}$$

- (b) Find the limit, $\lim_{x \rightarrow 0} \left(\frac{1}{x^2} - \frac{\cos 3x}{x^2} \right)$. (10)

2. (a) If $y = \cos\{\ln(1+x)^2\}$, then prove that $(1+x)^2 y_{n+2} + (2n+1)(1+x)y_{n+1} + (n^2+4)y_n = 0$. (10)

- (b) Let $f(x) = x^4 - 5x^3 + 9x^2$. Find the intervals on which (i) f is increasing and those on which f is decreasing, (ii) f is concave up and those on which f is concave down.

- Also (iii) find the relative extrema of each stationary point. (13 $\frac{1}{3}$)

3. Carryout the following:

(a) $\int \cot^{-1}(1-x+x^2) dx$ (8)

(b) $\int e^x \frac{1-\sin x}{1-\cos x} dx$ (8)

(c) $\int (3x-2)\sqrt{x^2-x+1} dx$ (7 $\frac{1}{3}$)

4. (a) Evaluate, $\lim_{n \rightarrow \infty} \left[\frac{1}{n} + \frac{\sqrt{n^2-1^2}}{n^2} + \dots + \frac{\sqrt{n^2-(n-1)^2}}{n^2} \right]$. (7)

(b) Evaluate, $\int_3^5 \frac{dx}{x^2 \sqrt{x^2-9}}$. (8)

- (c) Find the area of the region bounded by the asteroïd, $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$. (8 $\frac{1}{3}$)

MATH 103/URP**SECTION – B**

There are **FOUR** questions in this section. Answer any **THREE** questions.

5. (a) Form the differential equation of the curve $y = A\cos 3x + B\sin 3x$ by eliminating arbitrary constants A and B. (8)

(b) Find a curve in the xy -plane that passes through (0, 3) and whose tangent line at a point (x, y) has slope $2x/y^2$. (8 $\frac{1}{3}$)

(c) Solve the differential equation $(1+x)y' + y = \ln x$ subject to the initial condition $y(1) = 10$. (8)

6. (a) Solve: $\frac{dy}{dx} = e^{\sqrt{(x+2y-1)}}$. (7)

(b) Solve: $x^2 \frac{dy}{dx} - 2xy = 3y^4$. (8 $\frac{1}{3}$)

(c) The population of a community is known to increase at a rate proportional to the number of people present at time t . If an initial population P_0 has doubled in 5 years, how long will it take to triple? (8)

7. (a) Find the fundamental solution of the differential equation (8)

$$\frac{d^4 y}{dx^4} + \frac{d^3 y}{dx^3} + \frac{d^2 y}{dx^2} = 0.$$

(b) Find a differential operator that annihilates the function $f(x) = 7 - xe^{2x} + \sin x$ and hence solve the differential equation, $y'' + 3y = f(x)$. (15 $\frac{1}{3}$)

8. (a) Solve: $x^4 \frac{d^4 y}{dx^4} + 6x^3 \frac{d^3 y}{dx^3} + 9x^2 \frac{d^2 y}{dx^2} + 3x \frac{dy}{dx} + y = 0$. (11)

(b) Solve the following differential equation: (12 $\frac{1}{3}$)

$$x^2 \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} + 2y = x^4 e^x$$

by the method of variation of parameter.

SECTION – A

There are **FOUR** questions in this section. Answer **Q. No. 1** and any **TWO** from the rest.

1. Write short notes on followings (Use necessary sketches): **(3×10=30)**
 - (a) Scale and Proportion
 - (b) Form and Shape
 - (c) Path Space Relationship

2. "Architecture is generally conceived, designed, realized and built in response to an existing set of condition" – Francis D.K. Ching. Briefly define the meaning of Architecture according to this perspective of D.K. Ching. **(20)**

3. How does the vertical and horizontal elements as space defining elements affect the visual and spatial continuity in relation to the human scale? Explain with appropriate sketches. **(20)**

4. What are the critical factors for deciding any organisation type? Briefly discuss the organisation type of National Assembly Building, Dhaka. Use necessary sketches. **(20)**

SECTION – B

There are **FOUR** questions in this section. Answer **Q. No. 8** and any **TWO** from the rest.

5. Briefly discuss about the city planning layout of Indus-valley civilization. How does it differ from ancient Greek cities? **(8+12=20)**

 6. "Roman Architecture is a manifestation of extensive construction system" – justify this statement with respect to Roman amphitheatre. **(20)**

 7. Write down the design guidelines for warm-humid climate and justify them with relation to the climatic components. Use sketches/diagrams where necessary. **(20)**

 8. Write short notes on any TWO of the followings: **(15×2=30)**
 - (a) Stonehenge
 - (b) Optical corrections in Greek Architecture
 - (c) Impressionism
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SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) What is cartography? Describe the scope of cartography for an urban planner. (7)
- (b) Describe the different types of scales used in map making with their respective benefits and drawbacks. (13)
- (c) Map preparation involves the issue of generalization, simplification, and abstraction. What are the common tasks for these issues? Describe with the appropriate illustrations. (15)

2. (a) Define map. What are the objectives of map preparation? (7)
- (b) Explain various types of map elements with relevant examples and illustrations. (13)
- (c) What is RTK survey? Discuss the components, advantages, disadvantages, and major source of errors in RTK survey. (15)

3. (a) What do you understand by geodesy? Explain and illustrate the relationship between geoid height, ellipsoidal height, and orthometric height. (7)
- (b) What is flight planning? Describe the basic elements and steps of flight planning with contextual illustrations and examples. (13)
- (c) Critically analyze the map projection types based on distortion. How do we balance distortion with the purpose of map users? (15)

4. Write short notes on the followings: (5×7=35)
 - (a) Control segment of GPS.
 - (b) Types of Aerial Photographs.
 - (c) Ellipsoid and Datum.
 - (d) Cartogram.
 - (e) Advantages of aerial photogrammetry.

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SECTION – B

There are **FOUR** questions in this section. Answer any **THREE** questions.

5. (a) BUET is planning to develop a new campus on about 95 acres of land in the Purbachal area. Discuss which traditional survey techniques you would propose to apply and what maps you would produce to help the planning and construction process. You need to provide the rationale for your proposal. (25)
- (b) Define Reduced Bearing (RB) and Whole Circle Bearing (WCB). Show the relationship between RB and WCB using a diagram and a table. (10)
6. (a) Compare Chain Survey and Traverse Survey. (15)
- (b) To test the line of collimation of a Dumpy Level, the instrument was placed exactly mid-way between two points A and B, 50 m apart on a large ground. The staff readings at A and B were 2.23 m and 3.52 m respectively. The instrument was then placed at S, 20 m behind A in the same straight line and staff reading at A and B were 0.98 m and 2.20 m respectively. (3+5+12=20)
- (i) Is the line of collimation in adjustment?
- (ii) If not, is it inclined upwards or downwards?
- (iii) What should be the staff reading at A and B when the level is adjusted and placed at S?
7. (a) Compare orientation by trough compass and back sighting methods based on their processes and their advantages and disadvantages. (18)
- (b) Explain how chaining is done when obstructed by hill or ridge. (17)
8. Write notes on any TWO of the following topics: (17 ½ × 2 = 35)
- (a) Centering of a plane table
- (b) Tie line and check line
- (c) Methods of plotting traverse.
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The figures in the margin indicate full marks.

Symbols indicate their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Consider the economy of Bangladesh. The investment function is

(20)

$$I = I_n [MPK - (P_k/P) (r + \alpha)] + \alpha K$$

Where, I = Investment,

MPK = Marginal product of capital,

α = Depreciation rate,

P_k/P = Relative price of a capital good,

r = Real interest rate.

Based on the above investment function, answer questions (i) and (ii)

(i) What is the effect of a decrease in the MPK on the investment function? Show graphically and mathematically.

(ii) What is the effect of a decrease in the real interest rate on the investment function? Show graphically and mathematically.

- (b) According to Friedman's permanent-income hypothesis (PIH), if the marginal propensity to consume (MPC) out of permanent income equals 0.8 and current income equals \$65,000 (of which \$6,000 is transitory income), then what should be the amount of consumption?

(15)

2. Suppose the following equations describe the economy of Bangladesh.

$$Y = C + I + G$$

$$C = 100 + 0.75 (Y - T)$$

$$I = 300 - 10 r$$

$$(M/P)^d = Y - 50 r$$

$$G = 500$$

$$T = 400$$

$$M = 6,000$$

$$P = 8$$

Where, Y = Output, G = Government expenditure, T = Taxes, M = Money supply, P = Price level, $(M/P)^d$ = Money demand and r = Real Interest rate.

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Contd ... Q. No. 2

- (a) For this economy, derive the IS (goods market equilibrium) and LM (money market equilibrium) equations and graph the IS and LM curves on an appropriately labeled graph. (20)
- (b) What are the equilibrium level of income and the equilibrium interest rate? (15)
3. (a) Explain the impact of an increase and a decrease in the money supply in the short run and in the long run. Use the concept of aggregate demand, short run aggregate supply and long run aggregate supply to describe your answer. (20)
- (b) When real Gross Domestic Product (GDP) declines during a recession, what typically happens to consumption, investment, output and the unemployment rate? (15)
4. (a) Use the IS-LM diagram to describe both the short-run effects and the long-run effects of the following changes on national income, the interest rate, the price level, consumption, investment, and real money balances. (20)
- (i) A decrease in government purchases
- (ii) A decrease in taxes
- (b) What are the effects of "cost push inflation" and "demand pull inflation" on the output and price level considering other things remaining constant? Which one is relatively better for the economy? (15)

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Explain how we can measure gross domestic product (GDP) in expenditure approach. (10)
- (b) Distinguish between natural unemployment and cyclical unemployment. (10)
- (c) Given the information below, (15)

Year	Price of Oil	Quantity of Oil	Price of Sugar	Quantity of Sugar
2019	\$10	50	\$15	40
2020	\$15	95	\$18	75
2021	\$20	115	\$27	90

- (i) Calculate nominal and real GDP of year 2019, 2020 and 2021 considering 2019 as base year.
- (ii) Calculate the GDP deflator of year 2019, 2020 and 2021. Find the inflation rate of year between 2020 and 2021.

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6. (a) Define different measures of money. Briefly explain different functions of money. (10)
(b) Critically explain how the central bank influences money supply of a country. (15)
(c) "Even if inflation is always and everywhere a monetary phenomenon, the end of hyperinflation is often a fiscal phenomenon as well." Explain the statement. (10)
7. (a) Briefly explain the basic quantity theory of money. (10)
(b) What is crowding out effect? How can government spending crowd out private investment? Explain. (15)
(c) Suppose government takes a policy to rebate tax on investment in small and medium cottage industry. Discuss the impact of this policy on loanable fund market. (10)
8. Explain the current macroeconomic situation of Bangladesh in comparison with other South Asian countries considering the following macroeconomic variables: (35)
- (a) Gross Domestic Product (GDP) growth rate
 - (b) Size of the Gross Domestic Product (GDP)
 - (c) Inflation rate
 - (d) Government Expenditure
 - (e) Remittance
 - (f) Budget deficit
 - (g) National debt
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