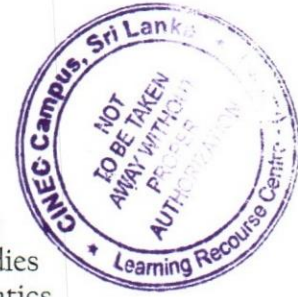


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Faculty of Management and Social Sciences
Department of Management and Business Studies
BSc (Hons) in Business and Industrial Mathematics
Course CODE: BSc 562

Year 3 Semester I
SEMESTER END EXAMINATION
Customs and Border Management - BBIM 3301

- This paper consists of EIGHT (08) questions on SIX (06) pages.
- Answer FIVE (05) questions including question 01.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.
- Write legibly.

Date: 2022.10.01

Pass mark: 40%

Time: 03 Hours

Question 01 (Compulsory)

Power Drink Lanka (Pvt) Ltd is a limited liability company registered under the Companies Act of Sri Lanka. "Pump-up" is a popular energy drink manufactured by Power Drink Lanka (Pvt) Ltd according to a secret recipe comprising several herbs and 1.5% of alcohol in the volume. This popular energy drink was sold in 300ml glass bottles until the company's Marketing Director proposed to market the same in 200ml cans. Since there was no facility for canning the energy drink in Sri Lanka Power Drink Lanka (Pvt) Ltd contracted a company namely Can Can (Bhd) Ltd in Malaysia for this purpose. According to the contract signed between the two companies Power Drink Lanka (Pvt) Ltd must supply Pump-up concentrate, alcohol, and empty cans to Can Can (Bhd) Ltd free of charge. The canning process included;

1. Preparation of beverage by mixing the Pump-up concentrate, alcohol, and water in the following proportion and can the same into the empty cans.
 - (a) Pump-up concentrate - 10 units
 - (b) Alcohol - 03 units



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(c) Water - 187 units

2. Packing the cans in the following manner for shipping and marketing purposes.

(a) 6 cans in a pack

(b) 10 packs in a carton

(c) 20 cartons in a pallet

The price agreed by the two parties for the above process is USD 0.75 ExWorks (EXW) per can.

To manufacture empty cans Power Drink Lanka (Pvt) Ltd retained the services of a company in Singapore namely Alu Can Co. Ltd. According to the agreement entered, Power Drink Lanka (Pvt) Ltd had to provide the artwork to print the empty cans to Alu Can Co. Ltd free of charge and the Alu Can Co. Ltd had to ship the empty cans directly from Singapore to Can Can (Bhd) Ltd. The price agreed by the two parties for this process was USD 0.25 DDP per can.

Power Drink Lanka (Pvt) Ltd retained the services of renowned Sri Lankan artist Mr. Sanura Silva to design the can and develop the artwork. He was paid Sri Lanka Rupees (SLR) 1 million (Rs. 1,000,000.00) for this task. Once the artwork was completed Power Drink Lanka (Pvt) Ltd sent the same to Alu Can Co. Ltd free of charge.

Power Drink Lanka (Pvt) Ltd purchased the alcohol from Best Spirits (Pty) Ltd in South Africa. According to the agreement entered, Best Spirits (Pty) Ltd had to ship the alcohol directly from South Africa to Can Can (Bhd) Ltd. The price agreed by the two parties for this process was USD 0.15 DDP per liter.

Accordingly, to start the manufacturing process Power Drink Lanka (Pvt) Ltd supplied the following items to Can Can (Bhd) Ltd free of charge.



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1. A shipment of 1,500 litres of Pump-up concentrate exported from Sri Lanka for USD 120,000 on DDP term.
2. A shipment of 150,000 empty cans exported from Singapore.
3. A shipment of 25,000 litres of alcohol from South Africa

As the first shipment Power Drink Lanka (Pvt) Ltd has imported a shipment of 01x20' container said to contain 400 cartons of Pump-up Energy Drink cans from Can Can (Bhd) Ltd.

Ms. Power Drink Lanka (Pvt) Ltd has entrusted the transportation of the said container from Malaysia to the Port of Colombo to a Freight Forwarding company namely Sea-Sky Lanka Ltd. The following charges have been paid by Power Drink Lanka (Pvt) Ltd to Sea-Sky Lanka Ltd as the total cost of transport

1. Main Carrier Charges (Sea Freight)	- USD 1285
2. Packing Cost	- USD 315
3. Inland Transport	- USD 725
4. Terminal Handling Charges at the origin port	- USD 250
5. Currency Adjustment Factor (CAF)	- USD 145
6. Bunker Adjustment Factor (BAF)	- USD 135
7. Terminal Handling Charges at the destination port	- USD 150
8. Container Deposit	- Rs. 5750
9. Container Washing	- Rs. 1150

The marine insurance has been obtained by Power Drink Lanka (Pvt) Ltd locally from Sri Lanka Insurance Company on payment of Rs. 18,436/= for the whole shipment



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In the Customs Declaration (CusDec) submitted by Power Drink Lanka (Pvt) Ltd to clear the subject shipment, the Customs Value was declared as Rs. 13,766,161.20. However, the Customs Officers rejected this value and move to calculate the correct Customs Value. Presume that you are the Customs Officer who was entrusted with this task and calculate the Customs Value of the subject shipment in Sri Lankan Rupees. The document containing the exchange rates published by Sri Lanka Customs is provided attached to this question paper. (40 Marks)

Question 02

Puff Promoters (Pvt) Ltd has imported a consignment of 49,235 kg "Pipe Tobacco" from South Africa in a 20' container. The transaction price is FOB USD 13.35 per kg. The freight charge paid for the full shipment is USD 1850. The insurance has been obtained for USD 85 for the full shipment.

According to the Sri Lanka Tariff Guide, Pipe Tobacco is classified within HS Code 2403.99.10 and the following taxes are payable for the importation.

- | | |
|------------------------------------|-----------------------------|
| 1. Customs Duty | - 250% or Rs. 2000/= per kg |
| 2. VAT | - 8% |
| 3. PAL | - 10% |
| 4. Excise (Special Provision) Duty | - 15% or Rs. 600/= per kg |
| 5. Cess | - 30% or Rs. 375/= per kg |

Calculate all five taxes payable for the above shipment in Sri Lankan rupees. Formulas and exchange rates are provided in the attached documents to this question paper.



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(15 Marks)

Question 03

Write an essay describing the functions and the legal framework of the Sri Lanka Customs

(15 Marks)

Question 04

Name the 6 methods given in the WTO Valuation Agreement to determine the Customs Value and explain the Transaction Value Method described in Article 1 and the adjustments under Article 8 of Schedule E of the Customs Ordinance.

(15 Marks)

Question 05

Explain the structure of an HS Code up to 8 digit level and the procedure one should follow to determine the HS Code of any given commodity.

(15 Marks)

Question 06

Write short essays on 3 of the following topics.

- a) Customs Ordinance
- b) Imports and Exports (Control) Act
- c) Exchange Control Act
- d) Antiquities Ordinance
- e) Fauna and Flora Protection Act



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- f) Revenue Protection Act
- g) Value Added Tax Act
- h) Cosmetics, Devices, and Drugs Act

(05 Marks*3 = 15 Marks)

Question 07

- a) Explain **Section 10** and **Schedule A** (Table of Duties) of the Customs Ordinance (07 Marks)
- b) Explain **Section 12** and **Schedule B** (Table of Prohibitions and Restrictions) of the Customs Ordinance (08 Marks)

Question 08

The payment methods in international trade have evolved based on how the risk is transferred between the buyer and the seller. Explain the six methods of payment in international trade with an emphasis on how the risk is transferred between the buyer and the seller. (15 Marks)

-----END OF THE QUESTION PAPER-----

Computation formulae for imported goods

Where

v	=	CIF value in Rupee
c	=	Cess levy under Sri Lanka Export Development Act
d	=	Customs Duty
e	=	Excise (Special Provisions) Duty (ED)
t	=	Value Added Tax (VAT)
p	=	Port and Airport Development Levy (PAL)
r _e	=	Rate of Excise (Special Provisions) Duty (ED)
r _t	=	Rate of Value Added Tax (VAT)
r _n	=	Rate of Nation Building Tax

- Customs Duty (d) = (CIF value) × (Customs duty rate)
or
= (quantity) × (unit rate of customs duty)
- Value Added Tax (t) = (v + 10% of v + d + c + p + e) × r_t
- Cess Levy (c) = (v + 10% of v) × (Cess levy rate)
or
= (quantity) × (unit rate of Cess levy)
- Port and Airport Development Levy (p) = (CIF value) × (PAL rate)
- Excise (Special Provisions) Duty (e) = (v + 15% of v + d + c + p) × r_e
or
= (quantity) × (unit rate of Excise Duty)
- Special Commodity Levy = (Quantity) × (unit rate of Special Commodity Levy)

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கொள்கை, திட்டமிடல் மற்றும் ஆராய்ச்சிய் பிரிவு
Policy, Planning and Research Directorate

No: RE/38/2022



ශ්‍රී ලංකා රේඛුව
இலங்கைச் சுங்கம் Sri Lanka Customs

Telephone: 2221510 (DC), 2445146 (DDC), 2445146(SC) E-mail: ddcppnr@customs.gov.lk

**Customs Notification (General)
Customs Ordinance (Chapter 235)
Rates of Exchange**

It is hereby notified that by virtue of powers vested in me under Section 17 of the Customs Ordinance (Chapter 235) I, **P.B.S.C. Nonis, Director General of Customs**, determine that with effect from **26.09.2022** all duties of Customs as well as other charges, penalties and forfeitures incurred under the Customs Ordinance (Chapter 235), shall be paid and received at the Rates of Exchange set out in the schedule overleaf.

The notification relating to the Rates of Exchange published in Gazette No: **2298/01** of **19.09.2022** is hereby rescinded.

P.B.S.C. Nonis
Director General of Customs

Sri Lanka Customs
Colombo 11
23.09.2022

Schedule
Rates of Exchange Effective From 26.09.2022 TO 02.10.2022

	Country	Country Code	Currency	Currency Code	Rate of Exchange (Rs.)
1	Australia	AU	Dollar	AUD	245.3333
2	Bahrain	BH	Dinar	BHD	981.1904
3	Bangladesh	BD	Taka	BDT	3.5880
4	Brazil	BR	Brazil Real	BRL	72.2846
5	Brunei	BN	Brunei Dollar	BND	260.5554
6	Canada	CA	Canadian Dollar	CAD	274.4647
7	China	CN	Renminbi	CNY	52.1518
8	China	CN	Offshore	CNH	52.1181
9	Czechoslovakia	CZ	Koruna	CZK	14.7386
10	Denmark	DK	Kroner	DKK	48.8987
11	Egypt	EG	Pound	EGP	18.9802
12	Euro Zone		Euro	EUR	363.6163
13	Ghana	GH	Cedi	GHS	36.0901
14	Hongkong	HK	Dollar	HKD	47.1273
15	Hungary	HU	Forint	HUF	0.8970
16	India	IN	Rupee	INR	4.5616
17	Indonesia	ID	Rupiah	IDR	0.0246
18	Iran	IR	Riyal	IRR	0.0088
19	Japan	JP	Yen	JPY	2.6041
20	Jordan	JO	Dinar	JOD	521.7539
21	Korea	KR	Won	KRW	0.2624
22	Kuwait	KW	Dinar	KWD	1,194.7276
23	Macau	MO	Pataca	MOP	45.7317
24	Malaysia	MY	Ringgit	MYR	80.9638
25	Maldives	MV	Rufiya	MVR	23.9278
26	Mauritius	MU	Rupee	MUR	8.3036
27	Myanmar	MM	Kyat	MMK	0.1762
28	Nepal	NP	Rupee	NPR	2.8591
29	New Zealand	NZ	Dollar	NZD	216.0353
30	Nigeria	NG	Naira	NGN	0.8599
31	Norway	NO	Kroner	NOK	35.4969
32	Oman	OM	Riyal	OMR	960.8278
33	Pakistan	PK	Rupee	PKR	1.5446
34	Papua New Guinea	PG	Kina	PGK	105.0583
35	Philippines	PH	Peso	PHP	6.3376
36	Poland	PL	Zloty	PLN	76.5048
37	Qatar	QA	Riyal	QAR	101.2421
38	Russia	RU	Rouble	RUB	6.0150
39	Saudi Arabia	SA	Riyal	SAR	98.3185
40	Seychelles	SC	Rupee	SCR	25.4688
41	Singapore	SG	Dollar	SGD	260.5646
42	South Africa	ZA	Rand	ZAR	21.0212
43	Sweden	SE	Krona	SEK	33.3789
44	Switzerland	CH	Francs	CHF	378.1869
45	Taiwan	TW	Dollar	TWD	11.6820
46	Thailand	TH	Baht	THB	9.9109
47	U.A.E.	AE	Dirham	AED	100.7115
48	United Kingdom	GB	Sterling Pound	GBP	415.7940
49	United States of America	US	Dollar	USD	369.9235
50	Zambia (Old)	ZM	Kwacha	ZMK	0.0712
51	Zambia (New)	ZM	Kwacha	ZMW	23.5290
52	Zimbabwe	ZW	Dollar	ZWD	0.9748



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Year 3 Semester I

END SEMESTER EXAMINATION

Production & Operations Management- BBIM 3304

- This paper consists of EIGHT (08) questions on TWELVE (12) pages.
- Answer FIVE (05) Questions including Question No: 01.
- Only non-programmable calculators are allowed.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 2022.09.25

Pass mark: 40%

Time: 03 Hours

Question 01 (Compulsory)

SELECT THE MOST APPROPRIATE ANSWER OUT OF THE GIVEN CHOICES.

1. Operations Management is

- (a) The management of transforming that create goods and/or provide services
- (b) The management of transforming that achieve the goals of the organization
- (c) The management of systems or processes that create goods and/or provide services
- (d) The management of systems or processes that achieve the goals of the organization



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2. System Operations functions are
 - (a) Decisions concerning capacity, inventory, scheduling, project management and quality assurance
 - (b) Decisions concerning personnel, inventory, scheduling, project management and quality assurance
 - (c) Decisions concerning personnel, location, scheduling, project management and quality assurance
 - (d) Decisions concerning personnel, inventory, arrangement of departments, project management and quality assurance

3. Characteristic of a Service operation,
 - (a) Low consumer participation
 - (b) Facility site selection dictated by the transportation facilities available
 - (c) Labor intensive
 - (d) Tangible

4. Manufacturing operations
 - (a) transform some inputs or raw materials into some outputs with systems
 - (b) transform some inputs or raw materials into some outputs with effective and efficient systems
 - (c) transform some inputs or raw materials into some outputs effectively and efficiently
 - (d) transform some tangible input or raw materials into some tangible output



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5. Forecasting is
 - (a) A process of predicting a future event
 - (b) A process of guessing a future event
 - (c) A process of identifying a future event
 - (d) A process of ready for a future event

6. Short range forecast is for
 - (a) Purchasing, job scheduling, workforce levels, job assignments, production levels
 - (b) Sales and production planning, budgeting
 - (c) New product planning, facility location, research and development
 - (d) workforce levels, facility location

7. Most accurate forecasting is
 - (a) Short Term forecasting
 - (b) Medium Term Forecasting
 - (c) Both Short Term and Medium-Term Forecasting
 - (d) Long Term Forecasting

8. Four stages of Product Life Cycle
 - (a) Introducing, Entering, Maturity, Decline
 - (b) Introduction, Growth, Maturity, Decline
 - (c) Introducing, Entering, Stable, Decline
 - (d) Introduction, Growth, Competition, Decline



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9. Trend in Product and Service Design
- (a) Reduce time to capture the market
 - (b) Market survey
 - (c) Reduce time to introduce new product or service
 - (d) Identify marketing features
10. Reasons for product and service design
- (a) Be competitive
 - (b) Development of new product
 - (c) Be comparative
 - (d) Change the existing product
11. Process selection decision is based on
- (a) Forecasting, Capacity Planning, Technological Change
 - (b) Forecasting, Product and Service Design, Technological Change
 - (c) Product and Service Design, Capacity Planning, Technological Change
 - (d) Forecasting, Capacity Planning, Product and Service Design
12. Process Types are
- (a) Job Shops, Batch, Repetitive, Continuous
 - (b) Make to Stock, Make to Assemble, Make to Order
 - (c) Job Shops, Intermediate, Repetitive, Continuous
 - (d) Make to Stock, Make to Assemble, Make to Order



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13. When you modify the capacity

- (a) Facilities can be added
- (b) People can be added
- (c) Jobs can be scheduled
- (d) Machines can be allocated

14. Importance of Capacity Decision

- (a) Impacts ability to make future requirements
- (b) Involves short term commitment
- (c) Affects operating cost
- (d) Increase competitiveness

15. Design capacity is

- (a) the maximum theoretical output of a system
- (b) the minimum theoretical output of a system
- (c) the capacity a firm expects to achieve given current operating constraints
- (d) the capacity a firm needs to achieve given current operating constraints

16. There are several policies which are considered in Aggregate Planning. They are

- (a) Workforce, Subcontracting, Hiring/Layoff
- (b) Subcontracting, Overtime, Inventory
- (c) Facilities, Backorders, Workforce
- (d) Hiring/Layoff, Overtime, Workforce



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17. Aggregate planning is a
- (a) Short Range Planning
 - (b) Intermediate Range Planning
 - (c) Both Short Range and Intermediate Range Planning
 - (d) Long Range Planning
18. One of the Aggregate Planning outputs is
- (a) Total cost of a plan
 - (b) Total budget
 - (c) Total capacity
 - (d) Labor flexibility
19. Product Standardization will not help you to
- (a) Reduce the parts in your inventory
 - (b) Reduce the training cost
 - (c) Fill the orders from inventory
 - (d) Do small production runs
20. Sources of ideas for product and service design
- (a) Employees, Marketing, Management Information System
 - (b) Employees, Customers, Competitors
 - (c) Marketing, Management Information System, Customers
 - (d) Competitors, Suppliers, Management information System

(01 Mark*20 = 20 Marks)



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Question 02

- (a) Briefly explain the Business Operations Overlap in the industry. (05 Marks)
- (b) Identify three characteristics of Service Operation and briefly explain one. (06 Marks)
- (c) Identify three Manufacturing Operations and briefly explain each. (09 Marks)

Question 03

- (a) New car sales for a dealer in a Company, for the past year are shown in the following table, along with monthly seasonal relatives, which are supplied to the dealer by the regional distributor.

Table 3:1 - Car sales

Month	Unit sold	Seasonal relative
Jan	640	0.80
Feb	648	0.80
Mar	630	0.70
Apr	761	0.94
May	735	0.89
Jun	850	1.00
Jul	765	0.90
Aug	805	1.15
Sep	840	1.20
Oct	828	1.20
Nov	840	1.25
Dec	800	1.25



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- i. Does there seem to be trend? (02 Marks)
- ii. Deseasonalize car sales. (04 Marks)
- iii. Forecast sales for the first three months of the next year. (08 Marks)

(b) A bank manager wants to estimate quarterly relatives for fixed deposit openings, based on the data shown.

Table 2:2 - Fixed Deposits

Year	Quarter			
	1	2	3	4
1	200	250	210	340
2	210	252	212	360
3	215	260	220	358
4	225	272	233	372
5	232	284	240	381

Determine quarter relatives. (06 Marks)

Question 04

- (a) An building contractor's records during the last five weeks indicate the number of job requests:

Table 4:1 - Number of job requests

Week	1	2	3	4	5
Requests	20	22	18	21	22



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Predict the number of requests for week 6 using each of these methods:

- i. Naïve. (04 Marks)
- ii. A four-period moving average. (04 Marks)
- iii. Exponential smoothing with $\alpha = 0.3$. Use 20 for week 2 forecast. (04 Marks)

- (b) "PQR" Company has accumulated the following historical sales data with some missing information, as shown below.

Table 4:2 - Data

Month	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Actual Sales	320		360			350	
Forecast Sales			380		350	340	

Use exponential smoothing with $\alpha = 0.5$ for answering the following questions.

- i. Find the sales forecasts for March and June. (04 Marks)
- ii. Find the actual values for March and April. (04 Marks)

Question 05

- (a) Identify the product and service activities. (05 Marks)
- (b) Briefly explain legal, environment and ethical issues of product and service design. (06 Marks)
- (c) Briefly explain three reasons for product and service design. (09 Marks)

Question 06

- (a) In a job shop, effective capacity is only 50% of design capacity, and actual output is 80% of effective output. What design capacity would be needed to achieve an actual output of eight jobs per week? (03 Marks)



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(b) A producer of felt-tip pens has received a forecast of demand of 30,000 pens for the coming month from its marketing department. Fixed costs of \$25,000 per month are allocated to the felt-tip operation, and variable costs are 37 cents per pen.

- (i) Find the break-even quantity if pens sell for \$1 each. (03 Marks)
- (ii) At what price must pens be sold to obtain a monthly profit of \$15,000, assuming that estimated demand materialises? (04 Marks)

(c) A small firm intends to increase the capacity of a bottleneck operation by adding a new machine. Two alternatives, A and B, have been identified, and the associated costs and revenues have been estimated. Annual fixed costs would be \$40,000 for A and \$30,000 for B; variable costs per unit would be \$10 for A and \$11 for B; and revenue per unit would be \$15.

- (i) Determine each alternative's break-even point in units. (03 Marks)
- (ii) At what volume of output would the two alternatives yield the same profit? (03 Marks)
- (iii) If expected annual demand is 12,000 units, which alternative would yield the higher profit? (04 Marks)

Question 07

For the set of tasks given below, do the following:

- (a) Develop the precedence diagram. (02 Marks)
- (b) Determine the minimum and maximum cycle times in seconds for a desired output of 500 units in a 7-hour day. Why might a manager use a cycle time of 50 seconds? (02 Marks)



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- (c) Determine the minimum number of workstations for output of 500 units per day. (03 Marks)
- (d) Balance the line using the largest positional weight heuristic. Break ties with the most following tasks heuristic. Use a cycle time of 50 seconds. (10 Marks)
- (e) Calculate the percentage idle time for the line. (03 Marks)

Table 7:1 - Tasks

Task	Task Time (Seconds)	Immediate Predecessors
A	45	-
B	11	A
C	9	B
D	50	-
E	26	D
F	11	E
G	12	C
H	10	C
I	9	F, G, H
J	10	I

Question 08

SummerFun, Inc., produces a variety of recreation and leisure products. The production manager has developed an aggregate forecast:

Month	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Forecast	50	44	55	60	50	40	51	350

Use the following information to develop aggregate plans.



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Regular Production cost - Rs. 80 per unit

Overtime cost - Rs. 120 per Unit

Regular capacity - 40 units per month

Overtime capacity - 8 units per month

Subcontracting cost - Rs. 140 per Unit

Holding cost - Rs. 10 per unit per month

Subcontracting capacity - 12 units per month

Back -order cost - Rs. 20 per Unit

Beginning Inventory - 0 units

Develop the aggregate plan using a combination of backlogs, subcontracting, and inventory to handle variations in demand. (20 Marks)

-----END OF THE QUESTION PAPER-----

Formula Sheet

Simple Moving Average

$$F_{t+1} = \frac{D_t + D_{t-1} + \dots + D_{t-n+1}}{n}$$

D_t : actual demand in period t

n : number of periods in the average

1. Weighted Moving Average

$$T_{t+1} = W_1 D_1 + W_2 D_{t-1} + \dots + W_n D_{t-n+1}$$

2. Exponential Smoothing

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

F_t = new forecast

F_{t-1} = previous forecast

α = smoothing (or weighting) constant ($0 \leq \alpha \leq 1$)

4. Trend Projections

$$y = a + bx$$

y = computed value of the variable to be predicted

a = y-axis intercept

b = slope of the regression line

x = the independent variable

$$b = \frac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma x^2 - n\bar{x}^2} \quad a = \bar{y} - b\bar{x}$$

5. Exponential Smoothing with Trend Adjustment

$$F_t = \alpha (A_{t-1}) + (1-\alpha) (F_{t-1} + T_{t-1})$$

$$T_t = \beta (F_t - F_{t-1}) + (1-\beta) T_{t-1}$$

$$FIT_t = F_t + T_t$$



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Year 3 Semester I

END SEMESTER EXAMINATION

Mathematical Models of Interest- BBIM 3305

- This paper consists of EIGHT (08) questions on ELEVEN (11) pages.
- Answer FIVE (05) Questions including Question No: 01.
- Only non-programmable calculators are allowed.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.
- Formula Sheet and the Normal Distribution Table are attached with the paper.

Date: 2022.09.20

Pass mark: 40%

Time: 03 Hours

Question 01: (Compulsory)

(a) Find the value of n , $40(1.065)^n = 600$.

- (i) $n = 2.64$
- (ii) $n = 43.00$
- (iii) $n = 39.458$
- (iv) $n = 5.324$
- (v) None of the above.

(b) Twenty thousand dollars is invested for 18 months at an annual interest rate of 15%. Find the accumulated value if interest is compounded monthly.

- (i) \$24,664.75
- (ii) \$23,238.63
- (iii) \$43,283.66
- (iv) \$25,011.55
- (v) None of the above.



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- (c) Find the present value at 16% simple interest of \$2000 due in 6 months.
- (i) \$1,851.85
 - (ii) \$3,258.46
 - (iii) \$2,985.45
 - (iv) \$5,899.78
 - (v) None of the above.
- (d) A debt of \$8000 with interest at 20% compounded semiannually is to be amortized by equal semiannual payments of \$R over the next 5 years, the first payment due in 6 months. Find the payment R to be made each period.
- (i) \$4,258.45
 - (ii) \$1,301.96
 - (iii) \$955.89
 - (iv) \$542.89
 - (v) None of the above

Answer (e) and (f) based on below information.

Mr. Amila is considering to invest Rs. 350,000 in a Hardware business. The cash inflows during the first, second and third years are expected to be Rs. 125,000, Rs. 150,000 and Rs. 170,000 respectively. Cost of Capital is 11%.

- (e) The NPV for the business is
- (i) Rs. 12,079.49
 - (ii) Rs. -10,557.78
 - (iii) Rs. 14,684.12
 - (iv) Rs. 15,545.45
 - (v) None of the above.



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(f) The IRR of the project is, (use 11% and 15% for the calculation)

- (i) 10.25%
- (ii) 17.65%
- (iii) 9.56%
- (iv) 12.71%
- (v) None of the above.

(g) If you expect to receive a cash flow (e.g., dividend from a share you own) of Rs.10 per year for an infinite period of time, and if the relevant discount rate is 10%, what the present value of these dividends.

- (i) Rs. 150
- (ii) Rs. 100
- (iii) Rs. 85
- (iv) Rs. 95
- (v) None of the above

(h) Given the nominal interest rate as 15% per annum with monthly compounding, calculate the effective interest rate.

- (i) 16.08%
- (ii) 32.16%
- (iii) 8.04%
- (iv) 3.25%
- (v) None of the above.



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- (i) A corporate bond has 5 years to maturity with a face value of \$1000. The bond pays semi-annual coupons of 9% per annum. The yield on similar bonds is 13%. What is the value of the bond?
- (i) \$652.58
 - (ii) \$935.26
 - (iii) \$ 837.21
 - (iv) \$1,521.22
 - (v) None of the above.
- (j) Calculate the present value of an annuity immediate of amount \$100 paid annually for 5 years at the rate of interest of 9%.
- (i) \$536.25
 - (ii) \$365.14
 - (iii) \$423.97
 - (iv) \$472.36
 - (v) None of the above.

(02 Marks*10 = 20 Marks)

Question 02

- (a) James has deposited \$2000 at the end of each year into an educational savings plan for the last 15 years. His deposits earned interest at $j_1 = 8\%$ for the first 6 years, at $j_1 = 12\%$ for the next 4 years; and at $j_1 = 10\%$ for the last 5 years. Consider compounding interest.
- (i) What is the total accumulated value of his educational plan? (05 Marks)
 - (ii) What is the total interest earned for the 15 years. (03 Marks)



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(b) Mrs. Joana has two options available in repaying a loan: she can pay \$500 at the end of 4 months and \$700 at the end of 9 months, or she can pay \$X at the end of 3 months and \$2X at the end of 6 months. If the options are equivalent and money is worth 15%, find X, using as the focal date

- (i) the end of 6 months (04 Marks)
 (ii) the end of 3 months. (04 Marks)

(c) A used car sells for \$9,550. Brian wishes to pay for it in 18 monthly installments, the first due on the day of purchase. If 18% compounded monthly is charged, find the size of the monthly payment. (04 Marks)

Question 03

(a) A stock is worth \$60 today. In a year, the stock price can rise or fall by 15%. If the interest rate is 6%, what is the price of a call option that expires in three years and has a strike price of \$70? Use three-step Binomial Model to obtain your answer. (15 Marks)

(b) If you deposit \$8,000 into an account paying 7% annual interest compounded quarterly, how long until there is \$12,400 in the account? (05 Marks)

Question 04

(a) David deposited a certain amount of money today and is supposed to receive 30 annual payments of \$5,000 each. However, the annuity will start 4 years from today and the applicable rate of interest is 5%. Calculate the amount of money deposited if the annuity payment is supposed to be made at the end of each year. (06 Marks)



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(b) Consider the given table of information for a call option.

Current Share Price	\$50
Strike Price	\$55
Number of Shares	100
Price of the call option to buy one share	\$4
Expiration Date	6 months

Obtain the graph of the profit function of the call option. Clearly mention the break-even value, profit region and the loss region. (08 Marks)

(c) (i) Find the NPV of an investment A having initial cash outflow of Rs. 280,000. The cash inflows at first, second, third and fourth years are expected to be Rs. 60,000, Rs. 97,000, Rs.100,000 and Rs, 110,000 respectively. Consider the cost of capital as 13%.

(03 Marks)

(ii) Suppose that there is another mutually exclusive project B along with investment A above, and the NPV of that project is Rs.(3588). What is your decision on implementing these projects? Give reasons to your answer. (03 Marks)



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Question 05

(a) Julian Company is considering investing in two independent projects. The company requires an 18% return (cost of capital) from its investments.

	Project X	Project Y
Initial Investment	\$108,000	\$95,000
Net Cash Flow Income		
Year 1	\$36,000	\$40,000
	\$40,000	\$40,000
Year 3	\$38,000	\$40,000
Year 4	\$45,000	\$40,000

- (i) Calculate NPV for Project X and Project Y. (06 Marks)
- (ii) Compute IRR for Project X using two discount rates as 10% and 18%. (06 Marks)
- (iii) What is the decision for Project X based on NPV? What is the decision based on IRR?
 Is there a conflict? (02 Marks)
- iv) Based on the results you obtained, what will be your advice to the Julian Company on both projects? (02 Marks)
- (b) How much money would you need to deposit today at 5% annual interest compounded monthly to have \$20,000 in the account after 9 years? (04 Marks)

Question 06

(a) Consider a stock that trades for \$75. A put and a call on this stock both have an exercise price of \$70 and they expire in 5 months. If the risk-free interest rate is 9% and the



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standard deviation of the stock is 0.35, compute the price of the call option and the put option using Black-Scholes Model. (15 Marks)

(b) A 7-year bond has a coupon rate of 15% per year. (Coupons are paid annually). The face value of the bond is \$50,000. The current market yield is 17% per year. Calculate the value of the bond. (05 Marks)

Question 07

(a) Mr. Nimal borrows a \$5000 debt with interest at 16% to be paid with annual payments over 5 years.

(i) Find the annual payment rounded up to the nearest cent. (03 Marks)

(ii) Construct a complete amortization schedule for this debt. (12 Marks)

(b) Consider the number 542.462.

(i) Round the given number to 3 significant digits. (02 Marks)

(ii) Write the characteristic and mantissa of the number 542.462. (03 Marks)

Question 08

(a) Suppose 70% of your portfolio is invested in Company A and the remainder in Company B. You expect a 12% return from Company A and 15% return from Company B. The standard deviation for Company A and Company B are given as 12.8% and 18.2%, respectively.

(i) Calculate the Portfolio Expected Return of this two-asset portfolio. (04 Marks)

(ii) Calculate the Portfolio Risk (Portfolio variance), assuming a correlation coefficient of 0.56 between the two assets. (04 Marks)



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(b) Assume that you are going to buy a business for 15 years. The franchise will bring you net cash flows (after all expenses) of \$100,000 at the end of first year. Then the cash flow will grow 4% annually. If you require a minimum return (assume this is the current interest rate) of 8% per annum, what is the present value of this growing annuity?

(06 Marks)

(c) Your company estimates it will have to replace a piece of equipment at a cost of \$800,000 in 5 years. To do this a fund is established by making monthly payments into an account at end of each month, paying 6.6% compounded monthly. How much should each payment be?

(06 Marks)

-----END OF THE QUESTION PAPER-----



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Formula Appendix

The accumulated value S of Principal P at rate j_m for t years is

$$S = P(1 + i)^n = P\left(1 + \frac{j_m}{m}\right)^{mt}$$

Present Value of an Ordinary Annuity $PVA_n = CF \left[\frac{1 - (1+i)^{-n}}{i} \right]$

Future Value of an Ordinary Annuity $FVA_n = CF \left[\frac{(1+i)^n - 1}{i} \right]$

Present Value of an Annuity Due $PVA_n = CF \left[\frac{1 - (1+i)^{-n}}{i} \right] (1 + i)$

Future Value of an Annuity Due $FVA_n = CF \left[\frac{(1+i)^n - 1}{i} \right] (1 + i)$

Deferred Ordinary Annuity Present Value Formula $PV = \frac{CF}{i} \left[\frac{1 - (1+i)^{-n}}{(1+i)^m} \right]$

Growing Annuity Present Value Formula $PV = \frac{CF_1}{i-g} \left[1 - \left(\frac{1+g}{1+i} \right)^n \right]$

IRR Calculation Formula $IRR = r_a + \frac{NPV_a}{NPV_a - NPV_b} (r_b - r_a)$

Price of a bond $= \frac{C}{i} \left[1 - \frac{1}{(1+i)^n} \right] + \frac{F_n}{(1+i)^n}$

Black-Scholes Model

$$c = S_0 N(d_1) - Ke^{-rT} N(d_2)$$

$$p = Ke^{-rT} N(-d_2) - S_0 N(-d_1)$$

Where $d_1 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$ $d_2 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$

Binomial Option Pricing Model

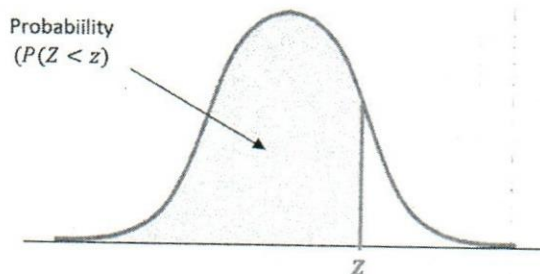
$$p = \frac{e^{rt} - d}{u - d} \quad \text{where} \quad u = e^{\sigma\sqrt{t/n}} = \frac{S^+}{S} \quad \text{and} \quad d = e^{-\sigma\sqrt{t/n}} = \frac{1}{u} = \frac{S^-}{S}$$

$$f = e^{-r\Delta t} [pf_u + (1-p)f_d]$$

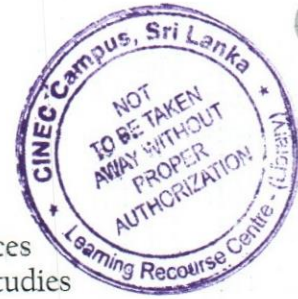


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Normal Distribution Table



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5754
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7258	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7518	0.7549
0.7	0.7580	0.7612	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7996	0.8023	0.8051	0.8079	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9430	0.9441
1.6	0.9452	0.9463	0.9474	0.9485	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9700	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9762	0.9767
2.0	0.9773	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9865	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9980	0.9980	0.9981
2.9	0.9981	0.9982	0.9983	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998	0.9998



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Year 3 Semester I
FINAL EXAMINATION
Numerical Methods for Business BBIM 3303

- This paper consists of Eight (08) questions on Three (03) pages.
- Answer All Five (05) Questions. Question 01 is compulsory
- Nonprogrammable Calculators are allowed.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 2022.09.21

Pass mark: 40%

Time: 03 Hours

Question 01 (Compulsory)

- (a) Using the Bisection method to solve the equation $t^2 + 2t - 8 = 0$ in the interval $[1,4]$. (07 Marks)
- (b) Show that the root of the equation $t^2 + 3t - 5 = 0$ lies in the interval $[1,2]$. Find the first three approximations to the roots of this equation using the Bisection method. (07 Marks)
- (c) Find a root of an equation $f(t) = t^3 - t - 1 = 0$ using Newton Raphson Method. (06 Marks)

Question 02

- (a) Consider the following Differential Equation $\frac{dy}{dx} = x + 2y$, $y(0) = 0$
 Let $h = 0.1$ and use Euler's Method to Approximate the $y(0.4)$

(10 Marks)

- (b) Apply Runge - Kutta Method of Second Order to solve below initial Value Problem

$$\frac{dy}{dx} = x + y, y(0) = 1, \text{ Use } h = 0.1 \text{ to find } y(0.2)$$

(10 Marks)



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Question 03

- (a) Use Lagrange's interpolation formulae to fit a polynomial for the below data set.

x	5	6	9	11
f(x)	12	13	14	16

(10 Marks)

- (b) Determine the Hermite Polynomial of Degree 3, which fits the Following data.

x	1/2	1
f(x)	4	1
f'(x)	-16	-2

(10 Marks)

Question 04

- (a) Find the y coordinate of a straight line which passes through (-2, -1) and (-3, -3) at the point at x=4 using Linear Interpolation

(10 Marks)

- (b) Find the formula of the curve which passes through (10,210), (15,320) and (20,500) using Quadratic Interpolation

(10 Marks)

Question 05

- (a) Calculate Cubic Spline which satisfy the below dataset.

x	1	2	3	4
y	1	5	11	8

(10 Marks)

- (b) Find the root of the function $f(x) = 8x^3 + 7.5x^2 - 4.25x - 2$ using Newton Raphson Method. (Assume that $x_1 = 0.8$)

(10 Marks)



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Question 06

Use Hermite Interpolation method to find the general formulae of the curve which satisfying below details.

x	$X_0 = 1/2$	$X_1 = 1$
F(x)	3	1
F'(x)	-15	-2

(20 Marks)

Question 07

Below table shows the calculated population of a city in the gaps of ten years between 1950 and 1990. Using Newton's Forward and Backward Interpolation formulas find the populations of year 1957 and 1987

Year (x)	Population (y)
1950	18000
1960	26500
1970	38000
1980	52000
1990	75000

(20 Marks)

Question 08

Find the $f(0.2)$ and $f(3.8)$ values of below given $(x, f(x))$ coordinates of function $f(x)$ using Newton's Forward and backward Interpolation formulas

(x)	f(x)
0	176
1	185
2	192
3	203
4	212

(20 Marks)

----- END OF THE PAPER -----

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Year 3 Semester I
SEMESTER END EXAMINATION
Decision Making For Business Analysis - BBIM 3302

- This paper consists of EIGHT (08) questions on SIX (06) pages.
- Answer FIVE (05) questions including question 01.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.
- Write legibly.

Date: 2022.09.12

Pass mark: 40%

Time: 03 Hours

Question 01: (Compulsory)

Game theory is a mathematical theory that deals with the competitive situations and highlights the decision making processes in an abstract way.

- (a) Who developed the game theory in operation research and briefly explain about the usage of game theory
- (b) List down the areas that game theory influences
- (c) Discuss how game theory impacts on Economics and Business
- (d) Mention the main assumptions of game theory

(20 Marks)



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Question 02

Games can be classified according to certain significant features, the most obvious of which is the number of players. Thus, a game can be designated as being a one-person, two-person, or n-person (with n greater than two) game, games in each category having their own distinctive features.

- (a) Briefly explain about One-person games, Two person zero sum game (with two players) and Two person zero sum game (with more than two players)
(05 Marks)
- (b) Compare and contrast the following games
(1) Perfect games and Imperfect games
(2) Finite games and infinite games
(3) Cooperative games and Non cooperative games
(05 Marks)
- (c) The strategy for a player is the list of all possible actions that he/she will take for every pay-off that might arise. Mention the types of Strategy and briefly explain about them.
(05 Marks)
- (d) Discuss on Minmax-Maxmin principle and hence mention the formula for Saddle point
(05 Marks)

Question 03

The Principle of Dominance in Game Theory also known as dominant strategy or dominance method.



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(a) State how does it function (05 Marks)

(b) Reduce the following matrices by dominance method (Show all the steps clearly)
 (10 Marks)

	B1	B2	B3	B4
A1	5	4	1	0
(1) A2	4	3	2	-1
A3	0	-1	4	3
A4	1	-2	1	2

(2)	Y1	Y2	Y3	Y4
X1	3	5	4	2
X2	5	6	2	4
X3	2	1	4	0
X4	3	3	5	2

(c) Hence, mention the order of the above matrices separately. (05 Marks)

Question 04

(a) Define Strictly determinable game in the context of game theory (05 Marks)

(b) Find the optimal plan for both the player by maxmin-minmax principle
 (05 Marks)



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	Player-B			
	I	II	III	IV
I	-2	0	0	5
II	4	2	1	3
III	-4	-3	0	-2
IV	5	3	-4	2

(c) For the game with payoff matrix

Player B

Player A	-1	2	-2
	6	4	-6

Determine the best strategies for players A and B and also the value of the game.

Is this game (i) fair (ii) strictly determinable? Explain

(05 Marks)

(d) Find the range of values of p and q which will render the entry (2,2) a saddle point for the game.

(05 Marks)

Player A	Player B		
	B1	B2	B3
A1	2	4	5
A2	10	7	q
A3	4	p	6



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Question 05

(a) Can always guarantee that a game has a saddle point? If it does not exist what are the methods used to find it? (05 Marks)

(b) By the method which you mentioned above, solve the following game

	A1	A2
B1	-2	3
B2	3	-4

Hence, find the value of the game? (05 Marks)

(c) Two player A and B match coins. If the coins match, then A wins two units of value, if the coin do not match, then B win 2 units of value. Determine the optimum strategies for the players and the value of the game (10 Marks)

Question 06

Probability plays an important role in mixed strategy Nash equilibrium calculation in game theory.

(a) Draw the probability tree diagram and solve the following questions

(i) A bag contains 4 Red balls and 5 Blue balls. Raheem picks 2 balls at random by not replacing those. Calculate the probability that he selects the same coloured balls.



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- (ii) Calculate the probability that he selects the different coloured balls by replacing them for the above same scenario. (10 Marks)
- (b) Define Nash equilibrium in game theory. (05 Marks)
- (c) Briefly explain the concept of Nash equilibrium by an example. (05 Marks)

Question 07

When the zero sum assumption is lifted, the game becomes a non-zero sum game and represents a more realistic decision making process.

- (a) List down the significant differences that non zero sum games have from zero sum games. (05 Marks)
- (b) Mention the roles of Pareto optimality in decision making process. (05 Marks)
- (c) When the Nash equilibrium is not the optimum, suggest a situation in game theory (05 Marks)
- (d) Define Subgame perfect equilibrium and give an example. (05 Marks)

Question 08

- (a) Mention three standard games in game theory (05 Marks)
- (b) Briefly explain the Prisoner's dilemma in the context of game theoretical scenario. (05 Marks)
- (c) Identify features of Mass action interpretation (05 Marks)
- (d) Define Evolutionarily stable strategies and give an example for Evolutionary game (05 Marks)

-----END OF THE QUESTION PAPER-----