

**Question Bank**  
**B.Sc. Economics Honours**  
(Covering the syllabi under the University of Calcutta)

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**Paper-IA**  
**Microeconomic Principles**

**Section A**

**Marks-4**

**Unit 1: The Economic Way of Thinking**

1. Describe some of the trade-offs by each of the following
  - i. A family deciding whether to send their son abroad for higher study.
  - ii. A recent college graduate deciding whether to take admission in master programme.
2. You are asked to go for watching cricket match by your friend instead of studying at the library. What is the opportunity cost of watching cricket? match?
3. The Social Security system provides income for people over age 65, if a recipient of Social Security decides to work and earn some income, the amount he or she receives in Social Security benefits is typically reduced.
  - i. How does the provision of Social Security affect people's incentive to save while working?
  - ii. How does the reduction in benefits associated with higher earnings affect people's incentive to work past age 65?
4. Explain whether each of the following government activities is motivated by a concern about equality or a concern about efficiency.
  - i. Introducing food stamp program me for the poor to purchase food free of cost.
  - ii. Introducing seat belt attachment in car while driving.
5. Draw a circular-flow diagram; identify the parts of the model that correspond to the flow of goods and services and the flow of dollars for each of the following activities.
  - i. Sima spends Rs. 3000 for travelling in Darjeeling.
  - ii. Mridule earns Rs. 10,000 for booking a flat.
6. Draw a production possibility frontier for bread and garments and explain its shape.
7. Classify the following topics as related to microeconomics or macroeconomics.
  - i. Mira's decision about how much income to consume.
  - ii. The impact of an increase in investment on national income of the country.
8. Classify each of the following statement as positive or normative and explain why they are positive and normative.
  - i. The government should introduce unemployment benefit.
  - ii. The government increases tax to meet expenditure.
9. Give an example in which both persons have comparative advantage in producing different commodities.
10. If two parties trade on the basis of comparative advantage, then what will be the terms of trade on the basis of which both parties will be benefitted?

## **Unit 2: Market and Adjustment & Unit 3: Market Sensitivity and Elasticity**

1. For each of the following events, what happens to the supply and demand in the market for refrigerator.
  - (i) The workers are getting higher wages.
  - (ii) A new technology is introduced in the factory.
2. Samir has decided to spend one-fourth of his income on clothing.
  - (i) What is her income elasticity of demand?
  - (ii) What is her price elasticity of demand?

## **Unit 4: Government Intervention, Unit 5: Utilitarian Approach &**

### **Unit 6: Markets and Welfare**

1. Which causes a surplus and a deficit in supply of a good – a price ceiling or a price floor?
2. A flood in Kashmir reduces apple supply, what happens to the consumer surplus?
3. What are corrective taxes? Give example.
4. Discuss the Law of Equi-marginal utility.
5. What is the principle of diminishing marginal utility? Explain the relation between marginal utility rule and the law of demand

## **Unit 7: Market Failures, Externalities and Public goods**

1. Explain why economic efficiency is unaffected by changes in property rights?
2. Distinguish between public goods and common property resources.
3. Explain what is meant by the term “free rider”? Can an individual be a free rider while consuming a public good?

### **Section B**

**Marks 6**

#### **Unit 1: Economic Way of Thinking**

1. What is meant by equilibrium at margin?
2. The following table describes the production possibilities of two cities in India.

	No. of trousers per worker per hour	No. of long skirts per worker per hour
West Bengal	4	2
Bihar	2	1

- i. Which state has an absolute advantage and which state has comparative advantage in the production of each garment?
- ii. Will these states trade with each other?

## Unit 2: Market and Adjustment & Unit 3: Market Sensitivity and Elasticity

1. A survey shows an increase in drug use by young people. In the ensuing debate, two hypotheses are proposed.
  - i. Increase in supply of drug.
  - ii. Cut back of expenditure on advertisement on evil effects of drug use.  
Use supply and demand diagrams to show how each of these hypotheses lead to the ultimate result?
2. A price change causes the quantity demanded of a good by 25 percent, while the total revenue of that good decrease by 10 percent. Is the demand curve is elastic or inelastic? Explain.

## Unit 4: Government Intervention, Unit 5: Utilitarian Approach & Unit 6: Markets and Welfare

1. The government has decided that the free market price of cheese is too low.
  - i. Draw a supply-demand diagram to show the effect of government imposed price floor in the cheese market.
  - ii. What is the effect of total revenue of the farmer?
2. If the government places a Rs. 5000 as sales tax on auto rickshaw, will the price paid by the consumer rise by more than, less than or equal to Rs. 50000.
3. Suppose a technological advance reduces the cost of making computers.
  - i. Draw a supply and demand diagram to show what happens to price, quantity, consumers' surplus and producers' surplus in the market for computers.
  - ii. Computers and software are complements, Draw a supply and demand diagram to show what happens to price, quantity, consumer surplus and producer surplus in the market for software.
4. Suppose that a market is described by the following supply and demand equations:
 
$$Q_s = 7p$$

$$Q_d = 200 - p$$
  - i. Solve for the equilibrium price and the equilibrium quantity.
  - ii. Suppose that a tax is imposed on buyers, what happens to the equilibrium
5. You are trying to decide what to order :  
Drinking a lemon juice gives you a marginal utility of 32, while drinking a cup of tea gives you a marginal utility of 27. Say the price of lemon juice is Rs 4 and the price of tea is Rs 3. What will you order and why? What will happen as a result of the good you order? Explain the relation between the behavior of consumer and law of demand?

6. Consider the following total utility schedule:

Quantities consumed	0	1	2	3	4	5	6	7	8	9
Total Utility	0	8	13	17	20	22	23	23	22	20

- i. Draw the TU schedule and derive the MU schedule from it.
- ii. Assume that marginal utility of money is money is 0.5. Plot the demand curve from the MU schedule

- iii. Find the equilibrium quantity Demanded if the price of the commodity is Rs 4 per unit.

### **Unit 7: Market Failures, Externalities and Public goods**

1. There are three industrial firms in Asansol.

Firm	Initial pollution level	Cost of reducing pollution by 1 unit
A	70 units	Rs. 20
B	80 units	Rs. 25
C	50 units	Rs. 10

The government wants to reduce pollution to 100 units, so it gives each firm 50 tradable pollution permits.

- Who sells permits and how many do they sell? Who buys permits and how many do they buy? Explain why the sellers and buyers are each willing to do so.
- What is the total cost of pollution reduction in this situation?
- How much higher would the costs of pollution reduction be if the permits could not be traded?

## **Paper IB**

### **Macroeconomic Principles**

#### **Section A**

**4marks**

- What would be the effect of each of the following on aggregate demand or aggregate supply:
  - A large cut in personal and business tax (on AD).
  - An arms-reduction agreement reducing defense spending (on AD).
  - An increase in potential output (on AS).
  - A monetary loosening that lowers interest rate (n AD).
- Below are some data from a country which is producing only two commodities—Rice and Potato for three different years:

Year	Price of Rice (Per KG)	Quantity of Rice (InKG)	Price of Potato (Per KG)	Quantity of Potato (In KG)
2005	10	100	15	50
2006	10	140	15	75
2007	20	140	22	75

- Now compute Nominal GDP, Real GDP and GDP deflator for each year taking 2005 as base.
  - Compute the change in Nominal GDP and Real GDP for 2006 and 2007.
- Of all adult population of a country, 1 41481000 were employed, 4209000 were unemployed and 78463000 were not in the labour force. Use this information to calculate:

- i) The adult population
  - ii) The labour force
  - iii) The labour force participation rate
  - iv) The unemployment rate
4. In recent decades, women have worked more hours in paid jobs and fewer hours in unpaid housework.
- i) How would this increase in work hours affect GDP?
  - ii) Explain why this change in measured GDP will overstate the true change in output.
5. If  $C = 10 + 0.9 Y$
- i. Find the value of  $S$  when  $Y = 1000$ .
  - ii. In the above case, what will be the value of  $S$ , if MPC becomes half of its original value?
6. 'Along the consumption function income changes more than income'—what does this imply for MPC and MPS.
7. Consider a project that costs Rs. 100 (at period 0) and yields Rs. 50 in period 1 and Rs. 70 in period 2. Will the project be accepted when the rate of interest is 10%? (i.e.  $r=0.1$ ).
8. Suppose the T-account for XYZ bank is as follows:
- | Asset    | Rs.    | Liabilities | Rs.    |
|----------|--------|-------------|--------|
| Reserves | 150000 | Deposit     | 400000 |
| Loans    | 250000 |             |        |
- i. If RBI requires banks to hold only 10% reserve then how much excess reserve XYZ bank holds?
  - ii. If XYZ banks now decides to hold only 10% then how much would the economy's money supply increases?
9. Suppose that all banks are bound to keep 100% reserves. If Rs. 1000 reserves are added to the economy, what will be the net effect of the reserve addition to the money supply in this case?
10. If the rate of interest is 10% and the annual yields for a capital asset (with two year life span) are Rs. 1,100 and Rs. 2,420 for the first and the second period respectively. Is the investment project profitable when the cost of the project is Rs. 2850? What happens when the cost rises to Rs. 3000?

## Section B

6marks

1. a) Explain the GNP measurement from income side and expenditure side.  
b) Why are these two sides equal?
2. What are the basic differences between GDP deflator and CPI?
3. How can Human capital be compared with physical capital when both promote productivity in the economy?
4. Derive the Money Multiplier?
5. What is Consumption Puzzle? Describe the Permanent Income Hypothesis.

6. Explain the Efficiency wage theory.
7. What are the different cost a society bears for inflation?
8. Why investment depends on rate of interest?
9. State Gresham's law. Explain why money supply is unaffected when budget deficit is met by borrowing from the public.
10. "The money supply is equal to the money multiplies (inverse of cash reserve ratio) times the monetary base". Explain and show that for the above statement to be true, we must assume that people are not holding money.
11. Distinguish between the 'relative prices' and 'absolute level of prices'. Which parts of the economy contribute to their respective determinations?

## Paper II A

### Statistics For Economics

#### Unit 1: Data Presentation

#### Section A

**4marks**

L. Classify the following characteristics as either an attribute or variable; if variable, mention whether discrete or continuous:

Size of Agricultural holding , Proportion of girls in a class of 100 students , educational levels of workers in a factory ,colour of flowers in a garden , total values of share sold each day in the stock market ,age of the boy in birthday time, time needed to complete to solve a hard sum , outcomes in rolling a die. (Model)

2. What should be the suitable diagram to represent the data in each case ?

- (a) The daily selling prices of gold in India in a particular week
- (b) The profit and losses of a business concern for a period of 10 years
- (c) Revenue and expenditure of the Central Government for a period of 5 years
- (d) The total production cost and its components of a manufacturing firm in a particular year.
- (e) Share of different institutions in rural credit in three different years
- (f) Growth of GDP in India during last 10 years.
- (g) Relative growth of population in India during the last five census years
- (h) The monthly sales of umbrella of a shop (number of umbrella sold each month differ widely).

3. With suitable examples distinguish between

- (a) Class limits and class Boundaries
- (b) Frequency density and Relative Frequency

4. State with reasons, whether the following statements are 'True' and 'False' :

- (I) To exhibit the population of 5 countries in 1991 diagrammatically the suitable diagram is ratio chart
- (II) Bar diagram is used to exhibit the frequency distribution of religion of persons
- (III) A line diagram shows the absolute change in the value of the variable with the change in time.
- (IV) A Discrete variable assumes only integral values.

5. (a) State with reasons whether the following statements are true or false:

- (I) In any grouped frequency distribution class intervals are of equal width
- (II) A column diagram is suitable for representing the frequency distribution of word length
- (III) Proportion of girls in a class of 100 students in continuous variable
- (IV) Marks obtained by students in Economics in a test is continuous variable.

6. What are the methods of collecting primary data? Which method do you prefer and why??

7. Can you draw Histogram when the class widths are unequal ?

State the cases when the Histogram is used as an efficient technique for representing the data.

8. What kind of diagrammatic representation would you consider appropriate to depict the following facts:

- (I) The monthly sales of cars of a particular firm during 2010
- (II) The mode of a distribution
- (III) The percentage share of each sector in total outlay during tenth five year plan
- (IV) In finding the quartile value of the distribution.

9. What should be the suitable diagram to represent the data in each case ?

- (I) Import and Export of a country during 2000-2001 to 2009-2010
- (II) Monthly family budget of industrial workers of Mumbai
- (III) Zone wise value of sales of 'Big Bazaar' during 2007-2010.
- (IV) Distribution of shops according to the number of wage earners employed at shopping complex .

10. Describe the significance of scrutiny of data.

11. Distinguish between discrete and Continues variable.

12. How will you draw a Histogram to represent a frequency distribution of continuous data.

## Section B

**6marks**

1. Find the value of Q1 from the data by drawing an ogive on a graph paper

Mid-value : 7 14 21 28 35 42

Frequency : 8 18 30 25 15 04.

2. Discuss the problems encountered in the construction of a frequency distribution from a raw data.



3. What is questionnaire ? What are the points to be kept in mind while framing a questionnaire? Mention the disadvantages of Questionnaire method in connection with collection of primary data.

## Unit 2: Central Tendency

### Section A

**4 marks**

1. Why is Harmonic Mean is never greater than the arithmetic mean of a set of observation ? Can they be equal ?

2. Giving suitable reason ,state which among AM,GM,HM,median,mode is the appropriate measure of Central Tendency for the following situation :

- (a) Size of footwear sold in shop
- (b) speed covered in fixed distance
- (c) life in hours of a sample of 80 bulbs
- (d) rate of interest in 5 different ways
- (e) monthly income of advocates in the city

3. State giving reasons how will you calculate mode from following data?

Class:        5-14   15-19   20-29   30-39   40-44   45-49

Frequency:   4        6        10       15       8        2

4. Suppose that in constructing the price index number for a certain year with a fixed base year , we take the simple arithmetic mean of price relatives. Would this be satisfactory index number ? Give reasons

5. Giving Appropriate reason state which among : AM GM HM median and mode is the appropriate measure of central tendency for the following situations :

- i.     Finding the most common car in parking lot
- ii.    Representing length of hospital stays for patients
- iii.   Finding out the average size of suits sold by a storeowner
- iv.    Suppose a person is throwing a party and needs to pick a day where 1 is Monday and 7 is Sunday . The best day would be the option that satisfies the most people

6. The mean and standard deviation of height readings of a group of employees of a firm are found to be 172cm and 18cm, while the same measures for their weight are 65kg and 9kg. Compare their variability of the height readings with that of the weight readings

7. State with reasons which measure of Central Tendency will be best to describe following cases::

- i.     A teacher has made a tally of the number of times each colour of crayon was used by kindergarten. She is to decide a suitable measure of Central tendency to determine the favourite colour of the class
- ii.    The test grades on Economics are posted. All students taking the test scored over 75. Unfortunately 4 students were absent for that day and computer listed their score as 0 what is the measure of Central Tendency would give the best representation of the data?

8. Consider the Cases :

- i. where there are few extreme values markedly different from majority of the values
- ii. A grouped frequency distribution where one or both of the terminal classes are open.

Which measure of Central Tendency should be used and why??

### Section B

6marks

1. The mean and median daily wages of 90 workers in a factory are Rs 285 and Rs 270 respectively

- I. Do the data imply that the majority of workers earn less than Rs 285 per day? Give Reasons
- II. Choose the correct option :  
The maximum number of workers is earning daily an amount close to  
(a) Rs 285  
(b) Rs 270

2. (a) State Two situations where you would prefer the median to the arithmetic mean

(b) Prove that the sum of the squares of the deviations of all values of a variable in a set of observation from any constant  $c$  is least if  $c = \text{Arithmetic Mean}$

3. What is the Cost of living Index Number? How is it constructed? Mention its uses

4. The median and mode of the following distribution are respectively 27 and 26. Find  $a$  and  $b$

Class Interval: 0-10 10-20 20-30 30-40 40-50

Frequency: 3 a 20 12 b

5. (i) If  $2u=5x$  is the relation between the variables  $x$  and  $u$  and GM of  $x = 2.5$ , find GM of  $u$ .

(ii) Show that when prices of all items change in the same ratio, then Lasperyes' index = Paasche's index

6. Why is Fischer's Index Number called ideal?

### Unit 3: Dispersion & Unit 4: Moments, Skewness and Kurtosis

#### Section A

4 marks

1. The mean and standard deviation of height readings of a group of employees of a firm are found to be 172cm and 18cm. while the same measures for their weight readings are 65kg and 9kg. Compare the variability of the height readings with that of weight readings.

2. In a moderately skewed distribution, the mean, median and coefficient of skewness are respectively 45, 48 & -0.9. Then the standard deviation is 30.

3. The standard deviation of a symmetrical distribution is 9. What value can you suggest for a fourth order central moment in order that the distribution is platykurtic?
4.  $\sum x^2=400$ , mean of  $x=7$ ,  $n=10$ , consistent? Give reasons for your answer.
5. The lower and upper quartiles of a distribution are 14.6 and 25.2 respectively and coefficient of skewness is 0.5. Find the median of distribution...
6. Show that the mean absolute deviation about arithmetic mean cannot exceed standard deviation ? When are the two equal?
7. What do you mean by 'skewness' and 'kurtosis'?
8. Find the mode of the normal distribution with mean  $\mu$  and variance  $s^2$ .
9. Check the consistency of the following facts: "For a leptokurtic distribution, the first and the second order moments about the origin are 10 and 116 respectively and fourth order central moment is 624"
10. a) Find the mean deviation from mean of 10 samples of equal values.  
(b) Can the skewness of a normal distribution be +5? Why or why not?
11. In a firm the coefficient of variation of wages of male and female workers are 55% and 70% respectively, the standard deviation are Rs 22.00 and Rs 15.40 respectively. Calculate the combined average for all the workers, if 40% of the workers are female.
12. Find the dispersion using a suitable measure

Farm size (acre)	0-40	41-80	81-120	121-160	161-200	201-240	241 & over
No .of farms	394	461	391	334	169	113	148

## SECTION B

6 MARKS

1. You are given the position in a factory before and after the settlement of an individual dispute comment on (i) the variability of distribution of wages and (ii) the symmetry of distribution of wages before and after dispute:

	Before	After
No. Of workers	3000	2900
Median wage (Rs)	250	240
Mean wage (Rs)	220	230
Standard Deviation(Rs)	30	26

2. The following table gives the distribution of monthly expenditure for 430 families in a particular region :

Monthly Expenditure (Rs.)	No. of Families
<1000	30
1000-1250	45
1250-1500	70
1500-1750	82
1750-2000	66
2000-2250	57
2250-2500	28
2500-2750	22
2750-3000	18
>3000	12

Can you compute the standard deviation from the above data? Give reasons. Find the dispersion using a suitable dispersion measure.

3. Compute the Karl Pearson's coefficient of skewness for the following distribution.

X:	5	10	15	25	35	45	60	80	100	110	120
f:	2	5	8	13	20	30	38	40	30	15	5

4. The mean and SD of 20 items is found to be 10 & 2 respectively. At the time of checking it was found that the value of one item entered as 8 was incorrect. Calculate the mean and SD, if (i) the wrong item is omitted (ii) it is replaced by 12.
5. The number of runs scored by cricketer A and B in a test series for each of 10 innings is shown below:

Cricketer A	72	32	45	57	63	41	13	85	18	52
Cricketer B	50	64	42	34	60	82	40	70	36	52

6. Show that  $\sum_{i=1}^n |x_i - A|$  is least when A is median.
7. After shift of origin and change of scale, a frequency (f) distribution of a continuous variable (X) with equal class length takes the following form of the changed variable (u).

U	-3	-2	-1	0	1	2	3
f	3	5	12	49	22	8	1

8. Consider a composite set consisting of K subsets, each containing n number of observations. If all the subjects have equal means, Show that  $S^2 = 1/k \sum s_i^2$ , where  $s_i^2$  denotes the variance of the ith subset and  $s^2$  is the variance of the composite set.

9 . (a) Can you compute the standard deviation from the following data? Give reasons for your answer

(b) Find the dispersion using a suitable measure.

Daily Expenses	% of household
0-199	18.9
200-399	26.9
400-599	30.8
600-799	10.4
800-999	.09
1000 & above	4.0

### Unit 5: Probability Theory

#### Section A

4marks

1. In a survey report it is stated that 65% of the college goers prefer surfing internet as pastime, 41% like music, 34% like sports, 17% like both surfing net and music, 10% both surfing net and sports, 15% both sports and music and 6% all three. Show that the statement as it stands is not correct.

2. Consider two events A and B with positive probabilities:

(a) If A and B are mutually exclusive will they be independent ?

(b) If A and B are independent, will they be mutually exclusive ?

3. Define and explain the limitations of classical definitions of Probability.

4. A problem in statistics is given to 3 students A, B and C whose chances of solving it are  $\frac{1}{2}$ ,  $\frac{3}{4}$ , and  $\frac{1}{4}$  respectively. What is the probability that a problem is solved if all them are solved independently?

5. Four roads lead away from jail. A prisoner escaping from the jail and selects a road at random. If road 1 is selected the probability of escaping is  $\frac{1}{8}$ , for road 2 it is  $\frac{1}{6}$  for road 3 it is  $\frac{1}{4}$  and if road 4 is selected, the probability of escaping is  $\frac{9}{10}$ . Find the probability that the prisoner will succeed in escaping.

6. Among the 250 candidates participated in a TV reality show, 100 candidates preferred red coloured dress, 80 preferred blue coloured dress and the rest preferred green coloured dress. What is the probability that (i) candidates wearing blue dress will win both first and second prizes?

(ii) A candidate wearing blue dress wins the first prize and the one wearing the green dress wins the second prize?

7. Given that A, B and C are mutually exclusive events. Examine if the following is permissible assignment of probabilities  $P(a)=0.4$ ,  $P(b)=0.6$  and  $P(c)=0.2$

8. Given that  $P(A)=\frac{3}{8}$ ;  $P(B)=\frac{5}{8}$  and  $P(A \cup B)=\frac{3}{4}$ . Are A and B independent?

9. There are two events A and B such that,  $P(A) > 0$  and  $P(B) > 0$ . Prove that

(i) A and B cannot be independent if they are mutually exclusive.

(ii) A and B cannot be mutually exclusive if they are independent.

10. In a competitive examination if 50% of the examinees are successful what is the probability that out of a group of 50 examinees more than 10 are successful?

### Section B

6marks

1. State and Prove the Bayes' Theorem.

2. A store has two identically appearing cases of canned fruit juices, each containing appearing cans. Case I has 12 cans each of mango and pineapple juices while Case II has 16 cans of mango and 8 Cans of pineapple juices. A case is selected at random from that case. The can when opened is found to contain mango juice. What is the probability that case (II) was selected?

3. A speaks truth in 70% cases and his friend B speaks lie in 20% cases. In what percentage of cases are they likely to contradict each other in narrating the same incident?

4. A person decides to go to work by one of the three modes of transportation car, bus and train. If he decides to go to work by car there is 50% chance he will be late. If he goes by bus the probability of being late is 20%, the commuter train is almost never late with a probability of 1%. Suppose he is late one day assuming the prior probability to each of three possibilities being  $1/3$ , find the probability that he drove to work that day.

5. In 2013 there will be 3 candidates for the position of principal in a college Dr. Bannerjee, Dr. Singh, Dr. Sen; whose chances of getting appointment are in the proportion 4:2:3 respectively. The probability that Dr. Banerjee if selected introduce co education in college is 0.3. The probability of Dr. Singh and Dr. Sen doing the same are 0.5 and 0.8 respectively (i) What is the probability that there will be co education in college in 2013 (ii) If there is Co- education in college in 2013 what is the probability that Dr. Sen is Principal.

6. The chances that doctor A will diagnose a disease X correctly is 60%. The chances that a patient will die by his treatment after correct diagnosis is 40% and the chances of death by wrong diagnosis is 70%. A patient of doctor A who has disease died. What is the probability that the disease was diagnosed correctly?

7. (a) Define the axiomatic approach to probability

(b) Two newspaper and Y are published in a city. It is estimated from a survey that 16% read X 14% read Y and 5% read both the newspapers. Find the probability that a randomly selected person

(i) Does not read any newspaper

(ii) Read only Y

8. There are three children in a family. Find the probability that all the children are boys.

(i) If no prior information is available about the children

(ii) If it is known two eldest are boys

(iii) If it is known that atleast two of them are boys

### Unit 6 : Random variables and Probability distribution

#### Section A.

4marks

1. Define a pdf . Is the following a pdf?

$$f(x) = 2x \quad 0 \leq x \leq 1$$

$$4 - 2x \quad 1 < x \leq 2$$

$$0 \quad \text{elsewhere}$$

2. What is standard normal variable ? Why is it necessary to convert a normal variate to standard normal variate while solving problems??

3.(a) In the following problems, which approximation of binomial probabilities -- Poisson or Normal should be used and why.?

(i) In a competitive examination if 50% of the examinees are successful, what is the probability that out of a group of 50 examinees more than 10 are successful?

(ii) In the above mentioned, if 2% of the examines got more than 75% marks, what is the probability that out of the same group of 50 examinees, 3got more than 75% marks?

4. 2% of the student balances of customers of a private bank contain error. Suppose a random sample check of 500 accounts is made. What is the probability that the number of incorrect account balances in the simple will be :

(a) less than 5?

(b) 6 to 13, both inclusive?

#### Section B.

6marks

1. (i) Write down the probability mass function of a binomial distribution which has mean 6 and standard deviation  $\sqrt{2}$ .

(ii) If X is a Poisson variate such that  $6P(X=2) = 9P(X=4) + 3P(X+2)$ . Find its mean.

2. What is a moment generating function? Using a moment generating function find the mean and standard deviation of a Binomial distribution.

3. The amount of bread (in hundreds of pounds)  $x$  that a certain bakery is able to sell in a day is found to be numerically valued random phenomenon, with a probability density function given by:

$$f(x) = kx \quad , \text{ for } 0 \leq x < 5$$

$$= k(10-x) \quad , \text{ for } 5 \leq x < 10$$

$$= 0. \quad , \text{ otherwise}$$

(i) Find the value of  $k$  such that  $f(x)$  is a probability density function..

(ii) What is the probability that the number of pounds of bread that will be sold tomorrow is more than 500 pounds.

4. The probability mass function  $f(x)$  of a random variable  $X$  is zero , except at the points  $X = 0,1,2$  and  $f(0) = c$ ,  $f(1) = 2c - 3c^2$ ,  $f(2) = 4c - 1$

(i) Determine the value of  $c$

(ii) Find  $P(X > 0 | X < 2)$

5. (a) A Poisson variate is such that  $P(X=1) = 2P(X=2)$ .. Find its mean and variance .

(b) State with justification whether each of the following is true or false:

(i) The expectation of a random variable cannot be negative.

(ii) If  $\text{Var}(x) = 0$  , then all values of  $x$  are equal.

6. (a) Find the mean and standard deviation of Poisson distribution using moment generating function.

(b). Express normal distribution in standardized form.

7.  $X$  is a discrete random variable having the following probability mass function:

Mass points (x):	0	1.	2.	3.	4.	5.	6.	7.
$P(X=x)$ :	0.	$k$ .	$2k$	$2k$	$3k$	$k^2$	$2k^2$	$7k^2+k$

(a) Determine constant  $k$  (b) Find  $P(x < 6)$ .

8.(a) Let  $X$  be the total when two dice are thrown. Calculate the possible values of  $Y$  where

$Y = 2X + 3$ . Calculate  $E(Y)$  and show that  $E(Y) = 2E(X) + 3$ ..

(b) A random variable  $X$  follows binomial distribution with mean  $5/3$  and  $P(X=2) = P(X=1)$ .. Find mean and variance.



## Unit 7: Bivariate Analysis

### SECTION –A

**4 MARKS**

1. Two variables  $x$  and  $y$  take the following values:

$x : 3 \ -2 \ -1 \ 0 \ 1 \ 2 \ 3$

$y : 9 \ 4 \ 1 \ 0 \ 1 \ 4 \ 9$

Show that correlation coefficient  $r_{xy} = 0$ . What is the reason for the correlation coefficient being zero?

2. If two variables  $x$  and  $y$  are related as  $y = a+bx$ ,  $a$  and  $b$  being constants, find the correlation coefficient between  $x$  and  $y$ .
3. Prove that correlation coefficient is independent of change of origin and scale.
4. Calculate the correlation coefficient between  $x$  and  $y$  for the following data :  
 $X: 1 \ 3 \ 4 \ 5 \ 7 \ 8 \ 10$   
 $Y: 2 \ 6 \ 8 \ 10 \ 14 \ 16 \ 20$
5. Out of two lines of regression given by  $x+2y-5=0$  and  $2x+3y-8=0$ , which one is the regression line of  $x$  on  $y$ ? Use the equations to find the means of  $x$  and  $y$  and the correlation coefficient.

### SECTION - B

**6 MARKS**

1) The correlation coefficient of  $5x$  and  $-3y$  is numerically the same as the correlation coefficient between  $x$  and  $y$ . True or false? Give reason.

2). 9 competitors on paper presentation were marked by the two judges A and B as follows :

Competitors: 1 2 3 4 5 6 7 8

Marks by Judge A : 45 60 32 45 32 58 56 47

Marks by Judge B : 51 51 38 54 54 38 62 58

Find Spearman's rank correlation coefficient

3.(a) For the variables  $x$  and  $y$ , the equations of the two regression lines are  $4x+y=52$  and  $x+y=32$ . Find the correlation coefficient between  $x$  and  $y$ .

(b) The sum of two regression coefficient is 1.4 and the correlation coefficient is 0.75. Do you agree?

4 a) If the two regression coefficient are 1.6 and 0.4, then the correlation coefficient is plus minus 0.8. True or false? Give reason.

b) Can  $Y=5+2.8X$  and  $X= 3-0.5Y$  be the estimated regression equations of  $Y$  on  $X$  and  $X$  on  $Y$  respectively? Justify.

c) State two limitations of simple correlation coefficient.

5) How would you interpret the sign and magnitude of a calculated correlation coefficient  $r$ ? Discuss the limitation of correlation coefficient as a measure of association between two variables.

6.) For the variables of  $x$  and  $y$ , the two regression lines were obtained as  $3x+2y=25$  and  $6x+y=30$ . Find the value of  $y$  When  $x=12$  and the value of  $x$  when  $y=25$

### Unit 8: Population Statistics

#### Section A:

4 MARKS

1. State two uses of life table.
2. Why is Specific Death Rate a better measure of mortality than the Crude Death Rate?

#### Section B :

6 MARKS

1. Define Crude Death Rate (CDR). Explain why CDR is not suitable for comparing the mortality situations of two countries
2. Distinguish between Gross Reproduction Rate and Net Reproduction Rate.

## Paper II B

### Mathematics For Economics

#### Unit 1: Introductions to Functions and Graphs

#### Section A

4 marks

1. Find the domain of the following functions
  - a.  $f(x) = (5 - x)^{1/2}$
  - b.  $f(x) = \frac{2x-1}{x-1}$
  - c.  $f(x) = \frac{x}{\sqrt{x-1}}$
  - d.  $f(x) = \frac{1}{\sqrt{1-x^2}}$
2. Find the marginal and average functions for the following total function and sketch their graph in one diagram:  
Total function :  $10q - q^2$
3. Verify the Euler's theorem for the function  $f(x_1, x_2) = x_1 x_2^3$
4. Consider the function  $f(x) = ax^2 + bx + c$ 
  - a. If  $a=0$ , is the function a quadratic?
  - b. If  $a=0, c=0$  is the function linear?
  - c. If  $b=c=0$ , is the quadratic function?

- d. If  $a=0, b=0$ , is it still a function?
5. State and prove the Euler's theorem.
6. From a linear demand curve, we have the following observation  
 at  $p=15/\text{unit}, q=35$  units  
 at  $p=12/\text{unit}, q=50$  units  
 Write down the functional relationship between  $q$  and  $p$ . in which of the quadrants of the Cartesian plane does this function lie?
7. Identify the following statements relating to a single-valued function  $f(x)$  as True or False and justify with example.
- A function  $f(x)$  may have a local maximum at a point where it is not differentiable.
  - An inflexional value of a function  $f(x)$  can only occur at a point where  $f'(x) = 0$ .
8. Consider a production function  $Q=150L$ , where  $Q$  is total output, and  $L$  is the quantity of labour employed. How does the total product curve look like? Can you describe the corresponding Average product and Marginal product curve?
9. Mention which of the following equations are functions which are not
- $y = x^2$
  - $y^2 = x$
  - $y = 10$
  - $y = 3x + 2$
10. Give the demand function  $q = -5p+100$ , find the point elasticity.
11. The total cost  $C$  of a firm per day is a function of its daily output  $Q$  :  

$$C = 100 + 5Q$$
 The firm has a capacity limit of 50 units of output per day. Determine the domain and range of the cost function.
12. What will be the shape and curvature of the indifference curve for the following utility function  $u = x^2 + y^2, x, y > 0$
13. Find out the elasticity of substitution for the production function :  $Q = L^\alpha + K^\alpha; 0 < \alpha < 1$
14. Assuming that each of the following functions are linear, give an economic interpretation of the slope of the following functions :
- $C(y)$  is the total national consumption when national income is  $y$
  - $f(Q)$  is the cost for producing  $Q$  units of output.
15. Define local and global maximum of a function  $y = f(x)$  at  $u = c$
16. Prove that if the function  $f(x)$  is differentiable at  $u = a$  then  $f(x)$  must be continuous at  $x = a$
17. Define Convex set, and closed set. What is a closed convex set?
18. Examine the continuity and differentiability of  $f(x) = 2x + |x - 1|$  at  $x = 1$
19. Show that the function  $f(x) = |x - 1|$  is not differentiable at  $x = 1$ , but it has a local minimum at  $x = 1$
20. Prove that – “continuity is a necessary condition but not a sufficient condition for existence of a finite derivative of a function”.
21. For each of the following functions sketch its graph and describe whether it is continuous and differentiable at the point of transition of its two formula :
- $y = \begin{cases} x^3; & x \leq 1 \\ x, & x > 1 \end{cases}$
  - $y = \begin{cases} x^2 + 1; & x \geq 0 \\ x^2 - 1; & x < 0 \end{cases}$
22. Graph the function

a.  $y = 16 + 2x$                       b.  $y = 8 - 2x$                       c.  $y = 2x + 12$

[In each case, consider the domain as consisting of nonnegative real numbers only]

What is the major difference between (a) and (b) in prob. 1? How is the difference reflected in the graph? What is the difference between (a) and (c)? How do their graph reflect it?

23. Mention which of the following equations are functions which are not :

a.  $y = x^2$ ,                      b.  $y^2 = x$ ,                      c.  $y = 10$ ,                      d.  $y = 3x + 2$

24. (a) If the domain of the function

$$y = 5 + 3x$$

in the set  $\{x | 1 \leq x \leq 9\}$

Find the range of the function and express it as a set

(b) Enumerate all the subsets of the set

$$S = \{a, b, c\}$$

(c) If  $U = \{1, 2, 3, 4, 5\}$  what is the complement of  $U$  where  $U \in S$ ,  $S$  is the set of natural numbers?

25. Suppose that the profit ( $\pi$ ) of a firm depends upon research ( $R$ ) and advertisement ( $A$ ) expenditures in the following way :

$$\pi = -R^2 - A^2 + 22R + 18A = 102$$

Find out the optimum research and advertisement expenditures of the firm for profit maximization.

26. In which of the following cases does the letter  $f$  symbolize a function?

(i)  $y = f(x, z)$

(ii)  $y = f\left(\frac{x}{z}\right)$

(iii)  $y = a + fx$

(iv)  $y = f(x) = c$

## Section B

6 marks

- Determine all stationary values of the following function and the corresponding values of the function :  $f(x) = x^5 - 5x^3$
  - Given the demand function  $q = -5p + 100$ . Find (i) are elasticity when price increases from Rs. 5 to Rs. 6, and (ii) point elasticity when price is Rs. 5.
- For the following function  $Q = 100L^{0.75}K^{0.25}$   
Show that the level curve relating to the function is negatively sloped and convex, and sketch the graph of the level curve.
- The total cost  $C$  of a factory per day is a function of its daily output  $q$  given by the equation  $C = 50 + 3q$ . The factory has a capacity limit of 60 units of output per day. Find the domain and range of the cost function.
- Define continuity and differentiability of a one to one mapping.
- Define a polynomial function.
- State whether the following statement is true or false:
  - "Every polynomial function is continuously differentiable"
  - "If  $f(x)$  is continuous,  $Cf(x)$  is also continuous"

7. The total cost  $C$  of a factory per week is a function of its weekly output  $Q$  given by the equation  $C = 500 + 12Q$ . The factory has a capacity limit of 600 units of output per week. Find the domain of definition and range of the cost function.
8. From the demand curve known to be linear, given  $p=15$ ,  $q=35$  and  $p=12$ ,  $q=50$ , write down the functional relationship between  $q$  and  $P$ . In which of the quadrants of the Cartesian plane does this function lie?
9. An employee gets a salary according to a contract that establishes a relationship between pay and the level of sales made by the employee. The contract stipulates that the salary will be composed of three parts: a) Rs. 500 as basic amount b) Commission of 10% over sales, c) Rs. 200 bonus if the sales exceeds Rs. 10000. From the function linking salary to sales, draw the graph of the function.
10. On the same axes, sketch the graphs of (a)  $x^2 + y^2 - 16 = 0$  and (b)  $x^2 + xy + y^2 = 16$ . Take  $x = -4, -3, -2, -1, 0, 1, 2, 3, 4$ . Do not try to produce accurate graphs, but try to show the general shape of each function.
11. If  $y = -x^3 + 6x^2 - 12x + 50$ , find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$
12. Graph the functions  
 a.  $y = -x^2 + 5x - 2$                       b.  $y = x^2 + 5x - 2$   
 with the set of values  $-5 \leq x \leq 5$  constituting the domain. It is well known that the sign of the coefficient of the  $x^2$  term determines whether the graph of a quadratic function will have a "hill" or a "valley". On the basis of the present problem, which sign is associated with the hill? Supply an intuitive explanation for this.
13. Graph the function  $y = 36/x$ , assuming that  $x$  and  $y$  can take positive values only. Next, suppose that both variables can take negative values as well; how must the graph be modified to reflect this change in assumption?
14. Consider the following expressions:  
 (a)  $x^4 X x^{15}$ ,                      (b)  $x^a X x^b X x^c$ ,                      (c)  $x^3 X y^3 X z^3$
15. Find : (a)  $x^3 / x^{-3}$ ,                      (b)  $\frac{(x^{1/2} X x^{1/3})}{x^{2/3}}$   
 Show that  $x^{m/n} = \sqrt[n]{x^m} = (\sqrt[n]{x})^m$  Specify the rules applied in each step.
16. Consider the following function :
- |         |         |
|---------|---------|
| $y = x$ | $x > 0$ |
| $= -x$  | $x < 0$ |
| $= 0$   | $x = 0$ |
- (a) Sketch the graph of the function  
 (b) Is  $Y$  continuous? Is it smooth?  
 (c) Over what interval is  $y$  monotonically increasing? Monotonically decreasing?
17. Determine which of the following functions are convex and which are concave:  
 (i)  $f'(x) > 0, f''(x) > 0$ ,                      (ii)  $f'(x) > 0, f''(x) < 0$ ,  
 (iii)  $f'(x) < 0, f''(x) < 0$ ,                      (iv)  $f'(x) < 0, f''(x) > 0$ .

18. Consider the following one-commodity micro model

$$q^d = a + bp \quad (a > 0, b < 0)$$

$$q^s = c + dp \quad (c, d > 0, a > c)$$

$$q^d = q^s$$

where the notations have their usual meanings.

- (i) Identify the behavioural equations.
- (ii) Identify the endogenous variables. Identify the exogenous variables, if any such exists, and parameters.
- (iii) Find out the equilibrium values of  $p$  and  $q$ .
- (iv) Does equilibrium still exist when  $a \leq c$ ? Explain.

## Unit 2: Derivatives and its uses in a Single Variable Calculus

### Section A

4 marks

1. Find the marginal and average functions for the following total function and sketch their graphs in one diagram:  
Total function :  $10q - q^2$
2. Consider the function  $f(x) = ax^2 + bx + c$ 
  - (a) If  $a=0$ , is the function a quadratic?
  - (b) If  $a=0, c=0$ , is the function linear?
  - (c) If  $b=c=0$ , is it a quadratic function?
  - (d) If  $a=0, b=0$  is it still a function?
3. Identify the following statements relating to a single-valued function  $f(x)$  as TRUE or FALSE and justify with examples.
  - (a) A function  $f(x)$  may have a local maximum at a point where it is not differentiable.
  - (b) An inflexional value of a function  $f(x)$  can only occur at a point where  $f''(x) = 0$
4. Use first derivative and second derivative of the following function to sketch the graph of the function :  $f(x) = x^3 + 3x$
5. Given the demand function  $q = -5p + 100$ , find the point elasticity of demand when price is Rs. 5. Also find the arc elasticity of demand if price changes from Rs. 5 to Rs. 6?
6. The local cost  $C$  of a firm per day is a function of its daily output  
 $C = 100 + 5Q$   
The firm has a capacity limit of 50 units of output per day. Determine the domain and range of the cost function.
7. What is meant by point of inflexion of a curve? Does the following curve has a point of inflexion?  
 $f(x) = \frac{1}{2}e^{-\frac{1}{2}x}$
8. Find out the elasticity of substitution for the production function  
 $Q = L^\alpha + k^\alpha; 0 < \alpha < 1$
9. Prove that if  $f(x)$  is continuous in  $a \leq x \leq b$  and its derivative exists in  $a < x < b$ . if  $x=c$  be a point in the domain of definition of  $f(x)$  and  $f(x)$  attains local extremum (critical point) at  $x=c$ , then  $f'(c) = 0$ .

10. Prove that the point elasticity is -1 exactly at the midpoint of the linear demand curve  $q = a - bp$  ( $a, b > 0$ )
11. Using the derivative sketch the graph of the following cubic function  $f(x) = x^3 - 3x$ .
12. State (without proof) the criterion for determining the maximum and minimum values of a single valued function.
13. Define points of inflexion of a curve. If  $y = xe^{-x}$ , does the curve have a point of inflexion?
14.  $y = L^a$ ,  $z > 0$  relates the level of input labor, to output  $y$ , this function is called the total product of labor,  $TP(L)$ . The marginal production of labour is  $MP(L) = \frac{dy}{dL}$ . If  $a=5$  obtain  $MP(L)$  and find if the curve is increasing or decreasing.
15. In Question no. 14, if 'a' is equal to -7, will  $MP(L)$  be decreasing ?

### Section B

6 marks

- The total cost  $C$  of a firm is given by  $C = 100q - 80q^2 + \frac{1}{3}q^3$ , where  $q$  is the quantity produced.
  - Find the marginal cost (MC) of production
  - Find the slope of the MC function.
  - At what value of  $q$  does MC equal average cost (AC)?
- The average revenue function (AR) is given by  $AR = 10 - 3q$ . find out the elasticity of demand when  $q=2$ .
- The demand function of a firm is  $3P + Q - 48$ . When  $P$  is the price per unit and  $Q$  is the number of units demanded. Find the level of output when total revenue (TR) is maximized. If the average cost (AC) is given by  $AC = Q^2 - 18Q + 3$ , find the level of output which maximizes marginal cost (MC)
- Define average and marginal change of a function.
- Define curvature of a function in terms of second derivative.
- For the cost function  $f(q) = q^3 + q + 1$ , graph the corresponding AC function and MC function on the same co-ordinate axes.
- Find the point elasticity of demand given by  $Q = \frac{K}{p^n}$ , where  $K$  and  $n$  are positive constants.
  - Does the elasticity depend on the price in this case?
  - In the special case where  $n=1$ , what is the shape of the demand curve?
  - What is the point elasticity of demand?
- Can the function  $y = \frac{x+1}{x}$  ( $x \neq 0$ ) have extremum? Give reasons for your answer.
- Find the elasticity of  $f(x) = Ax^b$ .
- If  $f(x)$  and  $g(x)$  are differentiable functions then  $E_{(f,g)x} = E_{f,x} + E_{g,x}$  where  $E$  denotes elasticity.
- (a) Determine all stationary values of the following function and the corresponding values of the function:  
 $f = x^5 - 5x^3$ .  
 (b) Given the demand function  $q = 5p + 100$ , find (i) are elasticity when price increases from Rs. 5 to Rs. 6 and (ii) point elasticity when price is Rs. 5.
- (a) Consider  $T=T(x)$  to be a total function. Write down the expressions for the marginal function (M) and the average function (A).

- (b) Show that, when A reaches a relative optimum, M and A must have the same value.
- (c) Find out the elasticity of the total function T at the point when A reaches an extreme value?
13. Write down the conditions required for finding out the extreme values(S) of the function  $Z = Z(x_1, x_2)$ . Derive the extreme values(S) of the function  $Z = Z(x_1, x_2) = 2x_1^2 + x_1x_3 + 4x_2^2 + x_1x_3 + x_3^2 + 2$ .
14. Classify the stationary values of the function  $f(x) = x^3 - 3x^2 + 5$  as local maximum, local minimum and inflexional values;
15. Let  $y = f(x), x > 0$  denotes a total function
- (a) Derive the expression for its Marginal Function (M) and the Average function(A)
- (b) Show that when the Average function reaches its relative extremum  $A=M$ .
- (c) Determine the elasticity of the total function at the point when the average function reaches its relative extremum.
16. (a) Determine the critical values of the following function  
 $f(x) = -x^3 + 6x^2 + 15x - 32$
- (b) Classify the stationary values associated with these critical values as local maximum or local minimum.
- (c) Can you identify any other stationary values which is (are) inflexional in nature?
17. What output combination (x,y) should a profit- maximizing firm produce when its profit function is  
 $T=80x - 2x^2 - xy - 3y^2 + 100y$   
 And its maximum output capacity is  $x+y=12$ ?

### Unit 3: Functions of Several Variables

#### Section A

4 marks

1. Define a level curve in a function  $y = f(x_1, x_2)$ .
2. Define a homogenous function
3. What is the distinction between homogenous function and homothetic function.
4. Prove that " If  $f(x)$  is a concave function then  $-f(x)$  is a convex function and vice versa."
5. Define homothetic function. Show that the following functions are homothetic."
  - i)  $Y = \log(x_1^2 + x_1x_2)$
  - ii)  $Y = (x_1x_2)^2 + x_1x_2$
  - iii) Let  $f(L,K) = A\{\alpha L^p + (1-\alpha)K^p\}^{1/p}$ . Show that  $f(L,k)$  is a linear homogenous function.
6. Define a level curve in a function  $y = f(x_1, x_2)$
7. State and prove the Euler's theorem.
8. Is the production function  $y = \log x_1^2 x_2^2$  homothetic function?
9. Verify the Euler's theorem for the function  $f(x_1, x_2) = X_1, X_2^3$
10. Determine the degree of homogeneity of the following homogeneous function. Is it homothetic?  
 $Y = y(x_1, x_2) = x_1, x_2, (x_1, x_2 > 0)$ .



**Section B****6 marks**

1. Check whether the following function  $z = x_1^2 + x_2^2$  is concave or convex, where  $U = (U_1, U_2)$  and  $V = (V_1, V_2)$  be any two distinct points on the domain.
2. Let  $y = L\alpha K^{1-\alpha}$  represent society's production function. Suppose  $L$  and  $k$  both grow at constant different rates; that is  $L = L_0 e^{mt}$  and  $k = k_0 e^{nt}$  where  $t$  represent time. Find  $\frac{dy}{dt}$  by direct substitution and by the chain rule.
3. If the utility function of an individual takes the form  $U = U(q_1, q_2) = (q_1 + 2)^2 (q_2 + 3)^3$  where  $U$  is the total utility  $q_1, q_2$  are the quantities of two commodities consumed.
  - a) Find the marginal utility function of each of the two commodities.
  - b) Find the value of the marginal utility of the first commodity when 3 units of each commodity are consumed.
4. If  $f(x_1, x_2, \dots, x_n)$  is homogenous of degree  $n$  than show that the first partial derivatives  $f_1, f_2, \dots, F_n$  are homogenous of degree  $(n-1)$ .
5. a) If  $f(x_1, x_2, \dots, x_n)$  is homogenous of degree  $r$  then show that
 
$$\frac{df}{dx_1} x_1 + \dots + \frac{df}{dx_n} x_n = r, f(x_1, x_2, \dots, x_n)$$
- b) Verify the Euler's theorem for the function  $f = x_1 x_2^2$
6. Show that the function
 
$$Q = Q(L, k) = L^\alpha k^\beta, \quad L, k > 0$$

$$0 < \alpha, \beta < 1$$

$$\alpha + \beta = 1$$
 Is linearly homogenous.  
 Now if  $Z = Q^2$ , then is  $Z$  a homogenous function? Is it homothetic?
7. What will be the level curve for the function  $Z = xy; (x, y > 0)$ ? Determine its slope. Examine whether it is strictly convex or not.
8. Give one example of a homogenous function. Verify Euler's theorem for this function.
9. Find the equation of an isoquant (level curve of a production function) for the production  $q = 100k^{0.25}L^{0.75}$ , where  $k$  and  $L$  are level of capital and labour respectively. Show that the isoquant is decreasing and convex function. Draw the sketch of the isoquant.
10. Derive the expression for a level curve corresponding to the following function
 
$$U = U(x, y) = x^2 y^2$$
 Hence determine its shape & curvature.
11. For the following function  $Q = 100L^{0.75}K^{0.25}$ . Show that the level curve relating to the function is negatively sloped and convex and sketch the graph of the level curve.
12. Show that the production function  $q = Ak^\alpha L^\beta$ ,  $A, \alpha, \beta > 0$ , has the property of increasing marginal productivity of capital and labour if  $\alpha > 1$  and  $\beta > 1$ . What will be the shape of the isoquant (level curve of the production function)

**Unit 4: Linear Algebra, Fundamentals of Matrices Algebra and LPP****Section A****4 marks**

1. The two commodity model can be written as a systems of two linear equations given by
 
$$C_1 P_1 + C_2 P_2 = -C_0$$

$$R_1 P_1 + R_2 P_2 = -r_0$$

Find out two Equilibrium Prices

2. In a two industry economy it is known that industry I uses 20% of its own product and 60% of commodity II to produce a rupee worth of commodity I; industry II uses none of its own product out uses 50% of commodity I in producing rupee worth of commodity II and open sector demands 100 crores of commodity I and 200 crores of commodity II.  
Write input and the specific input output matrix equation for this economy.

3. Solve General System

$$a_1x_1+a_1x_2=G$$

$$a_2x_1+a_{22}x_2=b_2$$

4. COST OF DIET AND NUTRIENT CONTENT

NAME OF NUTRIENT	NUTRIENT CONTENT PER UNIT OF FOOD(IN UNITS)		DAILY MINIMUM REQUIREMENT
	$X_1$	$X_2$	
CARBOHYDRATE	1	2	3
PROTEIN	1	4	4
MINERAL	3	1	3
PRO/kg	12	42	

Formulate an LPP on correct combination of  $X_1$  and  $X_2$  and daily minimum requirement. Formulate on LPP

5. Solve:

$$x-3y=2$$

$$8x-9y=6$$

Give Geometrical interpretation also

6. For what value of K, the following system is inconsistent

$$3x - xy = 5$$

$$X+3y=2$$

7. State Implicit Function Theorem. What are Kuhn-Tucker Conditions.

8. Let  $A = \begin{pmatrix} 1 & 2 \\ 3 & 6 \end{pmatrix}$        $B = \begin{pmatrix} 3 & -8 \\ 2 & 3 \end{pmatrix}$        $C = \begin{pmatrix} 5 & 2 \\ 1 & -2 \end{pmatrix}$  verify that  $AB=AC$

9. a) Is it possible to get a solution to the following system of three Equations? Why?

$$x+y=5$$

$$2x+y=8$$

$$x+3y=10$$

b) if the third Equation is replaced by the equation  $x+3y=9$  then what will be your answer.

10. (i) Given  $A = \begin{bmatrix} -1 & 5 & 7 \\ 0 & -2 & 4 \end{bmatrix}$

Show that  $AI=IA=A$  indicate the dimension of identity matrix used in each case.

- (ii) Given  $B = \begin{bmatrix} 6 & -12 \\ -3 & 6 \end{bmatrix}$

Can you find out  $B^{-1}$ ? If not, why not?

11. Below is given the pay off matrix of player A in a two person zero sum game

		Player B		
		1	2	3
Player A	1	3	1	1
	2	1	1	5
	3	1	4	1

Construct LPP model with respect to player B

12. Solve the following national income model using Cramer's rule

$$y = c + I + G_0 \text{ and } \bar{M} = kP.y + Ir \quad (I < 0)$$

$$c = a + by \quad (a > 0, 0 < b < 1) \text{ and } I = I_0 - dr \quad (I_0 > 0, d > 0)$$

where  $I_0$  and  $G_0$  are exogenously given.

13. Define an input output matrix under the Leontief Static Open System in a two commodity framework.

### Section B

6marks

1. a) State fundamental theorem on LPP.

b) Distinguish between Basic, Solution, Feasible Solution and Basic feasible solution.

2. a) The Simple National Income model can be written as

$$y = C + I_0 + G_0$$

$$c = a + by \quad (a > 0, 0 < b < 1)$$

where  $I_0$  and  $G_0$  are exogenously given. Solve the above model by Cramer's rule.

b) Let  $A = \begin{pmatrix} 1 & 2 \\ 3 & 6 \end{pmatrix}$ ,  $B = \begin{pmatrix} 3 & -8 \\ 2 & 3 \end{pmatrix}$   $C = \begin{pmatrix} 8 & 2 \\ 1 & -2 \end{pmatrix}$ , verify that  $AB = AC$  even though  $B \neq C$

3.  $(q-1)x + py = 0$  .....(i)

$(1-q)x - py = 0$  .....(ii)

$X + y = L$  .....(iii)

In this Linear Equation System.

(i) If  $p$  and  $q$  be between 0 and 1, how many solutions does this system have? Why?

(ii) Ignoring the condition that  $p$  and  $q$  must be between 0 and 1, find the values of  $p$  and  $q$  so that the system does not have any solution.

4. In a three sector economy, the input coefficient matrix and final demand vector are as given below

$$A = \begin{bmatrix} 0.3 & 0.2 & 0.3 \\ 0.1 & 0.3 & 0.4 \\ 0.2 & 0.3 & 0.0 \end{bmatrix} \quad \text{and} \quad F = \begin{bmatrix} 500 \\ 600 \\ 700 \end{bmatrix}$$

Find the sectoral output  $X_1$ ,  $X_2$  and  $X_3$  using Cramer's rule.

5. Solve the following LPP not dual

Minimize

$$c = 8x_1 + 14x_2$$

Subject to

$$2x_1 + 4x_2 \geq 9$$

$$x_1 + 3x_2 \geq 1$$

$$x_1 \geq 0, x_2 \geq 0$$

6. A person needs three kinds of nutrients viz. Calcium, Protein and Vitamin A to maintain good health. His diet is assumed to be consisting of two food items I and II. Prices of those foods nutrient contents are presented in the Table below:

Table : Prices and Nutrient Contents of Foods

Price per unit	Food-I (per kg)	Food II (per kg)	Minimum Daily requirement
Calcium (unit)	10	4	20
Protein (unit)	5	5	20
Vitamin A (unit)	2	6	12

Formulate a linear programming problem on the basis of above information. Also find out 1b dual problem.

7. Given the input-coefficient matrix and the final demand vector

$$A = \begin{bmatrix} 0.3 & 0.2 \\ 0.2 & 0.2 \end{bmatrix} \text{ and } C = \begin{bmatrix} 50 \\ 50 \end{bmatrix}$$

Find the optimum output levels of the two goods. Suppose that 0.2 and 0.1 are labour coefficients of the two goods respectively. If  $I=100$ , will there be unemployment in the economy.

8. Consider the following LPP

$$\text{Maximize } z = 40x_1 + 30x_2$$

$$\text{Subject to } x_1 \leq 16$$

$$x_2 \leq 8$$

$$x_1 + x_2 \geq 0$$

$$\text{and, } x_1, x_2 \geq 0$$

Solve it graphically. In so doing indicate the feasible solutions the basic solutions and the basic feasible solution.

9. In a two-industry economy, it is known that industry I uses 10 per cent of its own product and 60 per cent of commodity II to produce a rupee worth of commodity I; Industry II uses none of its own product but used 50% of commodity I to produce a rupee's worth of commodity II; the open sector demands 100 lakh rupees of commodity I and 200 lakh rupees of commodity II.

(i) Write down the input-coefficient matrix and specific input-output matrix equation.

(ii) Derive the rupee amount of the primary input used in producing a rupee's worth, each of commodity I and commodity II.

$$10. \text{ Given } A = \begin{bmatrix} 0 & 4 \\ -1 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 3 & -8 \\ 0 & 1 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 0 & 9 \\ 6 & 1 & 1 \end{bmatrix}$$

Verify

$$a) (A+B)' = A' + B'$$

$$b) (AC)' = C'A'$$

11. Consider a two sector open Leontief System where inter-industry input-coefficient matrix is

$\begin{bmatrix} 0.4 & 0.5 \\ 0.3 & 0.2 \end{bmatrix}$  Does this system satisfy Hawkins-Simon condition? Interpret the condition in simple economic forms.

12. Given

$$A = \begin{bmatrix} 2 & 8 \\ 3 & 0 \\ 5 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 0 \\ 3 & 8 \end{bmatrix} \quad C = \begin{bmatrix} 7 & 2 \\ 8 & 3 \end{bmatrix}$$

- a) Is AB defined? Calculate AB. Can you calculate BA?  
 b) Is BC defined? Calculate BC. Calculate CB and find out is BC=CB is true.
13. On the basis of this model, let final demand are  $d_1=30$   $d_2=15$   $d_3=10$  (all in billions). What are solution output levels for the three industries?

$$\begin{bmatrix} 0.8 & -0.3 & 0.2 \\ -0.4 & 0.9 & -0.2 \\ 0.1 & 0.3 & 0.8 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 \\ d_3 \end{bmatrix}$$

14. In a two industry economy, it is known that industry I uses 10% of its own product and 60% of commodity II to produce a dollar's worth of commodity I; industry II uses none of its own product but uses 50% of commodity I in producing a dollar's worth of commodity II; and the open sector demands \$1000 billion of commodity I and \$2000 billion of commodity II.
- a) Write out the input matrix, the Leontief's matrix and the specific input-output matrix equation for this economy.  
 b) Check neither the data in this problem satisfy Hawkers-Simon Condition.  
 c) Find the solution output levels by Cramer's rule.

15. Given the input matrix and final demand vector

$$A = \begin{bmatrix} 0.05 & 0.25 & 0.34 \\ 0.33 & 0.10 & 0.12 \\ 0.19 & 0.38 & 0 \end{bmatrix} \quad d = \begin{bmatrix} 1800 \\ 200 \\ 900 \end{bmatrix}$$

- a) Explain economic meaning of elements 0.33, 0, and 200  
 b) Explain the economic meaning (if any) of third-column Sum  
 c) Explain the economic meaning (if any) of the third-row sum  
 d) Write the specific input-output matrix  
 e) Check whether the data satisfies the Hawkins Simon Condition.
16. Find inverse of following matrices

$$E = \begin{bmatrix} 4 & -2 & 1 \\ 7 & 3 & 0 \\ 2 & 0 & 1 \end{bmatrix} \quad G = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \quad F = \begin{bmatrix} 1 & -1 & 2 \\ 1 & 0 & 3 \\ 4 & 0 & 2 \end{bmatrix}$$

Consider an economy where the government considers the removal of investment subsidy as a programme for contraction. Using IS-LM Model, discuss the impact of this policy on income, interest rate and investment.

## Unit 5: Optimization with Equality and Inequality Constraints

### Section A

4marks

- Find the maximum or minimum values of the following function  $f(x,y)$  subject to  $g(x,y)=0$  by the method of Lagrange Multipliers.  
 $f(x,y)=P_x x + P_y y$  ;  $g(x,y)=U^0 - xy$
- Define quasi-concave function. Give geometric interpretation.
- Check whether the following function is quasi-concave , quasi-convex or both or neither  
 $f(x,y)=x^\alpha y^\beta$  ( $x,y>0$ ;  $\alpha>0$ ;  $\beta<1$ )
- Find whether the function  $f(x)=2x^3-3x$  is quasi-concave or quasi-convex.
- Use the Lagrange Multiplier method to optimize the following Function  
 $Z=4x^2-3x=5xy-8y+2y^2$  subject to  $x=2y$
- Find the relative maximum/minimum of the following function :  
 $f(x_1,x_2)= 2x_2^3-x_1^3+147x_1-54x_2+12$
- Define duality in a linear programming problem.

8. What is a basic feasible solution in a linear programming problem?
9. Suppose that the profit ( $\pi$ ) of a firm depends upon research (R) and advertisement (A) expenditures in the following way:  

$$\pi = -R^2 - A^2 + 22R + 18A - 102$$
 Find out the optimum research and advertisement expenditures of the firm for profit maximization.
10. A laptop manufacturer determines that in order to sell  $x$  laptops the price must be  $p = 1200 - x$ . The cost of the manufacture for producing laptops is  $C(x) = 4000 + 300x$ . Find out the optimum number of laptops that will maximize the profit of the manufacturer.
11. Identify the following statements relating to a single valued function  $f(x)$  as TRUE or FALSE and justify with examples:
  - a) A function  $f(x)$  may have a local maximum at a point where it is not differentiable
  - b) An inflexional value of a function  $f(x)$  can only occur at a point where  $f''(x) = 0$ .
12. Use the Lagrange Multiplier method to solve the
13. following optimization problem :  
 Maximize  $xy$  subject to  $2x + y = M$  ( $x, y, M > 0$ )
14. A mini laptops manufacturer determines that in order to sell laptops, the price must be  $P = 1200 - x$ . The Cost of the Manufacture for Producing  $x$  laptops is  $C(x) = 4000 + 3x$ . Find out the optimum number of mini laptops that will maximize the profit.

### Section B

6marks

1. Given the profit function  $\pi = 160x - 3x^2 - 2xy - 2y^2 + 120y - 18$  for a firm producing two goods  $x$  and  $y$ , find the optimum production levels, check the second order conditions and find the maximum profit.
2. A firm sells two products  $x$  and  $y$  for which the demand functions are as follows  

$$x = 25 - 0.5P_x$$

$$y = 30 - P_y$$
 and the combined cost function is  $C = x^2 + 2xy + y^2 + 20$ 
  - a) Obtain the total revenue functions in terms of outputs of  $x$  and  $y$
  - b) Derive the profit function
  - c) Find the optimum outputs of  $x$  and  $y$  and the maximum profit
3. What output Combinations should a profit maximizing firms produce when its profit function is  $\pi = 80x - 2x^2 - xy - 3y^2 + 100y$  and its maximum output capacity is  $x + y = 12$
4. Optimize the production function  $q = 100(0.2K^{0.5} + 0.8L^{0.5})^2$  subject to the constraint  $10K + 4L = 4100$
5. Given the Demand Function  $P = 8.25e^{-0.02Q}$ , determine the quantity and price at which TR will be maximized.
6. Find the solution to the following non-linear programmings :
  - a) Max  $y = x_1x_2$  subject to  $x_1 + x_2 \leq 10$   
 $x_1 + 2x_2 \leq 18$   
 $x_1, x_2 \geq 0$
  - b) Max  $\pi = 64x - 2x^2 + 96y - 4y^2 - 13$  subject to  $x + y < 36$
7. Maximize the utility function  $U = xy$  subject to the budget constraint  $100 - xP_x - yP_y = 0$ . Find the optimal values of  $x$  and  $y$  in terms of prices and show that these demand functions are homogeneous of degree zero in prices and income.

8. For the following function defined by  $F(x,y)=x^3-y^3+9xy$ , find the critical points and classify the local maximum, local minimum and saddle point

9. a) Determine the critical values of the following :

$$f(x) = -x^3 + 6x^2 + 15x - 32$$

b) Classify the stationary values associated with these critical values as local maximum and local minimum

c) Can you identify any other stationary value(s) which is (are) inflexional value ?

10. What output combinations  $(x,y)$  should a profit maximizing firm produce when its profit function is  $\Pi = 80x - 2x^2 - xy - 3y^2 + 100y$  and its maximum output capacity is  $x+y=12$

11. Determine all stationary values of the following function and the corresponding values of the function

$$f(x) = x^5 - 5x^3$$

12. Solve:

$$\text{Maximize } 2xy + y \text{ subject to } x + y = 10$$

How are the conditions for Maximization changed when the constraint of this problem is  $x + y \leq 10$

13. Consider the following Linear Programming Problem :

$$\text{Maximize } Z = 50x_1 + 30x_2$$

$$\text{Subject to } 2x_1 + x_2 \leq 14$$

$$5x_1 + 5x_2 \leq 40$$

$$x_1 + 3x_2 \leq 18 \quad x_1, x_2 \geq 0$$

14. Write down the conditions required for finding out the extreme value(s) of a function  $Z = Z(x_1, x_2)$

Derive the extreme values(s) of the function

$$Z = Z(x_1, x_2) = 2x_1^2 + x_2x_1 + 4x_2^2 + 2x_1x_3 + x_3^2 + 2$$

15. Classify the stationary values of the function  $f(x) = x^3 - 3x^2 + 5$  as local Maximum, local Minimum and inflexional values

## Unit 6: Difference Equation

### Section A

4marks

1. From the difference equation  $y_t = 2y_{t-1} + 1$ , explain monotonic convergence?
2. It at  $t=0$ , your Bank deposit is Rs. 100 and the annual rate of interest is 12% on the amount deposited on the account at the end of each year, what is the difference equation relating the bank deposit in consecutive years.
3. Define linear second order difference equation for a single variable like price index.
4. Define monotonic convergence in a difference equation  $y_t = 2y_{t-1} + 1$
5. Solve the following difference equation:  $Y_{t+2} - 2Y_{t+1} = 1$ ,  $Y_0 = 3$ ,  $Y_1 = 4$
6. Solve the following difference equation  $Y_{t+2} + Y_{t-1} - 2Y_t = 12$  [ $Y_0 = 4$ ,  $Y_1 = 5$ ] and analyze the time path.

7. Convert the following difference equations into the form of  $Y_{t+1}=Y_t+2$ 
  - a)  $\Delta y_t = 7$
  - b)  $\Delta y_t = 0.3y_t$
  - c)  $\Delta y_t = 2y_t - 9$
8. Solve the following difference equation by iteration :
  - a)  $y_{t+1} = y_t+2$  ( $y_0=10$ )
  - b)  $y_{t+1} = \alpha y_t$  ( $y_0 = \beta$ )
  - c)  $y_{t+1} = \alpha y_t - \beta$  ( $y_t=y_0$  when  $t=0$ )
9. Solve the first order difference equation  $y_{t+1} - 5y_t = 1$  ( $y_0=7/4$ )
10. For each of the following difference equations, find  $y_i$ ,  $y_p$  and the definite solution
  - a)  $y_{t+1} + 3y_t = 4$  ( $y_0=4$ )
  - b)  $2y_{t+1} - y_t = 6$  ( $y_0=7$ )
  - c)  $y_{t+1} = 0.2y_t + 4$  ( $y_0=4$ )
11. Discuss the nature of the following time paths:
  - a)  $y_t = 3^t + 1$
  - b)  $y_t = 5(-1/10)^t + 3$
  - c)  $y_t = 2(1/3)^t$
  - d)  $y_t = 3(1/4)^t + 2$
12. Find the solution of the following and determine whether the time paths are oscillatory and convergent.
  - a)  $y_{t+1} - 1/3y_t = 6$  ( $y_0=1$ )
  - b)  $y_{t+1} + 2y_t = 9$  ( $y_0=4$ )
  - c)  $y_{t+1} + 1/4y_t = 5$  ( $y_0=2$ )
  - d)  $y_{t+1} - y_t = 3$  ( $y_0=5$ )
13. Determine the nature of the following time paths
  - a)  $y_t = 2(-4/5)^t + 9$
  - b)  $y_t = 3(2)^t + 4$

## Section B

6marks

1. Solve the following difference equations and comment on the nature of time path
  - a)  $X_{t+1} - 4X_t = 36$
  - b)  $\Delta y_t = y_t + 15$
2. Given the data below find the time path of national income ( $y_t$ )  
 $C_t = 200 + 0.75y_{t-1}$ ,  $I_t = 50 + 0.15y_{t-1}$ ,  $y_0 = 3000$ . In equilibrium  $y_t = C_t + I_t$ .
3. The demand and supply functions are given as follows  
 $Q_{dt} = 120 - 0.5P_t$   
 $Q_{st} = -30 + 0.3P_t$   
 $P_{t+1} = P_t - 0.2(Q_{st} - Q_{dt})$ ,  $P_0 = 200$   
 Find the time path of price and determine whether it is convergent.
4. Find the particular integral, the complementary function and the general solution for the following difference equation:  
 $Y_t = 10Y_{t-1} + 25Y_{t-2} = 8$
5. Write out the characteristics equation for each of the following and find the characteristic roots



- a)  $y_{t+2}-y_{t+1}+1/2y_t=2$   
 b)  $y_{t+2}+4/8y_{t+1}-1/2y_t=5$   
 c)  $y_{t+2}-4y_{t+1}+4y_t=7$   
 d)  $y_{t+2}-2y_t+1+3y_t=4$
6. For each of the difference equations in the above problem state on the basis of its characteristics roots whether the time path involves oscillation or stepped fluctuation and whether it is explosive.
7. Find the particular solution of these equations. Do these represent stationary or moving equilibrium?
8. Solve the following difference equations and analyze the time paths
- a)  $y_{t+2}+3y_{t+1}-2/4y_t=9$  ( $y_0=6; y_1=3$ )  
 b)  $y_{t+2}-2y_{t+1}+2y_t=1$  ( $y_0=3; y_1=4$ )  
 c)  $y_{t+2}-y_{t+1}+1/4y_t=2$  ( $y_0=4; y_1=7$ )
9. Find the particular solution
- a)  $y_{t+2}+2y_t=y_t=3^t$  ( $y_0$ )  
 b)  $y_{t+2}-5y_t=-6y_t=2(6)^t$   
 c)  $3y_{t+2}+9y_t=3(4)^t$   
 d)  $y_{t+2}-2y_{t+1}+5y_t=t$   
 e)  $y_{t+2}-2y_{t+1}+5y_t=4+2t$   
 f)  $y_{t+2}+5y_{t+1}+2y_t=18+6t+8t^2$

## Unit 7: Differential Equations

### Section A

**4marks**

1. Define a linear second order differential equation.
2. When would you use differential equations instead of difference equations in the dynamic analysis of the time path of a variable?
3. In the differential equation  $\frac{dy}{dt} = 2t$ ; find the particular solution, if  $y(t=0)=5$ .
4. Find the particular integral of each equation
  - a)  $y''(t) + 2y'(t) - y = -4$
  - b)  $y''(t) + y'(t) = 7$
5. Find the complementary function at each equation
  - a)  $y''(t) + 8y'(t) + 16y = 0$
  - b)  $y''(t) - 2y'(t) + y = 3$
6. Solve the equation  $\frac{dy}{dt} + 2y = 6$ , with initial condition  $y(0)=10$ .
7. Solve the equation  $\frac{dy}{dt} + 4y = 0$ , with the initial condition  $y(0)=1$
8. Find the particular integral of the following linear differential equation
  - a)  $y''(t) + 4y'(t) + 8y = 2$
  - b)  $y''(t) - 4y'(t) + 8y = 0$
9. Find the complementary function of each equation
  - a)  $y''(t) + 8y'(t) + 16y = 0$
  - b)  $y''(t) - 2y'(t) + y = 3$
10. Show that, as  $t \rightarrow \infty$ , the limit of  $te^{rt}$  is zero if  $r < 0$ , but is infinite if  $r \geq 0$ .

**Section B****6marks**

1. Obtain the time path  $P(t)$  of the following market model.

$$D=45-4P-\frac{6dP}{dt}-\frac{d^2P}{dt^2}$$

$$S=-9+5P$$

$$D=S$$

$$\text{With } P(0)=10 \text{ and } P'(0)=3$$

Investigate whether the time path is convergent or divergent.

2. Given the market model

$$D=30-5P-\frac{4dP}{dt}-\frac{d^2P}{dt^2}$$

$$S=-10+3P$$

$$D=S$$

$$\text{With } P(0)=10 \text{ and } P'(0)=4. \text{ Find } P(t).$$

3. Solve the differential equation  $9=\frac{d^2y}{dt^2}+\frac{2dy}{dt}-3y$  given the initial conditions  $y(0)=10$  and  $y'(0)=5$

4. Let the demand and supply functions be

$$D=a-bP+\sigma\frac{dP}{dt}$$

$$S=-C+dP, \quad a, b, c, d > 0$$

Assume that  $\frac{dP}{dt} = 3(D-S)$ . Find the time path  $P(t)$ .

5. Find  $y_c, y_p$ , the general solution and the definite solution of the given differential equation

$$2\frac{dy}{dt} + 4y = 6; \quad \text{given } y(0)=1\frac{1}{2}$$

Check the validity of your answer.

6. Find the solution of the following differential equation

$$\frac{dy}{dt} - 7y = 7; \quad \text{given } y(0)=7$$

Check the validity of your answer.

7. a) Find the partial integral, complementary solution and general solution of the differential equation

$$y''(t) + 3y'(t) - 4y = 12$$

b) Then definitize the solution with the initial conditions  $y(0)=4$  and  $y'(0)=2$ .

c) Are the inter-temporal equilibrium dynamically stable?

8. Find  $Y_p$  and the  $t_c$ , the general solution and the definite solution

$$a) \quad y''(t) - 2y'(t) + 10y = 5; \quad y(0)=6; \quad y'(0)=8\frac{1}{2}$$

9. Find the time path of  $y$  from the following equations

$$C(t)=ay(t)+b$$

$$I(t)=k\frac{dc}{dt}$$

And  $y(t)=c(t)+I(t)$  where  $b, k > 0$  and  $0 < a < 1$ . Check whether the time path is convergent or not.

10. Solve :  $\frac{dy}{dt} + 10y = 15; \quad y(0)=0$ . Find  $y_c, y_p$ , the general and the definite solution for the differential equation.

11. Find the general solution of the following differential equation

$$y''(t)+6y'(t)+9y(t)=27$$

definitize the solution with the initial conditions

$$y(0)=5; \quad y'(0)=-5$$

12. Find the general solution of the following differential equation

$$y''(t)+6y'(t)+5y=10$$

Then find the definite solution with initial conditions  $y(0)=4$  and  $y'(0)=2$ .

13. Find  $y_c$ ,  $y_p$ , the general solution and the definite solution, given the initial condition of the differential equation

$$a) \quad \frac{dy}{dt} + 10y = 15; \quad y(0)=0$$

14. Find the  $y_c$ ,  $y_p$  and general solution and the definite solution, given

$$\frac{dy}{dt} - 2y = 0; \quad y(0)=9$$

15. Find the solution for the given equations

$$\frac{dy}{dt} - 5y = 0; \quad y(0)=6$$

16. Let the demand supply be

$$Q_d = \alpha - \beta P + \sigma \frac{dP}{dt}$$

$$Q_s = -\gamma + \delta P \quad (\alpha, \beta, \gamma, \delta > 0)$$

- (a) Assuming that the rate of change of price over time is directly proportional to exchange demand, find the time path  $P(t)$  (general solution)
- (b) What is the inter-temporal equilibrium price? What is the market clearing equilibrium price?
17. (a) Find the particular integral, complementary function, the general solution of the differential equation
- $$y''(t)+3y'(t)-4y=12$$
- (b) Definitize the solution with the initial conditions  $y(0)=4$  and  $y'(0)=2$
- (c) Are the inter-temporal equilibrium dynamically stable?
18. Find the  $y_p$  and the  $y_c$ , the general solution and the definite solution of the differential equation
- $$y''(t)+4y'(t)+18y=2; \quad y(0)=2\frac{1}{4}; \quad y'(0)=4.$$
- Which time path does the equilibrium yield: damped, uniform or explosive fluctuation?
19. Find the  $y_p$ ,  $y_c$ , the general solution and the definite solution
- $$2y''(t)-12y'(t)+20y=40; \quad y(0)=4$$
- $$Y'(0)=5.$$
20. Find the  $y_p$ ,  $y_c$ , the general and the definite solution  $y''(t)+3y'(t)+4y=12; \quad y(0)=2; \quad y'(0)=2$ .  
The differential equations yields which time path (a) damped fluctuation; (b) uniform fluctuation; (c) explosive fluctuation.

## Unit 8: Game Theory

### Section A

4marks

1. What is a mixed strategy? Explain.
2. Distinguish between pure strategies and mixed strategies.
3. Why is constant sum game also a zero sum game?
4. A dominant strategy equilibrium is also a Nash equilibrium but the converse may not be true. Explain.

5. Use the concept of dominance to solve the game whose pay-off Matrix for player A is given below:

	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>
A <sub>1</sub>	4	3	6
A <sub>2</sub>	6	5	8
A <sub>3</sub>	7	1	5

6. By applying maximum-minimum criteria find the saddle point if any of the following game whose payoff matrix for Player A is given below

	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>
A <sub>1</sub>	9	2	19	5
A <sub>2</sub>	6	5	7	6
A <sub>3</sub>	7	3	4	10

7. Consider the following two person zero sum game where player A has the pay off matrix

	B <sub>1</sub>	B <sub>2</sub>
A <sub>1</sub>	4	-2
A <sub>2</sub>	5	-4

### Section B

**6marks**

1. Explain how the techniques of Linear Programming help us to solve two person zero sum games
2. Using the example of Prisoners' Dilemma game show that pure strategy is a special case of mixed strategy.
3. Using Linear Programming technique solve the following zero sum game

	B <sub>1</sub>	B <sub>2</sub>
A <sub>1</sub>	2	4
A <sub>2</sub>	3	1

4. Give an example to show that Nash equilibrium of a non-constant sum game may not be unique
5. Suppose two players A and B, each having a coin participate in a game of showing coins. Both the players show their coins simultaneously. If both of them show the same side of the coin then B given Rs.1 to A and otherwise A gives Rs.1 to B. put the above information in the form of pay-off matrix. Is there any pure strategy equilibrium? If not, what is the mixed strategy solution?
6. Solve the game where player A has the pay off matrix

	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>
A <sub>1</sub>	19	6	7	5
A <sub>2</sub>	7	3	14	6
A <sub>3</sub>	12	8	18	4
A <sub>4</sub>	8	7	13	-1

7. In a two-Industry economy, it is known that industry I uses 10% of its own product and 60% of commodity II to produce a rupee's worth of commodity I; industry II uses none of its own product but uses 50% of commodity I to produce a rupee's worth of commodity II, the open sector demands 100lakh rupees of commodity I and 200lakh rupees of commodity II.

- i) Write down the input-coefficient matrix and the specific input-output matrix equation.
- ii) Derive the rupee amount of the primary input used in producing a rupee's worth, each of commodity I and commodity II.

8. Locate all the Nash equilibrium solution for the following game:

	Strategy of Player B			
		Left	Centre	Right
Strategy of Player A	Top	1,0	1,3	3,0
	Middle	0,2	0,1	3,0
	Bottom	0,2	2,4	5,4

9. Consider a two sector open static Leontief system where the inter-industry input coefficient matrix is

$\begin{bmatrix} 0.4 & 0.5 \\ 0.3 & 0.2 \end{bmatrix}$  does the system satisfy Hawkins-Simon condition? Interpret the condition in simple economic terms.

10. Consider the following two-person zero-sum game where the pay-off matrix of player A is given as follows

		B's strategy	
		1	2
A's Strategy	1	80	20
	2	40	100

- a) Show that the game does not have a saddle point in pure strategy.
- b) Hence, determine the mixed strategy solution.

11. Use the concept of dominance and solve the following game whose pay off matrix for player A is given below

		Player B		
		4	3	6
Player A	6	6	5	8
	7	7	1	5

12. A person needs three kinds of nutrients, viz, calcium, protein, and vitamin A to maintain good health. His diet is assumed to be consisting of two food items I and II. Prices of these foods, nutrient, contents in these foods and minimum daily requirements of the nutrient contents are presented in the Table below:

	Food-I(per kg)	Food-2(per kg)	Minimum Daily requirement
Price per unit	60 paise	1 rupee	
Calcium	10	4	20
Protein(unit)	5	5	20
Vitamin(unit)	2	6	12

13. Below is given the pay-off matrix of player A in a two person zero sum game

		Player B		
		3	1	1
Player A	1	3	1	1
	1	1	1	5
	1	1	4	1

Construct a linear programming model with respect to player B

14. Consider the following (negative) pay off matrix (years of detention in jail) after two arrested individuals, suspect A and suspect B relating to a particular case. The suspects have been interrogated separately and no communication has been allowed between them

	Confess	Do not confess
Confess	(5,5)	(0,10)
Do not confess	(10,0)	(1,1)

Derive the dominant strategy adopted by each prisoner. Do you think that both of them could have done (in terms of getting detained in jail for lesser years) by co-operating?

15. In a two industry economy, it is known that industry I uses 20% of its own product and 50% of commodity II to produce a rupee's worth of commodity I, Industry II uses none of its own product, but uses 60% of commodity II. The open sector demands 1000lakh rupees of commodity I and 2000lakh rupees of commodity II

- Set up the input-coefficient matrix and the specific input-output matrix equation for the economy.
- Check whether the given data in the problem satisfy the Hawkins-Simon condition or not.

16. a) Define a constant-sum game with an example

b) find the Nash equilibrium solution (S) for the following game

		Player B		
		Strategy	Left	Centre
Player A	Up	-10,-8	-1,-4	7,-4
	Middle	-6,-3	6,-2	-3,-3
	Bottom	1,0	-1,-1	-4,-5

## Paper III

### Group A

#### MICROECONOMICS

##### Unit-1: Consumer behaviour

###### Section A

4 marks

1. Graph the budget line for a consumer in a two-commodity world with an income of Rs. 100, price of x is Rs.5 and price of Y is Rs. 10. Now graph her budget line if she is given a non-transferable coupon for three units of commodity Y.
2. Mira has the utility function,  $U=X+2Y$ , If price of X is 1 and the price of Y IS  $\frac{1}{2}$ , then how much she will consume in order to maximize satisfaction.
3. What is the economic interpretation of the slope of the budget line?
4. An expansion in income will always lead to the choice of higher amount of Giffen goods.
5. If two goods are perfect substitutes, what is the demand function for good 2?
6. If a consumer has a utility function  $U=XY$ , what fraction of her income will she spend on good 2?

###### Section B

6 marks

1. Derive an Engel curve from an Income consumption curve of an inferior good. Can both goods be inferior in a two-commodity world.
2. What is the difference between Hicksian and Slutsky methods of decomposition of price effect into income effect and substitution effect?
3. Show the change in consumer equilibrium in a two-commodity world when price of one of the commodities increases twice that of other commodity.
4. Using indifference curve, show how a proportional tax on interest income affects the consumer choice between current and future income.
5. Graphically derive the compensated and ordinary demand curves using Hicksian and Slutsky methods of compensation.

##### Unit 2: Production and Cost

###### Section A

4 marks

1. Draw Marginal Revenue and Average Revenue curves from the equation of the demand curve:  
 $Q=100-5P$ .
2. If constant return to scale exists at all levels of output in the long run, what would be the long run average cost?

3. What is the relationship between marginal cost of output and the marginal product of labour?
4. What is the relationship between average cost of output and the average product of labour?
5. A firm has a cost function given by  $C=10y^2+1000$ . At what output average cost is minimized?
6. A firm has a supply function given by  $S=4p$ . Its fixed costs are 100. If the price changes from 10 to 20, what is the change in its profit?

### Section B

6 marks

1. Consider the production function  $Q=5L+10K$  where  $Q$  is the total output,  $L$  is the quantity of labour employed, and  $K$  is the quantity of capital employed. What does the isoquant look like graphically? What law does it violate? Find two input bundles on the isoquant for  $Q=100$ . What is the slope of this isoquant?

2. Consider the cost function  $C(q)=q^2+1$ ,

Find the supply function (in terms of  $q$  as a function of  $p$ ) and depict it in a diagram.

3. (a) Explain the relation of LRAC with returns to scale.  
 (b) What happens to LRAC if there is technology improvement?  
 (c) What is the minimum efficient scale of production in LRAC?

4. Consider cost function  $C(q)=q^2+1$ ,

Find put the variable cost, average variable cost, average fixed cost, average cost and marginal cost and depict them in one diagram.

### Unit 3: Market Structure

#### Section A

4 marks

1. In a perfectly competitive market why do firms enter an industry when they know that in the long-run the economic profit will be zero?
2. Why the supply curve does not exist for a monopolist firm? Explain.
3. Show that Cournot equilibrium is a Nash equilibrium.
4. Different elasticities does not make price discrimination feasible. Do you agree? Explain.
5. State whether the following statements are true, false or uncertain, giving brief reasons:
  - i. It is wrong to explain huge yearly income of several million dollars, which the rock musicians sometimes earn, in terms of economic rent.



6. A monopolist faces a linear inverse demand function:  $P=a-bQ$ . Which of the following describes a correct relation between price elasticity of demand and marginal revenue? Explain.

- i. Demand is elastic when  $Q>a/2b$
- ii. Demand is inelastic when  $Q>a/2b$
- iii. Demand is unit elastic when  $P=a/2b$
- iv. Demand is elastic when  $Q<a/2b$

7. Why does differentiating its product allow an oligopolist to charge a higher price?

8. Is Stackelberg equilibrium a Nash equilibrium? Argue in brief.

9. Why could economic rent be variable with respect to the owner of a specific resource?

10. When does excess capacity exist in a monopolistically competitive market?

11. Answer whether the following statements are true or false or uncertain stating the reasons:

(a) The positive difference between price and marginal cost indicates the degree of power enjoyed by the monopolist.

(b) If  $MR=MC$ , firms will necessarily make profit under perfect competition.

12. Explain why a monopolist cannot produce at any point of the demand curve it faces.

13. Is it true that the tax burden (consumer and producer surplus) collected in the form of revenue by the government constitutes a net loss to the society? Explain.

14. Since long run equilibrium price exceeds the minimum value of long run average cost under monopolistic competition, monopolistically competitive firms earn positive economic profits. Do you agree?

15. Using the prisoners dilemma game, explain why individual maximization does not lead to the best outcomes for the players.

16. The more elastic the demand, the more price exceeds marginal cost in monopoly. Explore your agreement or disagreement?

17. In a natural monopoly, one firm can produce at a lower average cost than in monopoly. Explore your agreement or disagreement?

18. Briefly explain the difference between the outcomes of perfectly competitive and monopoly market structure.

19. Explain the difference in the characteristics of a monopolistically competitive firm and perfectly competitive firm?

20. A loss making perfectly competitive firm in the short run would shut down operation. Do you agree?
21. Briefly explain why perfectly competitive firm earn zero economic profit in long run.
22. Under a constant cost industry, explain the nature of long run supply curve in a perfectly competitive market structure.
23. (a) Define reaction function.  
(b) What is the difference between Cournot and Stackelberg model?
24. Explain why MC cannot intersect MR in the inelastic region of the monopolist's demand curve?
25. Over time a firm may lose its natural monopoly status. What factors could bring this about?
26. Explain why we cannot determine whether a monopolistically competitive industry will have more or fewer firms than would be present under perfect competition.
27. What kinds of economic and technological conditions are conducive to the formation of monopoly?
28. In a perfectly competitive market what is the relationship between the market price and the cost of production for all firms in the industry?
29. Does each of the following phenomena lead to a Nash Equilibrium?  
(i) The members of a product group opt non price competition;  
(ii) Both the duopolists act as followers.

## Section B

6 marks

1. A competitive industry is in long-run equilibrium. A sales tax is then placed on all firms in the industry. What do you expect to happen to the price of the product, the number of firms in the industry and the output of each firm in the long run?
2. A monopolist can produce at a constant marginal and average cost of Rs. 5. The market demand curve faced by the producer is  $Q=53-P$ . Calculate the profit-maximizing quantity combination and profit for the monopolist. How do the output level and profit of this individual change, if he operates in perfectly competitive structure? Can you identify and calculate the deadweight loss with the help of a diagram, when the conditions of producer's activities change from perfect competition to monopoly?

3. The duopolists A and B face an inverse demand function  $P=100-Q$ , where  $P$  is the price and  $Q=Q_a+Q_b$  is the total output produced by the two firms together. Each firm has a constant marginal cost equal to 10.

- i. Suppose A believes that B is going to produce  $Q_b^*$ . Derive A's reaction function.
- ii. Find the outputs of A and B in Cournot equilibrium.

4. A firm in a perfectly competitive industry has the following long-run cost function,  
 $C(q) = q^3 - 60q^2 + 1500q$

- i. If the firm can sell its output at  $P = \text{Rs. } 975$ , how much will it produce to maximize profit?
- ii. Is the output of the firm in (i) compatible with industry equilibrium?
- iii. If the industry is that of constant average cost, derive the equations for the long-run supply curve of the industry.

5. Firm A is a monopolist who produces at a constant average and marginal cost of  $AC=MC=5$ . It faces the market demand curve  $Q=53-P$ . Calculate profit maximizing price and quantity of firm A and determine A's profit. If Firm B enters the market and can produce at the same marginal and average cost of  $AC=MC=5$  and modified market demand curve becomes  $Q_a + Q_b = 53 - P$ , where  $Q_a$  and  $Q_b$  outputs of firm A and B respectively, determine the modified quantity and profit of Firm A if A makes his output decisions before Firm B. Determine also the quantity and profit of the new entrant B.

6. Does the soft drink industry conform more closely to monopolistic competition or oligopoly? Suppose minimum  $LRAC = \text{Rs. } 3$  per kg. for chicklet. Show that if the chicklet industry is monopolistically competitive, in the long run equilibrium, the price per kg will exceed  $\text{Rs. } 3$ . (2015) Also show decrease in the price of inputs used in chicklet production will affect in the industry. Assume that, after the decrease in cost, minimum  $LRAC = \text{Rs. } 2$

7. The inverse demand functions for two firms A and B are as follows:

$$P_A = 197 - 15.1q_A - 0.3q_B$$

$$P_B = 490 - 10q_B - 6q_A$$

Where  $P$  and  $q$  are the prices and quantities of two firms.

Assume each firm faces a constant marginal cost of  $\text{Rs. } 40$  per unit. Solve for the quantities and prices under Cournot equilibrium.

8. Should a competitive firm ever produce when it is making negative economic profit? Explain.

How can a price ceiling make consumers better off? Under what condition might it make the worse off?

9. (i) A discriminating monopolist sells in two markets with elasticities equal to 4 and 2 at the optimum. Can you obtain the ratio of the prices charged in the two markets?

(ii) A monopolist faces a demand curve  $Q=10-P$  and has a total cost function  $TC=4Q$ . To practice perfect price discrimination, how much profit should the monopolist earn?

10. The demand function in a duopoly market is  $Q=20-P$ , where  $Q$  is the total output sold by the two firms. The firms have cost functions  $C_i=8Q_i$ ;  $i=1,2$ .

- i. if the firms collude to act as a monopolist, what will be the industry output and profit?
- ii. What will be the price and outputs in Cournot equilibrium? What will be the profits?
- iii. If firm 1 acts as a Stackelberg leader and firm 2 as a Stackelberg follower, what will be the leader's output and profit in equilibrium.

11. Consider a duopoly market with two sellers,  $R=1,2$ . The market demand curve is linear and given by  $P_d = a - bQ$  where total output,  $Q=Q_1+Q_2$ . The technology is generated by identical and constant marginal cost of the two duopolists :  $MC^R(Q_g)=C >0$ . There is no fixed cost.

(i) Find out the equilibrium output under perfect competition.

(ii) Find out the equilibrium under monopoly.

(iii) Find out total equilibrium output under Cournot condition.

(iv) What is the relationship between output under perfect competition, monopoly and Cournot ?

12. The greater the degree of competition in a monopolistically competitive market, the flatter (more elastic) demand tends to be. As the amount of competition increases, how will this affect the degree of excess capacity of firms in the long run equilibrium?

13. Explain why the long run equilibrium price and output of a monopolistically competitive firm will change if other firms enter or leave the industry. Use a diagram to explain your answer.

14. A's accounting profit was Rs 30000 last year. The owner has been offered a job with another company with an annual salary of Rs 25000. The total investment in the business is Rs 70000 and a 12% return could be earned in other investments. Find the economic profit?

15. A monopolist faces a demand curve  $Q=20-P$  and has a total cost function  $TC=4Q$ . To practice perfect price discrimination, how much profit should the monopolist earn?

16. In a perfectly competitive industry, under what circumstances would you expect a rise in demand for an industry's product to be met primarily by a short-run output response on the part of existing firms? By a long-run response on the part of existing firms? By entry of new firms?

17. Graphically illustrate the impact of an increase in demand on price and quantity under a monopolistic market structure

18. What is consumers' surplus with a perfectly discriminating monopoly? What is the net welfare cost to society of such a monopoly?

### Unit 4: Input Market

#### Section A

4 marks

1. Under a perfectly competitive scenario, suppose the marginal product of a worker is 5 units per hour and each unit is sold in the market at Rs.6. the firm owner has to pay Rs. 40 per hour to the worker. Explain whether the owner will hire the worker.

2. State whether the following statements are true, false or uncertain, giving brief reasons:

- i. An IT company's demand for computer programmers depends not only on the current salaries of computer programmers but also on how much software the company expects to sell.
- ii. A monopsonistic employer will hire less number of workers but still pay higher wage than a competitive employer.

3. An increase in the demand for jari works increases the wages of women workers engaged in such work. Is the long run supply curve for jari works likely to be horizontal or upward sloping?

4. Explain the role played by mobility with respect to

- i. Capital
- ii. Land and
- iii. Labor

5. What does the supply of labor depend upon?

6. Explain the backward bending supply curve of labor.

7. If a monopsonist's inverse demand for labour is given by  $w=80-L$ , supply of labour is  $w=4L$  and MEC curve is  $w=8L$ , what is optimal level of labour employed and what is the wage paid?

#### Section B (6 marks)

1. Let  $q= L^3+5L^2+215L$  be the production function of a perfectly competitive firm.

- i. For  $w=Rs. 45$  and  $p= Rs.3$ , find the profit maximizing employment of the firm.
- ii. How would the firm behave if a minimum wage higher than Rs. 45 is imposed in the labour market?

2.  $W=100-L_d$ , where  $w$  is the wage 1. Let  $q=A+(W/P)L$  where  $A=(\pi^0+r/k)/P$ .

- (a) Assuming that  $\pi^0=400$ ,  $R=5\%$ ,  $K=1000$  and  $P=Rs\ 3$ , calculate the value of A.
- (b) For  $w=Rs\ 45$  and  $p=Rs\ 3$ , a firm maximizes profit at  $q=300$ . Calculate the amount of L (labour units) that will be employed by the firm.
- (c) Assuming the capital and labour are the only inputs or factor of production, what will be the total profit of the firm?
- (d) Calculate the marginal productivity of labour and value of marginal product of labor.
3. Let the labour supply function be given by  $w=L_s$  and the demand for labour be given by rate.
- (a) Find out the equilibrium wage and employment in this market.
- (b) Suppose that there is a minimum wage in this market. What will happen to employment if this minimum wage is (i) 70 (ii) 30
4. If the production functions of all the constituent firms of a perfectly competitive industry exhibit increasing returns to scale only, account for the long-run implication of the market and its equilibrium. Is the wage paid by a monopsonistic employer higher than that offered by a competitive employer? Are the numbers of workers hired by them equal?
5. College professors can earn extra cash by reviewing articles for academic journals. Editors pay around Rs 500 per article for an academic opinion about whether it should be accepted for publication. Reviewing a paper takes 1 hour. Professor Chatterjee has 15 hours available each month for outside work such as reviewing. He draws Rs 30000 monthly from his college, and is his only source of income.
- (a) Plot Chatterjee's Labour-leisure budget constraint.
- (b) Suppose professor reviews 6 papers in March. Plot and label his chosen alternative.
6. Suppose the marginal product of a machine hour in chair production was 30 chairs per month. When a machine hour cost Rs 20 and a labour hour costs Rs 10, which factor will the firm hire and why?

### Unit 5: Other Issues Related To Market

#### Section A

**4 marks**

1. Using Edgeworth box diagram, state the competitive or Walrasian equilibrium.
- 2 Explain Pareto efficient allocation. Define the contract curve in this context.
3. What is a general equilibrium allocation?
4. Define the two theorems of welfare economics. Mention the intuition behind the first welfare theorem.

5. In an economy clothing and food are produced with the help of labour and capital. Suppose that  $w=r=Rs\ 4/hr$ . Suppose also that in clothing production,  $MP_l/MP_k=2$  and that in food production,  $MP_l/MP_k=1/2$ . Is this economy efficient in production? If not, how should it reallocate its inputs?

6. What are the major sources of market failure? State briefly why each of them prevents a competitive market from operating efficiently?

7. Joy has 16 litres of coca-cola and 4 sandwiches. Bitan has 4 litres of coca-cola and 8 sandwiches. With these endowments, Joy's MRS of coca-cola for sandwiches is 1. Draw an Edgeworth box diagram to show whether this allocation is Pareto efficient. Explain your answer.

## Paper –III

### Group B

### MACROECONOMICS

#### Section—A

4marks

- a) Derive the Long Run Supply curve in Classical Economics and explain.
- b) What is natural rate of unemployment.?
- c) Economically explain why output increases more than that of increase in investment or government expenditure in Keynesian economics.
- d) Explain why the following statements are true:
  - i) If investment does not depend on interest rate, the IS curve is vertical.
  - ii) If money demand does not depend on interest rate, LM curve is vertical.
- e) If we increase Money supply what will happen in Long run Economics?
- f) What is Classical Dichotomy?
- g) What is Philips Curve?

#### Section—B

6marks

- a) Suppose RBI increases money supply then
  - i) using IS-LM, explain what happens to interest rate and output;
  - ii) using AD-AS, explain what happens to the price level.
- b) If investment increases then output increases in Keynesian Cross and in IS-LM, but the increase in output in IS-LM is less than that of Keynesian Cross. Why?
- c) Derive AS curve using Sticky price model.
- d) Derive the Short run and Long Run Philips Curve and explain why the shapes are different?

e) The consumption func. Is given by  $C = 200 + 0.75(Y - T)$ . The investment function is given by  $I = 200 - 25r$ .  $(M/P)^d = Y - 100r$ .  $M^s = 1000$  and  $P = 2$ .  $G = T = 100$ .

i) Calculate equilibrium output and interest rate.

ii) The Phillips curve

$$\pi = \pi_{-1} - 0.5(u - 0.06)$$

i) What is the natural rate of unemployment?

ii) How much cyclical unemployment is necessary to reduce inflation by 5% points? Using Okun's Law, compute the sacrifice ratio.

Suppose G increases to 150 from 100 then calculate the new equilibrium output and interest rate.

f) Derive the Govt Expenditure Multiplier both in SKM and IS-LM and explain the economic reasoning behind the difference?

g) Derive the Aggregate Supply curve through using the Labour demand and Labour supply curve.

h) Suppose that an economy has the Phillips curve

$$\pi = \pi_{-1} - 0.5(u - 0.06)$$

i) What is the natural rate of unemployment?

ii) How much cyclical unemployment is necessary to reduce inflation by 5% points? Using Okun's Law, compute the sacrifice ratio.

## Paper IV

### Group A

## DEVELOPMENT THEORY

### Unit 1: Concepts and Measures of Development

#### Section A

2 Marks

1. What is the scope of Development Economics?
2. Mention any two critical issues which are dealt into Development Economics
3. Can you describe the need for considering PPP Exchange Rate between countries?
4. Why should consumption per man hour worked be considered as better index of Economic Development?
5. What variables are taken into consideration for measuring HDI?
6. Mention the three sub indices which are taken into account for measuring HDI.
7. Distinguish between Economic Growth and Economic Development.
8. Give the most common way of constructing a PPP ratio.
9. Give the relevance of 'Life Expectancy at Birth' for developing nations.
10. Can you define Economic Development in terms of capability according to A.K Sen?  
Economic Development is something more than Growth – Explain.



11. Can you give the implication of the slogan 'Redistribution from Growth' – from view point of a Developing Economy?
12. Indicate the variables taken into consideration for measuring Human Poverty Index(HPI)

### **Section B**

**10 Marks**

1. Do you think that Human Development Index is a quality different measure compared to other income-based measures development?
2. Distinguish between Economic Development and Growth. Discuss whether per capita income can be used as a good index of development.
3. Economic Development is something more than Growth – Elucidate.
4. Explain the capabilities approach towards Economic Development.
5. Despite the existence of diverse set of developing nations they have some common characteristics – Explain.
6. What is PPP? Why do we require a PPP measure of PCI while making international comparisons regarding Economic Development?
7. What is the implication of the difference in PCI ranking and HDI ranking between two countries?

## **Unit 2: Process of Development – Theoretical Perspectives**

### **Section A**

**2 Marks**

1. Simon Kuznets has indicated six characteristic features of Economic Growth Mention any four features .
2. Indicate one of major determinants of resource shift from primary to secondary sector on basis of Clark-Fisher theory regarding structural changes in an economy.
3. Mention first two growth laws as proposed by Kaldor.
4. What do you mean by Verdoorn's Law?
5. Indicate the pattern of change in the occupational structure while a country ascends from less developed status to a more developed status.
6. Give two conditions that are to be fulfilled by an industry to become a leading sector at the 'take off' stage.
7. State any two criticisms of Rostow's stage of growth theory.

### **Section B**

**10 Marks**

1. Explain the growth laws as put forward by Kaldor in establishing the relationship between Industrial Growth, GDP Growth and productivity Growth in an Economy.
2. Examine the roles of 'Higher Investment Rate' & 'Leading Growth sectors' in any economy for attainment of 'take-off' stage as suggested by Rostow.

3. Explain basic approaches of Neo Classical counter revolution towards Economic Development.
4. Explain the Clark - Fisher views regarding Economic Transition of a country.
5. Critically analyze the Rostow's theoretic approach towards Economic Development.
6. Explain in brief the concept of economic growth as suggested by Simon Kuznets. Elucidate six characteristic features of Modern Economic Growth as observed by him.
7. Show that the characteristic features of modern economic growth as observed by Kuznets are mutually reinforcing.
8. Critically examine Rostow's pre-conditions for take-off in the perspective of Economic Development.

### **Unit 3: Factors in Economic Development**

#### **Section A**

**2 Marks**

1. Distinguish between casual Labour and long term contract labour.
2. 'Higher efficiency Wage in less developed countries may be the reason for their choosing capital intensive technology '—Explain in brief.
3. indicate any two instances of urban bias against agriculture .
4. State the objectives of land reforms.
5. Distinguish between ICOR and ACOR
6. Mention a situation when ICOR will approximate in ACOR.
7. Give the implication of Learning-Curve .
8. Mention any two ways through which investment in education can expand Human Capital .
9. Distinguish between fixed rent tenancy and share cropping.
10. Indicate a situation where fixed rent tenancy is preferred to share cropping.

#### **Section B**

**10 Marks**

1. Explain the major the contributions of the agricultural sector towards economic development of a nation.
2. Critically discuss the Marginal Per Capita Reinvestment Quotient Criterion for resource allocation in LDCs .
3. "Land Reform may be considered as a necessary condition for increasing agricultural productivity but cannot be treated as a sufficient condition" —Briefly Explain .

4. Discuss the rationale for land reforms .

5.(a) Explain some of the barriers to agricultural development in LDCs.

(b) Explain the reasons behind higher incidence of share-cropping as opposed to fixed-rent tenancy in Asian countries.

## **Unit 4 : Population and Development**

### **Section A**

**2 Marks**

1. Indicate two determinants of population growth in a country.
2. Define Total Fertility Rate.
3. Define Youth Dependency Ratio.
4. What are basic features of the first stage of demographic Transition?
5. What are the basic features of second stage of demographic Transition?
6. Explain any one indicator of dependency burden as in population structure of developing economy.
7. When is technological progress said to be 'Hicks' Neutral?
8. When is technological progress said to be 'Harrod' Neutral?

### **Section B**

**10 Marks**

1. Discuss how population growth can adversely affect Economic Growth of a country. How it can be stimulus to Economic Growth?
2. The term 'Technological Progress' is used in several different senses – Explain.
3. Explain the concept of capital saving, labour-saving and neutral technological progress on Hick's classification.
4. Examine the view that it is not possible to make an invariable choice in favor of more labour intensive techniques even in the over populated countries unless we make explicit choice between the present and the future.
5. Explain the relationship between formation of Human Capital and Economic Development in LDC.
6. Discuss the process of demographic transition and its implications in Economic Development of a country?
7. Explain the concept of Capital Output Ratio as an instrument of development planning  
Discuss Human capital
8. Can population pressure inevitably result in low level of Equilibrium Trap in any LDC?
9. What is the role of capital in economic growth of a country?
10. Capital Accumulation is seen as an escape route from the vicious wide of poverty? Discuss
11. Analyze Arrow's concept of 'Learning By Doing'.
12. Explain role of investment in education towards the expansion of Human Capital.
13. In what sense can technological progress can be considered as biased?
14. Discuss different variants of the technological progress based on Hicks' classification.

15. Illustrate the concept of neutral technological progress based on Harrow and Hicks.

### **Unit 5: Development Strategies**

#### **Section A**

**2 Marks**

1. How can you explain 'underdevelopment' as coordinator failure?
2. What are dynamic gains from trade?
3. What do you mean by 'Forward Linkage'? Give suitable Example
4. Point out the indivisibilities in Big Push Theory .
5. Why and what sense, should Growth be balanced?
6. How can you explain the declining terms of trade (TOT)?
7. What is Prebisch-Singer Thesis?
8. Show the poverty trap as indicated from supply made by Nurske.
9. Indicate the factor that lead to dynamic gains from trade?

#### **Section B**

**10 Marks**

1. Explain the nation of poverty trap as explain by Nurske.
2. Explain the relevance of 'Big push theory' of Rosenstein Rodan in overcoming this trap.
3. What should be choice technique in capital source developing nation ?
4. Critically analyze the view of 'Unbalanced Growth.'
5. Explain the problem of long-term decline in terms of trade of any less development country on the basis of Prebisch-Singer Doctrine. Do you fully agree with propositions of doctrine?
6. Discuss the situations where a labour-surplus economy may choose capital-intensive technology instead of labour-intensive technology.

### **Unit 6: Development In A Labour Surplus Economy**

#### **Section A**

**2 Marks**

1. State two basic assumptions of the Lewis' Model
2. State any possible reason for the premature end of the process of labour absorption as observed in Lewis' Model
3. Mention any two characteristics of Urban Informal Sector.
4. Give two arguments in favour of promotion of Urban Informal Sector
5. Give the basic motivational force behind the rural-urban migration as suggested by Harris-Todaro Model.
6. How does present value of the net future income stream influence the migration delusion of a rural worker?
7. Mention any two basic characteristics of Labour Surplus Economy.
8. Mention any two basic features of Todaro-Migration Model

9. What is economic dualism?
10. Can you indicate a situation where Lewis' Model would show capital accumulation without any growth in employment and total wage payment?
11. Why does efficiency wage differ very little between developing and developed nations?
12. Indicate a measure for disguised unemployment.

### **Section B**

**10 Marks**

1. Explain the concept of 'economic dualism' .
2. Critically analyze the process of industrialization and rural-urban migration in a labour-surplus economy on the basis of Lewis' Model. Mention some situation where there might be premature ending of the process
- 3 .a) Explain the role of capital accumulation as an escape route for the diminishing return and zero marginal productivity of labour in agriculture using a classical dual economy mode.  
b) Discuss the impact of relaxation of single good assumption in this model.
4. Indicate cases where i) ratio of capitalists profit to total output of the capitalist sector does not grow in the process. ii) Capitalist's surplus falls despite an increase in marginal product of labour in capitalist sector
5. a) Use suitable model to explain process of rural-urban migration where rural worker to imagination delusion on basis of their expected income.  
b) Suggest suitable policy measures to restrict migration process.
6. The policy-decision regarding the creation of urban employment may ultimately end up with greater urban unemployment – Explain this paradoxical result with help of suitable rural-urban migration model.
7. 'The Lewis Two- sector model of development requires considerable modification in assumptions to fit the reality of contemporary Third World Nations' – Do you agree with the above view?
8. How can you measure disguised unemployment?
9. Explain concept of static and dynamic surplus of labour with respect to estimation of disguised unemployment.

## **Unit 7 : Development, Inequality and Poverty**

### **Section A**

**2 Marks**

1. State inverted-U-Hypothesis as suggested by Kuznets
2. Explain Kuznets' Ratio.
3. Define Social dimension of poverty.
4. Distinguish between absolute and relative measures of poverty.
5. What are tenets of World Bank's Strategy for poverty alleviation?
6. Define Lorenz consistency.
7. What are main indices of HPI?
8. Can you describe the shape of Lorenz Curve for perfect inequality in income distribution?
9. Give any one reason for greater incidence of poverty among female headed households in LDCS?

**Section B****10 Marks**

1. Explain Kuznets' inverted – U Hypothesis regarding income inequality in a country.
2. a) How can Lorenz curves be used to indicate the process of dualistic development?
  - a) Briefly discuss the following measures of poverty and inequality :
    - a. HCR, Gini Coefficient
3. a) Briefly discuss four criterion of Lorenz consistency.
4. Explain how Lorenz curve can be used to make judgment on inequality.
5. a) Define Lorenz consistency.
  - b) What ambiguities arise when Lorenz curves Cross?
6. a) Can you explain why Gini coefficient is Lorenz consistent?
  - b) Explain relation between Gini coefficient & Lorenz curve.
7. a) Define 1) absolute Measures of Poverty 2) Relative Measures of Poverty
  - b.) What is the difference between them?
- 8.) What is bias inherent in head count measure of poverty?
- 9.a) Why does income gap ratio be used as an effective measure to address the problem from poverty gap measure?
  - b) Why may poverty gap ratio present a misleading picture of poverty in highly unequal societies?
10. Compare and contrast the strength and weakness of head count ratio, Poverty gap ratio and income gap ratio?

**Unit 8 : Environment and Development****Section A****2 Marks**

1. Policies that are justified on economic grounds alone can also deliver substantial environment benefits – Mention one such example.
2. Define Global public good with an example?
3. Can you suggest two policies which can improve both economic efficiencies and natural environment?
4. Define sustainable national income?
5. What are opportunity costs of reserving rainforests?
6. Define Environmental Kuznets Curve.
7. Define sustainable development.
8. Suggest two policy measures that LDC can adopt for arresting environmental degradation.

**Section B****10 Marks**

1. "Environmental accounting is needed to achieve the objective of sustainable development" Explain.
2. Explain the ways in which poverty affects the environment.
3. Analyse the possible trade offs between (i) rural development and environmental quality (ii) urban development and environmental quality.
4. Discuss the nature of global environmental problems in terms of the destruction of rainforest and increase in the level of green house gases. Suggest some policy options before the less developed countries to meet this challenge.
5. Do you think that the direct control measures for pollution control are inefficient? Give arguments. Can the imposition of emission taxes be considered as a better option?
6. Show that pollution control through the introduction of tradable emission permits would be a better option compared to the imposition of emission taxes.

## **Paper IV**

### **Group B**

#### **INDIAN ECONOMY SINCE INDEPENDENCE**

##### **Unit 1: Indian Economy at the time of Independence**

###### **Section A**

**2 Marks**

1. What is de-industrialisation?
2. What was the nature of occupational structure of the Indian Economy at the time of Independence?

###### **Section B**

**10 Marks**

1. Describe the features of Indian economy on the eve of independence with a reference to the colonial rule.

#### **Unit 2 : Planning: Evolution of India's Goal and Strategy**

###### **Section A**

**2 Marks**

1. Mention any two objectives of Economic Planning in India.

2. Mention any two causes behind implementation failure of planning in India.
3. Examine the concept of Trickle Down Strategy.
4. Why did development strategy in Indian Planning prefer the institution of state over that of market?
5. Can you indicate agriculture industry relationship in India from view point of supply side and demand side?
6. What do you mean by PL-480?
7. State any two reasons for failure of Nehru-Mahalanobis Plan.
8. What were the Structural constraints of Indian Economy during fifties?
9. State the basic argument of fifth Five Year Plan.
10. Which area of development was emphasized in 2<sup>nd</sup> Five Year Plan.
11. What is urban bias in Indian Planning?
12. Mention two situations to establish a demand side and supply side linkage between agriculture and industry.
13. What was new strategy introduced in 4<sup>th</sup> Five Year Plan?
14. Explain the role of foreign aid in Fifth Five Year Plan?
15. What are the 3 basic characteristics of Indian planning.
16. Which area of development was emphasized in 2<sup>nd</sup> five year plan and why?
17. Why are first three five year plan separate from other plans?
18. State the basic arguments of 5<sup>th</sup> Five Year Plan?
19. Give one example of information problem resulting from the Indian centralized planning system?
20. Mention one cause of crisis of Indian Economy during 7<sup>th</sup> Five Year Plan?
21. What change in development strategy was symbolized by adoption of New Economic Policies in 1991.
22. State one way in which the role of Indian State changed following the adoption of New Economic Policies?
23. Which area of development was emphasized in 2<sup>nd</sup> Five Year Plan? Why?
24. State any two causes of plan failures in Indian Economy.

## **Section B**

**10 Marks**

1. Discuss the role of state in the planning of a Mixed Economy. Write a short note on the problems and prospects of decentralized planning in India.
2. Indian plans are good in papers but not so good in implementation- Do you agree with this view? Give reasons for your answer.
3. Why and how was the development objective modified in the Fifth Five Year Plan.
4. Explain the structural constraints to the implementation of Planning Problem.
5. Describe the rationale behind adoption of India's development objective and strategy in early phases of planning.
6. Explain causes behind regional inequality in India and probable corrective measures?
7. Explore the various problems that arose with respect to implementation of plans



8. Explain the choice of investment strategy in India during 2<sup>nd</sup> Five Year Plan?
9. Why was inequality demanded in planning even when it was considered important by planners?
10. Examine the role of foreign aid and poverty eradication in Fifth Five Year Plan.

### **Unit 3: Land and Agriculture**

#### **Section A**

**2 Marks**

1. Mention the policy objectives of structural reorganization.
2. Mention any two features of green revolution.
3. Distinguish between the concepts of marketed surplus and marketable surplus.
4. What are the limitations of the agricultural price policy in India?
5. What were three types of land reform measures adopted in the 1950s policy of land reform program?
6. Why was the adoption of abolition of intermediary tenants seen as important under the land reform program?

#### **Section B**

**10 Marks**

1. State the objectives of land reforms in India and the reason behind its failure
2. Do you think that the relation between farm size and productivity is scale neutral?)
3. Explore the reason behind the partial success of Green Revolution in India?
4. What were the objectives behind the price policy in agriculture? Do you think that the outcomes have fulfilled the proposed objectives?
5. Distinguish between support price and procurement price in the context of Indian agricultural sector?
6. Describe how the relation between minimum support price and foodgrain surplus evolved in the pre-NEP period?
7. Explain the sources of growth in agriculture output from the early 1650s to 1980s?
8. Under the land reform program adopted after independence, what was the projected role of ceiling on land holding? Explain whether this reform measure was successful?

### **Unit 4: Industrial Development, Trade and Policy**

#### **Section A**

**2 marks**

1. Mention any two causes behind industrial sickness in India .
2. What is FERA?
3. What was the objective of industrial planning before the first five year plan?
4. What is the objective behind small scale reservation policy?
5. What were reasons behind introducing licensing policy in India?
6. State the reasons behind the deceleration of Indian Industries in mid sixties?
7. What is MRTP act?
8. Mention the basic reasons behind promoting foreign investment in India?
9. Why do you consider the pattern of industrial growth during mid-1960s to mid 1970s as structural retrogression?
10. Mention names of any four industrial enterprises under the Navaratna Category of India.
11. Mention the major causes behind attracting FDI in India.
12. What is Disinvestment Policy?

### **Section B**

**10 marks**

1. What were the objectives of Industrial Licensing Policy of the Government of India?  
Explain how far this policy was successful in initiating the process of industrialization.
2. Discuss the major problems that rose as a result of import-substitution policy adopted during the plan period in India?
3. Evaluate the performance of Industrial-Licensing system.
4. Examine the role of quantitative restriction in India's pre-NEP foreign trade regime.
5. Comment on the changes which have taken place in the trade structure in India after the introduction of NEP?
6. Explore whether the adverse terms of trade against industry was a factor responsible for recession of Indian industries during mid 1960's.

## **Unit 5: Employment, Wages and Inflation**

### **Section A**

**2 marks**

1. Mention two major causes of inflation in India during 1980's.
2. Mention any two schemes implemented by the Government for general rural employment in India.
3. Discuss the concept of unemployment used by NSSO.
4. Explain in brief the concept of informal employment in India.
5. Why did basic minimum need find a place in India's 5<sup>th</sup> Five Year Plan?
6. What is MGNREGA?

### **Section B**

**10 marks**

1. Explore the trend of wages in India .

2. Describe the process of informalization of employment following the process of industrialization in India.
3. Why was minimum wages adopted? Did it have the designed effect?
4. What were the policies taken to counteract inflation during the 1980's?
5. Explain the principal causes of inflationary pressure in India during 1980's?

# Paper VA

## International Economics

### Section A

4 marks

- a. Identify the gains from trade under constant opportunity cost.
- b. How do the changes in terms of trade affect production, consumption and overall level of welfare of a trading country?
- c. "Growth in poor country is self-defeating." – Explain.
- d. "Tariff and Quota are equivalent"-Explain in which sense this statement is true.
- e. If a large country imposes tariff on imported goods will it improve its terms of trade
- f. "If the world terms of trade for a country are somewhere between the domestic cost ratio of A and that of B, then country A and country B will both gain from trade.", Justify.
- g. "Gains from trade can be understood by thinking of trade as an indirect method of production." Explain using an example.
- h. "A rise in terms of trade increases a country's welfare while a decline in terms of trade reduces its welfare." Justify.
- i. What is biased growth? Explain with the help of diagram.
- j. Identify the gainers in a tariff imposing country.
- k. "In Ricardian model each country necessarily specializes completely in the good in which it has comparative advantage"- Do you agree?

### Section B

6 marks

- a. State and explain the basic assumptions of the Heckscher-Ohlin Theorem.
- b. Briefly contrast the elasticity and absorption approach to devaluation and balance of payments.
- c. The price changes caused by tariff and subsidies change both relative supply and relative demand". Explain.
  - ii. How does an export subsidy affect the international distribution of income?
- d. "If factor-endowment ratios of two trading countries differ widely, free trade may not lead to factor-price equalisation" Explain the statement.
- e. When the rest of the world experiences economic growth, the effect may be bad for a nation" True or False-Explain.
- f. What would be the value of optimum tariff when Metzler paradox exists?
- g. Show that the multiplier effect of an increase in government expenditure is smaller in an open economy than that for a closed economy.
- h. Justify the statement: "Balance of payment always balances".
- i. Do think Metzler's paradox can be of practical use in real world?
- j. What happens to the international terms of trade when a small country imposes tariff? Explain.
- k. What is meant by the J-curve?
- l. Explain with diagram the effect of an autonomous increase in export on trade balance

- m. If a country experiences import biased growth does it necessarily gain in terms of Welfare? Explain your answer.
- n. "A transfer worsens the donor's terms of trade if the donor has a higher marginal propensity to spend on its export well than the recipient "Discuss.
- o. Using offer curves of two nations, logically explain the stability of international equilibrium.
- p. 'A quota on imports can convert a potential monopolist into an actual monopolist"- explain.
- q. "If there is free trade between two countries in a HO world, and both countries produce both goods, then rent in the two countries will be the same" Justify.
- r. An import tariff and an export subsidy can be treated as similar policies since they both support domestic producers"- Do you agree? Explain.
- s. Who are the losers in a tariff imposing country? How do you measure loss? How is the loss related to the price sensitiveness of demand for importable.
- t. Show that the multiplier effect of a fiscal expansion is smaller in an open economy than that in a closed economy.
- u. Distinguish between fixed and flexible exchange rate systems.

## **Paper VB**

### **Public Finance**

#### **Section B**

**4 marks**

1. Distinguish between private and public finance.
2. What is meant by a merit good? Do you think that such goods should be provided by the government?
3. What do you mean by tied grant and matching grant?
4. What is Coase's law? Explain with example.
5. Do you think that executive budget is preferable to the legislative one? Give reason for your answer.
6. What is the difference between conventional budget and cash budget?
7. Is consumption a good tax base? Explain
8. Distinguish between external and internal public debt.
9. Why public sector is required in any economy?
10. Distinguish between public provision and public production
11. Distinguish between conditional and unconditional aid
12. Compare- a) revenue account and capital account,  
 b) Unit tax and ad valorem tax,  
 c) VAT and GST,  
 d) Impact and incidence of tax.
13. Mention and explain any two properties of public goods.
14. Under what conditions Balanced Budget multiplier becomes more than or equal to one?

## Section B

6 marks

1. Explain the regulatory function of the Government and its economic significance.
2. "A selective grant earmarked for specific public outlay is more effective than a general grant"- Explain
3. What is a mixed good? "Mixed goods generate external benefit or costs and call for correction by subsidies or taxes"- Explain
4. Explain the basic structure of Govt budget. What are the spill over effects?
5. On what ground would you justify the benefit approach to taxation?
6. What are the effects of taxes on savings
7. What are the merits and demerits of VAT
8. Discuss the role of the State in any developing nation.
9. Make a comparison of matching and non-matching grants.
10. How efficient provision of public goods is are determined in the world consisting of one public and one private good?
11. "Efficient provision of social goods involves vertical rather than horizontal addition of individual pseudo-demand schedules"- Explain.
12. Briefly discuss the basic assumptions and logic of Ability to pay approach to taxation.
13. What are the effects of income tax on work effort?
14. Does public debt create burden for future generation?
15. Analyze the impacts of proportional income tax and an equal yield expenditure tax on savings.
16. Clearly discuss the solution proposed by Lindahl regarding the optimal provision of public goods.
17. Do you think that an indirect tax necessarily imposes an excess burden compared to direct tax of equal yield? Give reasons.
18. What is progressive system of taxation and why is the tax system of a country made progressive?
19. Under Equal Sacrifice Principle, show that the taxation will be progressive if the term "equal sacrifice" is interpreted in a specific way.

## Paper VIA

### Comparative Development Experience

#### Group-A

#### Unit 1: International Comparison of Development

##### Section A

4 marks

1. What are the two aspects to the measurements of income inequality across the world?
2. "International inequality" and "Global inequality" do not reflect the same aspects to the measurement of income inequality across the world- Do you agree?
3. Do you support the view that the absolute gap between the richest and the poorest countries has widened over time? Give some evidences.

4. Can global inequality be higher than international inequality? Explain.

### **Section B**

**10 marks**

1. What are the three basic components of development? Use Goulet's and Amartya Sen's concepts to explain these components' individual contribution and interrelationship. Hence comment on how together they strive for fulfilling the true purpose of development.
2. Explain some of the significant differences in initial conditions of development between LDCs and present day developed countries.
3. How can you assess the development gap between nations on the basis of growing income inequality across the world?

## **Unit 2: Genesis Of Capitalism**

### **Section A**

**4 marks**

1. What is the basic difference between feudal and semi-feudal character of a pre-capitalist society?
2. State some possible reasons for the breakdown of feudalism in Western Europe.
3. Distinguish between mercantile and industrial phases of capitalism.
4. Mention any two causes of economic crisis faced by Great Britain during Great Depression of 1930.
5. Give two illustrations of pre-capitalist societies other than feudalism.
6. State some possible reasons for the breakdown of feudalism in Western Europe.

### **Section B**

**10 marks**

1. 'The Western European Capitalism transformed the Third World Countries partly by interacting with and partly by destroying the pre-capitalist structure of society'- Do you agree? Explain briefly.
2. Distinguish between mercantile and industrial phase of capitalism.
3. Explain different phases of capitalism in Western Europe and the nature of exploitation in these phases.
4. Examine the debate regarding the period of 'First Industrial Revolution'.

## **Unit 3: Industrialization Experiences in early part of 20th Century**

### **Section A**

**4 marks**

1. Mention two effects of the British Industrial Revolution.
2. State two identifiable changes in the methods and characteristics of economic organization that constitute industrial revolution.
3. Mention and explain any one point in the debate between Heavy industrialization and light industrialization
4. Mention any two features of New Economic Policy in Soviet Union.
5. Distinguish between the 'First New Deal' and 'Second New Deal' as implemented in USA to overcome the impact of Great Depression.

6. Mention some basic causes of economic crisis faced by Great Britain during the great Depression of 1930s.
7. Mention any two fundamental flaws in the economic structure of USA that led to its economic collapse during 1930s.

### **Section B**

**10 marks**

1. Explain the argument why priority was laid on heavy industrialization in Soviet Union during early phase of development planning.
2. Mention some of the principal features of Industrial Revolution in Great Britain.
3. Distinguish between the 'First New Deal' and 'Second New Deal' as implemented in USA to overcome the impact of Great Depression.

## **Unit 4: Post Second World War Development Scenario**

### **Section A**

**4 marks**

1. What are the special features of a Welfare state?
2. What do you mean by primary and secondary inward looking policies for economic development?
3. Mention the basic objectives of UNCTAD.
4. Distinguish between the objectives of IMF and World Bank.
5. Distinguish between FDI and FPI.
6. Explain in brief the 'Structural Adjustment landing' by the World Bank.
7. Define an MNC and indicate two important characteristics of these MNCs.
8. Distinguish between a bilateral international capital flow and multilateral international capital flow.

### **Section B**

**10 marks**

1. 'Import Substitution Strategy towards industrialization has been largely unsuccessful'- Explain.
2. Distinguish between export promotion and import substitution policies? Name two countries which followed the two policies.
3. Do you think that Import Substitution Argument for industrialization is the same as Infant Industry Argument?
4. What do you mean by primary and secondary inward-looking policies for development

## **Unit 5: Development and Underdevelopment as Historical Process**

### **Section A**

**4 marks**

1. State the dimensions of dependency argument of development.
2. Who propounded the theory of Unequal exchange? What do you mean by it?
3. Differentiate between the notions of 'centre' and 'periphery'.



4. What is meant by 'New Dependence' as explained by Dos Santos?

### **Section B**

**10 marks**

1. Explain the fundamental limits upon the development of peripheral economies as created by the historical process of dependency.
2. 'Exchange is unequal between rich and poor countries because wages are lower in poor countries'- explain.

## **Unit 6: Evolution of New International Economic Order**

### **Section A**

**4 marks**

1. What are the basic tenants of Neo-liberalism?
2. Indicate some basic differences between GATT and WTO.
3. 'The Washington Consensus is essentially Neo-liberal'- Do you agree? Give justification.
4. Explain the notion of economic integration between developing nations.
5. What are the principal functions of WTO? What do you mean by Market Access in WTO?
6. What are "Regional Trading Blocs"? Give two examples.

### **Section B**

**10 marks**

1. Explain the process of gradual transition from GATT to WTO.
2. Discuss the controversies regarding the TRIPS and TRIMS from the view point of their possible impacts upon the LDCs.
3. Discuss the economic rationale for the gradual integration of the LDCs through the formation of regional trading blocs.
4. Explain the notion of global polarization and evolution process of the modern (capitalist) polarization.
5. Discuss the impacts of Washington Consensus and the Neo Liberal policies of the IMF and World Bank on the developing Nations by giving example from the experience of any country.
6. Explain the rationale for re-examining the role of IMF in maintaining global economic stability in the era of globalization.
7. Examine the welfare effect of trading blocs in the form of, say, a Customs Union.

## **Unit 7: Development Policies and role of the State**

### **Section A**

**4 marks**

1. What constitutes development planning?
2. Distinguish between the concepts of 'comprehensive plan' and 'partial plan'.
3. Mention two principal components of development planning in a mixed economy.

4. Mention two aspects in which the role of State has changed following the Washington Consensus
5. What do you mean by 'New Consensus' as opposed to 'Washington Consensus'?

### **Section B**

**10 marks**

1. What are the impacts of Washington Consensus on the role of State?
2. Explain the rationale for adopting development planning in LDCs.
3. Explain the Notion of New Consensus and the role of State in attaining this New Consensus.

## **Unit 8: Some Recent Development Experiences**

### **Section A**

**4 marks**

1. Indicate one major reason behind the economic crisis in Argentina.
2. Mention two basic characteristics of the remarkable growth pattern of the Chinese economy during the last few decades

### **Section B**

**10 marks**

1. Do you think that the spectacular growth in Chinese economy during the last few decades is simply the outcome of markets, trade and globalization? Give justification to your answer from the growth experience of China.
2. Examine the 'Domestic destiny' and 'Domestic policy' based explanations which are offered for indicating the causes of slow growth of African economy.
3. Discuss the 'Debt-led growth' experience of Argentina since 1980s.

## **Paper VIB**

### **Contemporary Economic Issues: India and West Bengal**

#### **Group A: Contemporary Economic Issues: India**

### **Unit 1 : Economic Reform In India Since 1991**

#### **Section A**

**2 marks**

1. Mention the two causes behind the macroeconomic crisis of 1991.
2. Mention any two changes in the role of the state.
3. In what way did the new economic policy bring about a shift in the development strategy of India?
4. What were the components of the reform package outlined in 1991?
5. Mention the two categories of policy changes in 1991.
6. What were the objectives behind the adaptation of the stabilization policies and structural reform policies?
7. State the reforms in trade policy.
8. What is strategic sale of public enterprise?

9. What is privatization?
10. What is National Investment Fund?
11. Mention two reform measures adopted in the area of foreign investment in 1991.
12. What are the two perspectives used to explain inefficiency in the public sector?
13. Which were the six Industries where the Govt was allowed to hold majority of share?
14. Mention any four 'Navaratna' companies as identified by the Govt of India.
15. Forward two causes for the poor performance of the PSUs.
16. Mention two arguments in favour of Disinvestments of PSUs.
17. What was the Argument put forward by the Disinvestment Commission regarding the methods of Disinvestment? What was the problem with this Argument?
18. What are the objectives of Monetary Policy of RBI?
19. State any two reforms undertaken in the money market.
20. What is Automatic Monetization?
21. What are the direct and indirect instruments of monetary policy of RBI?
22. What are the different channels through which Open market operations is conducted by RBI?
23. Define Repo rate.
24. Mention the role of liquidity adjustment facility.
25. What is the goal of market stabilization scheme?
26. What is the difference between index futures contracts and index options?
27. What instruments helped in the transformation of call money into an interbank market?
28. State any two advantages of LAF?
29. What is SEBI? Mention one of its functions.

## **Section B**

**10 marks**

1. What were the immediate backgrounds that lead to the adoption of **New Economic Policies**? Examine its objectives.
2. Describe the changing role of Indian state following the adoption of New Economic Policy.
3. Explain three changes in the Industrial Policy since the reforms in early 1990s.
4. Examine the Changes in policy to attract private investment in infrastructure.
5. Describe whether the arguments levelled against Disinvestment of Public Enterprise are valid.
6. Examine any two theories which explain that public ownership brings about efficiency losses.
7. Using the recommendations of various committee and commissions. Examine the experience of privatization in India.
8. Explain the measures undertaken in the new economic policy to revive the industrial scenario in India.
9. Describe the reforms initiated with respect to government securities market.
10. Examine the debate on the issue of separation of debt from monetary management.
11. Describe the changes in the instruments and target of monetary policy in India since the reforms where initiated.
12. Explain the role of competition and FDI in the banking sector.

13. Describe the banking reforms undertaken in India.
14. Mention 2 areas of concern in the credit delivery system. What are being done to streamline credit delivery?
15. Describe the tax reforms in India.
16. Examine the consequences of subsidies.
17. Explain the changing pattern of Fiscal Deficit since the early 1990s. Why is fiscal deficit being currently considered a major area of concern?
18. Explain the fiscal policy measures taken by both Centre and Periphery.
19. How was public debt attempted to be managed through the enactment of the FRMB Act following the global economic crisis since 2007?
20. Explain the Balance of Payment crisis in the late 1980s. What were the microeconomic responses to this crisis?
21. Examine the initial effects of reform on the current account and capital account.
22. Describe the various changes undertaken by the Indian State with respect to convertibility.
23. What are the supply and demand side factors that continue to adversely affect India's performance as an exporter?
24. What policies were taken to encourage foreign direct investment in India? What was the impact of these policies on FDI inflows?
25. Mention the different types of interventions in the foreign exchange market in India. How can cross-border currency flows be regulated?
26. Explain the measures taken in currency convertibility in the post reform period.
27. What are the policies taken to promote exports by India? How far these policies were successful in promoting growth?

## **Unit 2 : Agriculture, Poverty and Social Security**

### **Section A**

**2 marks**

1. State two risks faced by farmer.
2. What are the challenges faced on account of deforestation?
3. What was the Indian Forest Act of 1927?
4. What was the principal of National Forest Policy of 1952?
5. What is Joint Forest Management?
6. How can forest be related to conversation strategy?
7. What are the objectives of NREGA?
8. What are the provisions of NREGA?
9. Define informal labour.
10. Mention the two reasons for the deceleration of agricultural growth in the post-reform period.
11. Mention any four policy reforms needed to achieve the goals of agricultural development.
12. What are two reasons for decline in productivity growth in agriculture?
13. Mention any two proposals of NCEUS.
14. What was Antodaya Anna Yojana?

## **Section B**

**10 marks**

1. Explain three changes in industrial policy since the reforms in early 1990s.
2. Examine the changes in policy to attract private investment in infrastructure.
3. Describe whether the arguments levelled against disinvestment of public enterprise are valid.
4. Examine any two theories which explain that public ownership brings about efficiency losses.
5. Using the recommendation of various committee and commissions, examine the experience of privatization in India.
6. Explain the measures undertaken in the New Economic Policy to revive the industrial scenario in India.

### **Unit 3: Post Reform performance of Indian Economy**

#### **Section A**

**2 marks**

1. How pro-market orientation is different from pro-business orientation?
2. Was there any convergence between the states in terms of growth? If not, then any one explanation in support of your answer.

#### **Section B**

**10 marks**

1. Describe whether the Indian economic reforms have been gradual or big bang.
2. Compare India's growth experience in 1991-2011 to that experienced in pre-reform India.

### **Unit 4: Indian Economy : Some Current and Future Issues**

#### **Section A**

**2 marks**

1. What is social exclusion?
2. Define social inclusion.
3. Mention any two difficulties in assessing performance on inclusiveness.
4. Why employment is considered as a challenge in inclusive growth strategy?
5. Why is environment important for inclusive development?
6. State whether and how far the lowest quintile of Indian population has fared in terms of the distribution of growth benefits?
7. Mention the changes in service sector's share in overall economy since 1990s.
8. What are objective of food procurement policy?
9. What are the major elements of food procurement policy in India?
10. State the structure of public distribution system?
11. What is "eminent domain"?
12. Define the special economic zone.
13. What is "window of opportunity" in the theory of demography transition?

## **Group B**

### **Economy of West Bengal**

#### **Section A**

**2 marks**

1. What do you mean by State Domestic Product? What are the official sources of statistics on State Domestic Product?
2. What can you say of the general trend of State Domestic Product of West Bengal during the last decade?
3. Mention two features of land reform policy of the state of West Bengal during the last twenty five years?
4. Mention two features of agrarian relations in the state of West Bengal.
5. What do you mean by Rural Non Farm sector? Does this sector contribute to State Domestic Product in West Bengal?
6. Indicate any two reasons for the deceleration in agricultural growth rate in West Bengal during the last decade.
7. What was the reason for the increase in the work participation rate in West Bengal between 1991 and 2001?
8. What percentage of the operation holdings of West Bengal belong to the small and marginal category?
9. Mention two important hindrances to the industrialization process in West Bengal.
10. How can the formation of Self Help Groups empower the rural poor in West Bengal?

#### **Section B**

**10 marks**

1. Compare trends in employment and growth in SDP in West Bengal with five major states in India.
2. What do you mean by Operation Barga? Discuss the major debates around this policy in West Bengal.
3. What has been the growth of informal sector in West Bengal during the last two decades? How do you explain this growth?
4. What are Self-Help groups?. What were the reasons behind the policy of setting up such groups in the State of West Bengal?
5. What were the policies of poverty alleviation in the State of West Bengal ?
6. Examine the structure of West Bengal's economy in terms of the composition of NSDP.

7. What are the problems faced by the small scale industries of West Bengal and what incentives have been given to them?

## Paper VIIA : Statistics and Basic Econometrics

### UNIT 1: JOINT DISTRIBUTION

#### Section A

4 marks

1. Is the following a joint probability density function (pdf)? If yes, examine whether the variables are independent or not.

$$f(x, y) = \begin{cases} \frac{2}{3}(x+1)e^{-y}, & 0 < x < 1, y > 0 \\ 0 & \text{elsewhere} \end{cases}$$

2. Let the joint pdf of (X, Y) be

$$f(x, y) = \begin{cases} e^{-y}, & 0 < x < y < \infty \\ 0 & \text{elsewhere} \end{cases}$$

Find (i) the Marginal pdf of X (ii) The marginal pdf of y .

3. Evaluate the conditional distribution  $K(y/x=1)$ , given the joint probability function  $f(x, y) = e^{-x-y}$ ,  $x > 0, y > 0$ .

4. Evaluate the conditional probability that  $P(X \geq 1/y=2)$  if the joint probability function is given as  $f(0,0) = 1/8, f(2,0) = 1/8, f(0,2) = 1/8, f(1,2) = 1/8, f(2,2) = 1/8, f(x, y) = 0$  elsewhere.

5. The joint probability density function of two random variables  $x$  and  $y$  is given by

$$f(x, y) = \begin{cases} k_y(1 - x - y); & x \geq 0, y \geq 0, x + y \leq 1 \\ 0 & \text{Elsewhere} \end{cases}$$

Find the value of k

6. Explain the concepts of marginal distribution and conditional distribution of jointly distributed random variables.

7. Prove that the expectation of the product of two independent random variables is equal to the product of their expectation.

#### Section B

6 marks

1. The joint density of X and Y is given by  $f(x, y) = xe^{-(x+y)}, x > 0, y > 0$   
 $= 0$  , otherwise

Find the marginal densities of X and Y. are X, Y are independent?

2. Let  $x$  and  $y$  be two continuous random variables having joint probability density function

$$f(x, y) = \begin{cases} 1 - \frac{x}{3} - \frac{y}{3} & 0 \leq x \leq 2, 0 \leq y \leq 1 \\ 0 & \text{, otherwise} \end{cases}$$

Obtain the marginal densities of  $X$  and  $Y$ . Also find  $E(xy)$ .

3. Let  $X$  denote the number obtained from the throw of a die. Let  $Y$  be another variable such that

$$Y = \begin{cases} +1 & \text{When } X \text{ is odd} \\ -1 & \text{When } X \text{ is even} \end{cases}$$

From the joint distribution of  $X$  and  $Y$ , calculate  $V(Z=xy)$ . Are  $X$  and  $Y$  independent?

4. A perfect coin is tossed three times in succession. Given  $X=1$  if first toss gives head,  $x=0$  if first toss gives tail and  $y =$  no. of heads obtained in three tosses. Construct the joint distribution of  $X$  and  $Y$ . are  $X$  and  $Y$  independent?

5. A perfect die is thrown twice. Find the expected values of the sum and the product of the number of points obtained in two throws.

## UNIT 2: SAMPLING THEORY & UNIT 3: SAMPLING DISTRIBUTION

### Section A

**4 marks**

1. Explain the concepts of sampling distribution and standard error of a statistic.
2. Distinguish between (any one pair)
  - i) parameter and statistic
  - ii) Random and non-random samples
  - iii) Simple random sampling with replacement and simple random sampling without replacement
3. If  $x_1, x_2, x_3$  be a random sample from  $N(0, \sigma^2)$  population, what would be the distribution of the following statistics? Mention the degree of freedom.

a)  $\frac{(x_1^2 + x_2^2 + x_3^2)}{\sigma^2}$

b)  $\frac{x_1^2}{x_2^2}$

### Section B

**6 marks**

1. Find the standard error of sample mean in both SRSWR and SRSWOR .



2. Draw a random sample of size 10 (with replacement) from the following data:

45	24	43	17	5	28	27	21	11	46
33	26	24	14	34	21	25	48	35	38
26	27	35	8	30	26	30	28	21	27
20	13	23	36	38	20	25	31	24	18

Use the random sampling numbers given below

5967	8941	7989	3335	7577	9735
3042	8409	7053	5364	5872	1143

3. Consider a population of 4 members having values 4, 6, 6 and 9 and obtain random samples of size 2 drawn with replacement and without replacement. Derive the sampling distribution of the statistic ( $\bar{x}$ ) in both the cases and verify that their expectations equal population mean.

4. Derive the expressions for the expectation and standard error of sample mean in SRSWOR.

5. Marks of statistics for a population of 30 students of a class are given below:

70	93	86	68	94	90
75	65	81	72	92	68
80	80	78	69	93	88
85	95	74	83	66	92
90	92	79	86	72	75

Draw a simple random sample of students and obtain the sample average of marks. Consider without replacement schemes while drawing the samples with the help of the following random sampling numbers:

4652	8431	2352	0043
3819	2150	2472	3488
9031	7617	1220	4129

## **UNIT 4: Classical Statistical Inference**

### **Section A**

**4 marks**

1. Let  $T_1$  and  $T_2$  be statistics with expectations.  $E(T_1) = 2\theta_1 + 3\theta_2$  and  $E(T_2) = \theta_1 + \theta_2$ . Find unbiased estimators of parameters  $\theta_1$  and  $\theta_2$ .
2. What are the desirable properties of an estimator?
3. Comment : Rejection of any hypothesis indicates its falsity.
4. Distinguish between point estimation & interval estimation
5. Explain with examples : (i) p-value (ii) one-sided test

6. What do you mean by an estimator of a parameter? Define its unbiasedness and consistency properties
7. Define Type-I and Type-II error. Can you reduce both the errors simultaneously?
8. If T is an unbiased estimator of  $\theta$ , show that T is a biased estimator for  $\theta^2$ .
9. Given  $H_0 : \mu=30, n = 35, \sigma = 0.05$  for what value of sample mean  $\bar{x}$  with  $H_0$  be accepted?
10. Argue whether True/False : - "If  $H_0$  is accepted at  $\alpha_1$  % level of significance it will definitely be accepted at  $\alpha_2$  % level of significance, where  $\alpha_1 < \alpha_2$ ."
11. If  $X_1, X_2, \dots, X_n$  be 'n' normally distributed variables having identical  $\sigma^2$  with mean  $\mu$ , what form will the distribution of  $\frac{X_1^2+X_2^2+\dots+X_n^2}{\sigma^2}$  take? Justify your answer.
12. What do you mean by an estimator of a parameter? What is MVUE? Give an example.
13. Explain (i) Type-II error (ii) p-value
14. Let  $x_1, x_2, \dots, x_n$  be a random sample from an infinite population with variance  $\sigma^2$  and  $\bar{x}$  as the sample mean. Show that  $\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$  is a biased estimator of  $\sigma^2$ .

## Section B

6 marks

1. What do you mean by an estimator of a parameter? What is MVUE? Why interval estimation is superior to point estimation?
2. Explain the notions of unbiasedness, consistency, efficiency and sufficiency of a point estimator.
3. Show that the MLE of the mean and variance of a Normal population is equal to the sample mean and sample variance.
4. Find the MLE of the mean of a Poisson population from a random sample of size n and show that it is unbiased.
5. Explain the method of M.L.E for estimating unknown parameter of a population. Find the M.L.E. of the variance  $\sigma^2$  for a normal population, when  $\mu$  is known. Show this estimator is unbiased.
6. Obtain MLE of parameter p on the basis of a random sample of size k taken from a Binomial (n, p) population .
7.  $X_1, X_2$  and  $X_3$  is a random sample of size 3 from a population with mean  $\mu$  and variance  $\sigma^2$   
 $T_1, T_2$  and  $T_3$  are estimators to estimate  $\mu$ , where  $T_1 = X_1+X_2+X_3, T_2 = 2X_1+3X_3-4X_2, T_3 = (\lambda X_1+X_2+X_3)/3$ .
  - i. Check unbiasedness of  $T_1$  and  $T_2$ .
  - ii. Find  $\lambda$  such that  $T_3$  is an unbiased estimator for  $\mu$ .
  - iii. Which is the best estimator?
8. Let  $t_1, t_2, \dots, t_k$  be mutually independent and unbiased estimators of  $\mu$  with variances  $V_1, V_2, \dots, V_k$  respectively. Consider the linear function  $T = a + \sum_{i=1}^k b_i t_i$ .  
 Choose the constants a,  $b_1, b_2, b_3, \dots, b_k$  in such a way that T is unbiased and has the smallest variance among all unbiased linear estimators.
9. If  $T_1, T_2$  and  $T_3$  are independent unbiased estimators of  $\theta$  with variances in the ratio 2:3:5, which of the following estimators of  $\theta$  would you prefer most?  $(2T_1+T_2+T_3)/4, (T_1+2T_2+T_3)/4,$

$$(T_1 + T_2 + 2T_2)/4.$$

10. In a big city 325 men out of 600 were found to be smokers. Does this information support the conclusion that majority of men in this city are smokers? State the hypothesis clearly. (At 5% level of significance, critical region is  $Z \geq 1.645$ ).
11. The fraction of defective items in a large lot is  $p$ . to test the null hypothesis  $H_0: p=0.2$ , a sample of 8 items is taken. The hypothesis is rejected if no. of defective item is greater than 6. What is the probability of Type-I error of this test? What is the Type-II error if  $p=0.1$ ?
12. It is claimed that students entering a college have an average I.Q. higher than 100. A random sample of 16 is taken and a sample mean is found to be 106. The sample s.d. is 10. Is the claim supportable? [It is assumed that the I.Q. are normally distributed and given  $t_{0.01,9} = 2.82$ ].
13. (i) A firm manufacturing rivets wants to limit variations in their length as much as possible. The lengths (in cm) of 10 rivets manufactured by a new process are:

2.15, 1.99, 2.05, 2.12, 2.17, 2.01, 2.03, 1.98, 2.25, 1.93

In the past, the S.D. of length of rivets manufactured by the firm has been 0.145cm. Examine whether the new process seems to be superior to old. Given  $\chi^2_{0.99,9} = 20.88$  and  $\chi^2_{0.95,9} = 3.325$ .

14. A manufacturer claimed that at least 90% of the components which he supplied, conformed to specifications. A random sample of 200 components showed that only 164 were up to the standard. Test this claim at 5% level of significance.

### Unit 5: Elementary Econometrics

#### Section A

**4 marks**

1. Consider the following regression equation:

$$y_i = 0.7437 + 0.6416 X_i$$

$$se = (1.8355) (\dots)$$

$$t = (\dots) (9.6536) \quad n=13$$

- i) Find out the missing numbers within the parentheses.  
 ii) Obtain  $r^2$  (Co-efficient of determination)
2. Are the following models linear regression models? Give reasons.
- (a)  $Y_i = \alpha + \beta \sqrt{x_i} + U_i$   
 (b)  $Y_i = \alpha X^B + U_i$   
 (c)  $Y_i = \alpha + \sqrt{\beta} X_i + U_i$   
 (d)  $Y_i = \alpha + \beta \log X_i + U_i$   
 (e)  $Y_i = \alpha X_i \beta e^{ui}$

Justify the introduction of random disturbance term in the model.

3. What happens to OLS estimator if homoscedasticity assumption is violated? What are the sources of heteroscedasticity?

4. In the regression model  $Y_i = \alpha + \beta x_i + u_i$ , if the sample mean  $\bar{x}$  is zero, show that  $\text{cov}(\hat{\alpha}, \hat{\beta}) = 0$  where  $\hat{\alpha}$  and  $\hat{\beta}$  are least square estimator of  $\alpha$  &  $\beta$  respectively.
5. What is the basis of Gold field and Quandt test in determining heteroscedasticity?
6. Given the estimated regression equation as  $y = a + 1.5x + e$ , estimated standard error of  $\beta$  as 0.5,  $r^2 = 0.5$ ,  $\bar{x} = 10$ ,  $\bar{Y} = 25$  and  $\sum Y_i^2 = 6895$ . Find the sample size and the residual sum of squares (RSS)
7. "The non stochasticity of X is sufficient but not necessary to ensure the linearity of CLRM". Do you agree?
8. Show that if a regression line is fitted through origin, the sum of residuals may not equal zero.
9. Explain whether true or false : (answer any one)
- If heteroscedasticity is present, the conventional t-test is valid.
  - Durbin-Watson Test is a conclusive test to detect the presence of autocorrelation.
  - In the model  $y_i = \alpha + \beta x_i + u_i$ ,  $i = 1, 2, \dots, n$  the following sample moments have been calculated from 10 observations :  
 $\sum y_i = 8$ ,  $\sum x_i = 40$ ,  $\sum y_i^2 = 26$ ,  $\sum x_i^2 = 200$ ,  $\sum x_i y_i = 20$ . Calculate the estimated value of  $\beta$  ( $\hat{\beta}$ ) & also its standard error.
10. Consider the following regression equation :
- $$Y_i = 0.2033 + 0.6560X_i, i = 1, 2, \dots, n$$
- Se = (0.0976) (0.1961)
- $$r^2 = 0.397$$
- Find out n (sample size)
11. Consider the following regression equation :
- $$Y_i = 0.00681 + 0.75815X_i$$
- Se = (0.02596) (...)
- t = (...)(2.80700)
- $$r^2 = 0.4406$$
- Find the missing numbers within the parentheses.
  - Obtain the sample size(n)
12. Argue whether the following statement is true or false:
- In the context of a 2 variable regression model
- $$r^2 = \frac{[\text{cov}(x,y)]^2}{\text{Var}(x) \cdot \text{Var}(y)}$$
  - $$r^2 = \frac{ESS}{TSS}$$
13. Suppose Y is related to X in the following way  $Y_i = Ae^{\beta x_i + u_i}$  where  $u_i$  is a stochastic error term that satisfies the usual assumption of CLRM. How would you estimate the parameters of the equation?
14. Explain whether the following statement is true or false :
- Linearity in both variables & parameters is essential for a CLRM.

15. Show that the least square estimators of  $\beta$  in the model  $y_i = \alpha + \beta x_i + u_i$  is unbiased. Derive the variance of the estimator of  $\beta$ .

16. Show that the least square estimators of  $a, b$  in the model  $y = a + bx + \varepsilon$  are unbiased. Write down the variances of the estimators.

## Section B

6 marks

1. Consider the following regression equation  $Y_i = \alpha + 1.5X_iU_i$ , with standard error of the estimated  $\beta$  coefficient = 0.5,  $n = 0.5$ ,  $\bar{x} = 10$ ,  $\bar{y} = 25$ ,  $\sum Y_i^2 = 6895$ . Find out

- Total number of observations ( $n$ )
- The estimated intercept coefficient ( $\alpha$ )
- Estimated error variance ( $S^2u$ )

2. A random sample of 10 observations corresponds to non auto correlated regression model  $Y_i = \alpha + \beta X_i + U_i$ , where  $u \sim N(0, \sigma^2)$ ,  $\sum X_i = 70$ ,  $\sum X_i^2 = 600$ ,  $\sum Y_i = 80$ ,  $\sum Y_i^2 = 734$ ,  $\sum X_i Y_i = 480$ . If  $X_i$  is non-stochastic, test the hypothesis that  $X$  &  $Y$  are negatively correlated against the hypothesis that they are not at 5% level of significance. Obtain the estimated value & estimated error of  $\alpha$  &  $\beta$ .

3. Explain the effects of autocorrelated or heteroscedastic errors on the ordinary least square estimators in a CLRM. How are they correlated?

4. In the linear regression model  $Y_i = \alpha + \beta X_i + U_i$ , the error  $U_i$  are assumed to have variance depending on a variable  $Z_i$ . Explain how to choose among the following four specifications?

- $\text{Var}(U_i) = \sigma^2$
- $\text{Var}(U_i) = \sigma^2 Z_i$
- $\text{Var}(U_i) = \sigma^2 Z_i^2$
- $\text{Var}(U_i) = \sigma^2 Z_i^3$

5. How can you use the Weighted Least Square Method to correct the problem of Heteroskedasticity?

6. In the regression  $y = \beta_1 + \beta_2 X_i + U_i$ , suppose we multiply each  $x$  value by a constant say 2. Will it change the residuals & fitted values of  $y$ ? Explain what happens if we add a constant value 2, to each  $x$  value.

7. A regression model is specified as  $y_i = \beta x_i + u_i$  where  $u$  &  $x$  satisfy all basic assumptions of CLRM. Three estimators of  $\beta$  have been proposed as :

i.  $b_1 = \bar{y} / \bar{x}$

ii  $b_2 = \sum x_i y_i / x_i^2$

iii.  $b_3 = \sum(x_i - \bar{x}) (y_i - \bar{y}) / \sum(x_i - \bar{x})^2$

Find the expectation and variance of each of these estimators. Which one is the least square estimator?

8. What assumptions are made regarding the error term in a CLRM? What happens to the OLS estimators if homoscedasticity assumption is violated? What are the sources of heteroscedasticity.

9. Given the data on Y and X explain how will you estimate the parameters in the following models by using OLS technique :

(a)  $Y = \alpha X^\beta$

(b)  $Y = \frac{X}{\alpha X - \beta}$

(c)  $Y = \alpha + \beta \log X$

10. Consider the following estimated regression equation :  $y_i = \hat{\alpha} + 1.5x_i + e_i$

With standard error of estimated  $\beta$ -coefficient 0.5. it has further been given that  $r^2 = 0.5$ ,  $\bar{x}=10$ ,  $\bar{y} = 25$  and  $\sum y_i^2 = 6895$

Find the following :

(i) Sample size (ii) Total sum of squares(TSS) (iii) Estimated error variance ( $\hat{\sigma}u^2$ )

11. What do mean by presence of autocorrelation in an econometric model? Describe the Durbin Watson Test for the detection of autocorrelation.

## Unit 6: Time Series Data

### Section A

**4 Marks**

1. Reduce the trend equation  $T_t = 2036 + 56t$  (origin at 2000 and unit of  $t=1$  year) for yearly totals to a half yearly trend equation.
2. The Trend Line fitted to the production figures of a certain product is found to be :  
 $T_t = 9560 + 85t$  (origin at 1995 and unit of  $t=5$  years)  
 Estimate the production for the year 2000. Find the time when the Production figure will be 9985
3. With which component of time series would you mainly associate each of the following:
  - (a) Increase in the sales of Automobile.
  - (b) Delay in the production of a factory due to sudden machine break down
  - (c) Sales of a department store after puja.
  - (d) Increase in the sales of television sets before World Cup Football tournament.

## Section B

6 marks

1. Compare the method of Mathematical curve fitting and the method of moving averages connection with type determination of trend in a time series.
2. Discuss the various methods for measuring seasonal fluctuations from Time Series Data.
3. The annual revenue expenditure of the Government of India is given below for 6 successive years

Year	:	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
Revenue	:	225	238	268	293	399	520
Expenditure							
(in Rs Cr)							

Fit a linear trend by the Method of least squares.

## Paper VIIB: Applied Economics Group B: Mathematical Economics

### Section A

4 marks

- (i) Distinguish between Homogenous Utility Function and Homothetic Utility Function.
- (ii) Define Quasi-Linear Utility function.
- (iii) Define CES production function.
- (iv) Why a Saddle point solution called Saddle?
- (v) Define Nash Equilibrium.
- (vi) Define one two-players game where more than one Nash Equilibrium is possible.
- (vii) Define Mixed strategy.
- (viii) Define Backward Induction Process of solution with an example.

### Section B

6 marks

1. Utility function between leisure  $X_1$  (hours/week) and earned income  $X_2$  (Rs/week) of a person is given by  $U=15X_1X_2-100X_1-140X_2-25X_1^2-2X_2^2$ . Find the equilibrium values of  $X_1$  and  $X_2$  and hence determine the implied wage rate.

2. Consider the indirect utility function:  $V(p_1, p_2, m) = m/(p_1 + p_2)$ . (i) What are the demand functions? (ii) What is the direct utility function?
3. Derive the Roy's Identity.
4. The total cost function of a perfectly competitive firm is  $C = X^2/25 + 3X + 100$ . Determine (i) the lowest price to cover total cost and (ii) the lowest price to cover total variable cost.
5. A firm has production function  $Y = x_1 x_2$ . If the minimum cost of production at  $w_1 = w_2 = 1$  is equal to 4, what is the value of  $Y$ ?
6. Show that a matrix  $A = [a_{ij}]$  has a saddle point at  $(i, j)$  if and only if the strategy  $(i, j)$  is a Nash equilibrium for the zero sum game determined by Matrix  $A$ .
7. State the properties of any tree in sequential decision.
8. This is a strategic form game with three players 1, 2, 3. The strategy sets of the players are  $S_1 = S_2 = S_3 = [0, 1]$ . Their payoff functions are given by  $u_1(x, y, z) = x + y - z$ ,  $u_2(x, y, z) = x - yz$  and  $u_3(x, y, z) = xy - z$ , where for simplicity we let  $S_1 = x$ ,  $S_2 = y$  and  $S_3 = z$ . Prove that the strategy profiles  $(1, \alpha, 0)$  (where  $0 \leq \alpha \leq 1$ ) are the only Nash equilibria of the game presented.
9. It is easy to see that the matrix game

$A = \begin{bmatrix} 0 & 3 \\ 2 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 3 & 0 \\ 1 & 2 \end{bmatrix}$  has no Nash equilibrium. Compute Mixed Strategies for both players.

## Paper VIIB

### Applied Economics

#### Group B: Managerial Economics

##### Unit 1: Nature and Scope of Managerial Economics

###### Section A

**4 marks**

- a. Is it appropriate to think firms economic entities ?
- b. Define opportunity cost . How it is different from incremental cost?
- c. Explain 'opportunity cost' principle in decision making .

###### Section B

**6 marks**

- a. Describe the role of managerial economist in a business firm .
- b. How is the Business profit different from economic profit? Does the introduction of the concept of normal profit helps to mitigate the difference?



- c. Suppose that all the Internet Service Providers (ISPs) were required to obtain a license from the Government, the fee being  $p$ . Will the number of ISPs vary with the value of  $p$ ? What would be the size of the ISPs? What would be the number and Average size of ISPs if the value of  $p$  is reduced by 95%?

## Unit 2 : Demand, Cost and Profit Analysis

### Section A

**4 marks**

- a) Differentiate between Industry Demand and Firm Demand.
- b) What is the relation between the Demand function and Demand Curve?
- c) What is the link between accounting and economic valuation?
- d) Differentiate between historical and current cost.
- e) What is the importance of 'replacement cost' in a world of decreasing price of computers, hardware and software taking together?

### Section B

**6 marks**

- a) (i) The estimated demand function for various types of bank deposits are as follows :

$$CD = 1428.85 + 0.332Y - 572.79I_n + 0.4450B$$

$$SD = -2588.12 + 0.387Y + 525.11I_s - 176.39I_n$$

$$FD = -7441.41 + 0.073Y + 659.94I_n - 1082I_i + 1791.791I_m$$

Where, CD=Current Deposits

SD = Savings Deposits

FD= Fixed Deposits

Y= National Income

$I_n$  = Interest of 3 months time deposits

$I_s$  = Interest on savings deposit

$I_i$  = Yield on variable dividend from industrial securities

$I_m$  = Maximum permissible interest on 3 months deposit

B= No. of Scheduled bank branches

Interpret the role of each of the variables on each type of deposits in terms of magnitudes and signs.

- (ii) Find out the demand curve given by the demand function

$$q = \frac{1000}{p+10} - 40$$

where,  $q$  = Quantity demanded

$p$  = Price of the product

- b) Are the Historical data useful in the time of launching a new product?
- c) What are the merits and demerits of market survey?
- d) What is the 'break even' quantity for a firm? What is its importance in the presence of pre determined profit level?

**Unit 3: Organizational Design ,Principal-Agent Analysis  
and Incentive Design**

**Section A**

**4 marks**

- (a) Describe the role of firm change for proprietorship and partnership firms?
- (b) Describe 3 main legal forms of a firm
- (c) What is the legal definition of a firm? What are its main forms?
- (d) Distinguish between U-form and M- form of organizational structure

**Section B**

**6 marks**

- (a) Why do firms exist?
- (b) What is the role of transaction cost in the existence of modern firms?
- (c) What is sacrificing behaviour of firms?
- (d) Distinguish between 'Self enforcing contract' and 'Incentive compatibility contract'.

**Unit 4: Pricing Policies & Practices**

**Section A**

**4 marks**

- (a) What do you mean by cyclical pricing?
- (b) Distinguish between 'rate of return pricing' and 'going rate pricing'.

**Section B**

**6 marks**

- (a) Why are the strategies of skimming price policy and penetration price policy adopted by firms?
- (b) What is product line pricing? Does it change with economies of scale
- (c) What is limit pricing? Explain the concept with the help of a diagram. Is it an efficient strategy to restrict entry?
- (d) Distinguish between 'full cost mark-up price' and 'average- cost mark-up'.

**Unit 5:Capital Budgeting**

**Section A**

**4 marks**

- (a) What is discounted cash flow? How it helps investment appraisal?

- (b) Why is capital rationing needed?
- (c) What are the modern techniques of investment appraisal based on discounted cash flow?

**Section B**

**6 marks**

- (a) Compare the NPV and IRR methods of Investment appraisal. Which one is functionally better?
- (b) Define Capital budgeting and give an example of capital budgeting problem
- (c) What is capital rationing? Why it has to be implemented?

**Unit 6: Cost of Capital**

**Section A**

**4 marks**

- (a) What is cost of Capital?
- (b) Is there any relationship between cost of capital and 'share price'?

**Section B**

**6 marks**

- (a) If a firm earns profit the shareholder get dividend so can there be any conflict between the motive of the manager and shareholders
- (b) Define preferred shares. State the difference between true cost of debentures and preferred shares.
- (c) What is cost of retained earnings? Why is the company not free to use the difference between cost of retained earnings and cost of capital?

**Unit 7: Inventory Management**

**Section A**

**4 marks**

- (a) How the definition of inventory changes with the type of firm? Why?
- (b) Does the accumulation of 'anticipation inventory' indicate a wrong estimation of demand?
- (c) What are the three basic components of inventory? Give example.
- (d) Define and discuss the necessity of ABC analyses.

**Section B**

**6 marks**

- (a) Define Inventory cost. What is the relationship between inventory cost and inventory size

- (b) What is Economic order quantity (EOQ)? Use the algebraic method to determine EOQ.

### **Unit 8: Corporate Governance**

#### **Section A**

**4 marks**

- a) Distinguish between M-form and U-form organisational structure.
- b) List the mechanisms of internal and external control for a firm.
- c) Are Government controls the only external controls?
- d) What are Horizontal and Vertical Relationships?

#### **Section B**

**6 marks**

- a) What are the main issues involved in corporate governance?
- b) How is 'actions beyond obligation' justified for better governance.
- c) Do you think Institutional Investors have an important role to play in the governance of the firm?

### **Paper VIIIA**

### **Indian Economic History**

#### **Section A**

**4 marks**

**Write short notes on**

- i) Ottawa Agreement.
- ii) Railway freights and fares policy.
- iii) Home charge.
- iv) Decay of Handicrafts.
- v) Main recommendations of Hilton-Young Commission.
- vi) Gold Exchange Standard.
- vii) Problems of cotton-textile industry under British rule.
- viii) Irrigation system under British rule.
- ix) Permanent Settlement.
- x) Basic features of colonialism in India.
- xi) Imperial Preference.
- xii) Role up protection in the development of iron and steel industry in India.

**Answer in Brief :**

- a) What do you mean by commercialization of agriculture?

- b) What was the main role of managing agency system?
- c) Define economic drain.
- d) What were the causes of decline of handicrafts?
- e) What are the different phases of railways?
- f) What are the main features of old guarantee system?
- g) What are the main features of new guarantee system?
- h) Briefly discuss railway rates policy.
- i) What is Home charges?
- j) Discuss permanent and temporary settlement under British rule.
- k) What do you mean by land tenure system under British rule?
- l) Define discriminating protection.

### **Section B**

**10 marks**

1. Analyse the major features of the pattern of foreign trade introduced in India by the British Govt.
2. Briefly discuss, the consequences of the pattern of India's economic development, under British rule.
3. Explain the nature of price fluctuation in India from the beginning of the twentieth century to the end of the Second World War.
4. What factors led to the commercialization of Indian agriculture in the second half of the nineteenth century?
5. Evaluate the over-all impact of the commercialization on the Indian economy.
6. Account for the commercialization of Indian agriculture in the second half of the nineteenth century and analyse its effects.
7. What is meant by "De-industrialization in India" in the nineteenth century? What factors were responsible for this de-industrialization?
8. What do you understand by De-industrialization in India in the nineteenth century? Discuss the factors responsible for this De-industrialization and also explain its effects on the Indian economy
9. What were the most significant changes in Indian agriculture in the nineteenth century? Explain the causes of these changes and evaluate its overall impact on Indian economy.
10. Give an outline of the changes in the Indian land ownership and tenancy system introduced during the British period .Discuss whether these changes helped or hindered India's agricultural development.
11. "The managing agency system placed a positive role in the formation and expansion of modern industries in India"---comment.
12. Discuss the role of the managing Agency system in the development of Indian industries.
13. Critically examine the arguments advanced to establish the theory of 'Economic Drain' from India in the second half of the nineteenth century.
14. Discuss the drain theory in the context of India's economic history.
15. Analyse the different phases of railway development in India from 1853 to 1947.

16. Discuss the view that the contraction of railway had a limited 'linkage' effect of India industry.
17. Do you think that the 'New Guarantee System' was better than the 'Old Guarantee System' in the history of Railways in India?
18. Trace the development of irrigation in India during the British rule. In this connection, discuss the issues 'Railways vs. Irrigation'.
19. Discuss briefly the phase of railway development in British India.
20. Did the railways perform any positive role in India's economic development?
21. Critically examine the policy of discriminating protection introduced in India during the inter-war period.
22. Discuss the effect of the Discriminating protection on India's industrial development.
  
23. Discuss the major features of the policy of discriminating protection followed in India between the First and Second World War.
24. Analyse the way of the Discriminating protection policy contributed to the expansion of Indian industries.
25. Discuss the role of foreign capital and entrepreneurship in the formation of India industries during the period of British rule.
  
26. Discuss the role of foreign capital and organization in developing India industry during the British rule.
27. What was the Gold - Exchange Standard? How did it work? Why did this system break down in 1917?
  
28. Discuss the evolution of the Indian currency system from the Silver Standards to the Gold Exchange Standard.
  
29. Mention the main recommendations of the Hilton- Young Commission (1925) on the Indian Currency systems. Discuss the different points of view in the 'ration controversy' originating from these recommendations.