

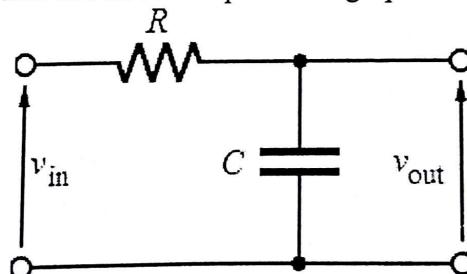
Pabna University of Science and Technology
Department of Computer Science and Engineering
B. Sc. Engineering Examination 2nd Year 1st Semester-2020
 Course Title: Course Title: Electronic Devices and Circuits
 Course No: EEE 2101
 Time: 3.00 hours (For PART-A and PART-B)

N.B.: i) The figures in the right margin indicate full marks.
ii) Answer any THREE questions from PART A

PART A

Full Marks: 70

- | | | |
|----|--|----------------|
| 1. | a) What is semiconductor? Mention the difference between semiconductor and conductor. | 03 |
| | b) Draw and explain the V-I characteristics curve of PN junction diode and also mention its usage. | $8\frac{2}{3}$ |
| 2. | a) What do you mean Avalanche and Zener effect? | 05 |
| | b) What is Zener diode? How Zener diode used in voltage stabilizer describe with a block diagram? | $6\frac{2}{3}$ |
| 3. | a) What do you mean by Rectifier? Mention its importance and usage. | $3\frac{2}{3}$ |
| | b) Draw and explain the working principle of a center tapped half wave rectifier and mention the input and output waveforms. | 08 |
| 4. | a) Why biasing is needed? Compare between BJT and FET. | $3\frac{2}{3}$ |
| | b) What is Q-point? Describe significance of proper Q-point selection on the DC load line for transistor amplifying action. | 03 |
| | c) Determine whether this circuit is low pass or high pass and why? | 05 |



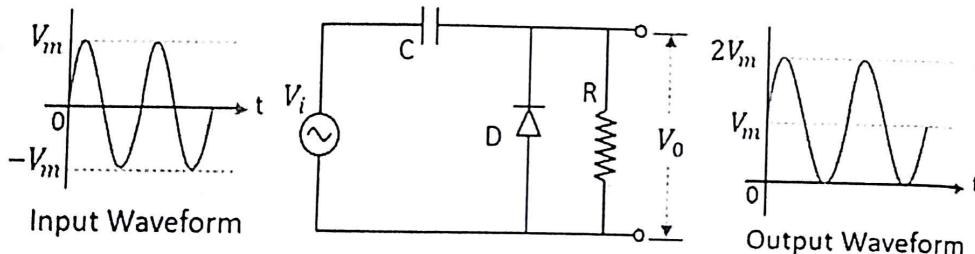
Pabna University of Science and Technology
Department of Computer Science and Engineering
B. Sc. Engineering Examination 2nd Year 1st Semester-2020
 Course Title: Electronic Devices and Circuits
 Course No: EEE 2101
 Time: 3.00 hours (For PART-A and PART-B)

N.B.: i) The figures in the right margin indicate full marks.

ii) Answer any THREE questions from PART B

PART B

- | | |
|---|----------------|
| 5. a) What is clipper? Mention its usage. | 03 |
| b) What is clamper? Describe how the following circuit is a positive clumper circuit? | $8\frac{2}{3}$ |



- | | |
|--|----------------|
| 6. a) What is transistor? Briefly mention its usage. | 04 |
| b) How 180^0 phase shift is introduced in CE amplifier? Briefly explain with necessary diagram. | $7\frac{2}{3}$ |
| 7. a) What do you mean an Oscillator? Mention its usage. | 03 |
| b) Draw a basic block diagram of an oscillator and describe each part. | $5\frac{2}{3}$ |
| c) Write down the difference between crystal oscillator and RC phase shift oscillator. | 3 |
| 8. a) What is opAMP? Write down the usages of opAMP. | 05 |
| b) Design and implement analog to digital converter and digital to analog converter. Write down the usages of analog to digital converter. | $6\frac{2}{3}$ |

Pabna University of Science & Technology

Department of Computer Science & Engineering

2nd Year 1st Semester Examination-2021

Course Title: Electronic Devices and Circuits

Course no: EEE 2101

Time: 3:00 hours (For PART-A and PART-B)

PART-A

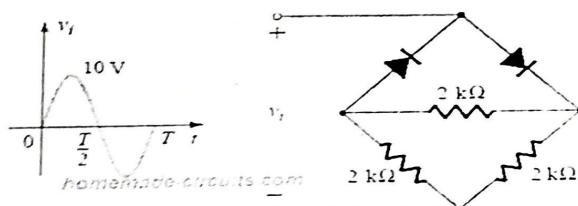
Full Marks: 35

N.B. (i) Answer any Three questions out of Four

(ii) Separate answer script must be used for answering the questions of PART-A.

(iii) Figures in the right margin indicate marks.

- | | | |
|---|---|------|
| 1 | (a) Define the following terms i) Voltage ii) Conductor iii) Resistance iv) Valence band | 04 |
| | (b) Classify the solids in accordance with energy bands and explain briefly with necessary diagrams. | 7.67 |
| 2 | (a) Explain the process of increasing charge carrier in semiconductor? | 3.67 |
| | (b) Briefly explain the formation of PN junction with necessary diagram. | 6 |
| | (c) Define extrinsic and intrinsic semiconductor with example. | 2 |
| 3 | (a) Determine the output waveform of the following circuit shown in Fig. 3(a). Also find the output dc level, | 3.67 |



- | | | |
|--|---|---|
| 4 | (b) Differentiate between diffusion and transition capacitance. | 2 |
| | (c) Write short notes on: i) photo diode, ii) varactor diode, iii) Tunnel diode | 6 |
| (a) Define i) CMRR, ii) Inverting Amplifier and Non-inverting amplifier. | 3.67 | |
| (b) Explain the operation of a positive clamper circuit with necessary diagrams. | 4 | |
| (c) What is the range of the output voltage in the circuit of figure 4(c) if the input varies from 0.1 to 0.5 V? | 4 | |

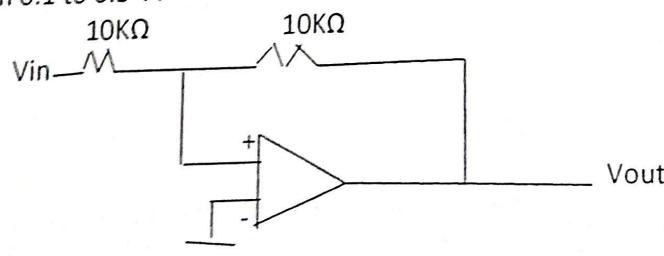


Fig: 4(c)

Pabna University of Science & Technology

Department of Computer Science & Engineering

2nd Year 1st Semester Examination-2021

Course Title: Electronic Devices and Circuits

Course no: EEE 2101

Time: 3:00 hours (For PART-A and PART-B)

PART-B

Full Marks: 35

N.B. (i) Answer any Three questions out of Four

(ii) Separate answer script must be used for answering the questions of PART-B.

(iii) Figures in the right margin indicate marks.

- | | | |
|---|---|------|
| 5 | (a) What is FET? Draw a basic block diagram of a FET and also differentiate between FET and BJT. | 7 |
| | (b) What is BJT? Why it is called so? Briefly mention its usages. | 4.67 |
| 6 | (a) Draw the basic block diagram of CB, CC. and CE configuration of NPN transistor. | 4.67 |
| | (b) Define Oscillator and why it is used? Write down the necessary conditions for oscillation and also draw a block diagram of an oscillator. | 7 |
| 7 | (a) Define logic gate. What do you mean by Basic gates and Universal gates and why they called so? | 4.67 |
| | (b) Draw the basic block diagram of DCTL NAND gate and NOR gate and also mention its advantages and disadvantages. | 4 |
| | (c) Draw a NOT gate using NPN transistor and write down its working principle. | 3 |
| 8 | (a) Calculate the equation for current gain for the CB configuration of NPN transistor. | 5.67 |
| | (b) How 180° phase shift is introduced in CE amplifier? Briefly explain it. | 6 |

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination 2022

Course Title: Electronic Devices and Circuits

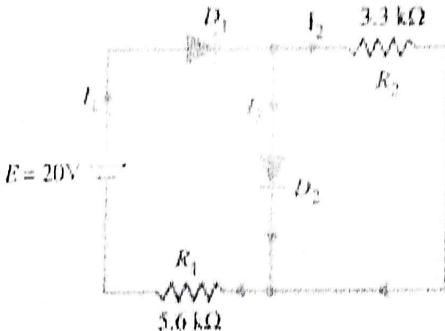
Course Code: EEE 2101

Time: 3:00 hours (PART-A & PART-B) Full Marks: 70

[Answer any Three questions from PART A(Q1-Q4) and any Three questions from PART B(Q5-Q8)]

PART-A

Marks 35

- | | | |
|---|---|----------------|
| 1 | (a) Define the following terms i) Current ii) Voltage iii) Conduction band | 3 |
| | (b) Briefly explain semiconductor, conductor and insulator with necessary energy bands diagrams. | $4\frac{2}{3}$ |
| | (c) What is doping? How you can convert a pure Si into P-type and N-type semiconductor? Explain briefly. | 4 |
| 2 | (a) What is semiconductor diode? Explain the forward biased and reverse biased of semiconductor with necessary figures. | $4\frac{2}{3}$ |
| | (b) Determine the currents I_1 , I_2 and I_3 for the given circuit. | 4 |
| |  | |
| | (c) Write short notes on: i) photo diode, ii) LED iii) varactor diode | 3 |
| 3 | (a) Draw a full wave rectifier, explain its operation and also calculate its rectification efficiency. | $6\frac{2}{3}$ |
| | (b) Differentiate between a full wave and full wave bridge rectifier. | 3 |
| | (c) What is ripple factor and why Pulsating DC is called so? | 2 |
| 4 | (a) Draw Inverting Amplifier and Non-inverting amplifier with necessary input and output. | $4\frac{2}{3}$ |
| | (b) Draw and explain the operation of summer circuit using op-amp with necessary diagrams. | 5 |
| | (c) Why operational amplifier is called so? Explain. | 2 |

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination 2022

Course Title: Electronic Devices and Circuits

Course Code: EEE 2101

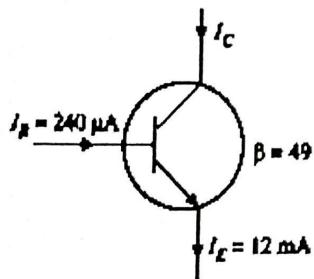
Time: 3:00 hours (PART-A & PART -B) Full Marks: 70

[Answer any Three questions from PART A(Q1-Q4) and any Three questions from PART B(Q5-Q8)]

PART-B

Marks 35

- 5 (a) What do you mean by biased clipping? Draw a biased clipper circuit and explain its operation in brief. $4\frac{2}{3}$
(b) Differentiate between BJT and FET in terms of their functionalities and usage. 4
(c) Draw the common emitter (CE) configuration of BJT. Establish the relationship between current application factor of CE and CB. 3
- 6 (a) What is rectifier and Oscillator? Mention their importance in electronics. $3\frac{2}{3}$
(b) Classify Oscillator in brief. Briefly explain the operation of an oscillator with necessary block diagrams. 4
(c) Find the α rating of the transistor and collector current from the given configuration. 4



- 7 (a) What do you mean by a load line? Briefly explain DC and AC load line with necessary diagrams. $4\frac{2}{3}$
(b) What is cut-off, saturation and Q point of a load line? Explain 4
(c) How a transistor can be used as a switch, explain. 3
- 8 (a) What is α and β ? Find out their relation. $3\frac{2}{3}$
(b) How a transistor can be used as a amplifier? Briefly explain it. 4
(c) Determine the output voltage of an integrator and differentiator for an input of $V_{in} = 10 \sin 4t$. 4

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering Examination 2nd Year 1st Semester-2020

Course Title: Elementary Statistics and Probability

Course No: STAT 2101 (Improvement)

Time: 3.00 hours (For PART-A and PART-B)

N.B.: i) The figures in the right margin indicate full marks.

ii) Answer any THREE questions from PART B

iii) Separate answer script must be used for answering the question of PART B

PART B

Marks: 35

- | | | |
|-----|---|---------------------------------------|
| 01. | (a) Define probability of an event. Explain the additive law of probability
(b) Two unbiased dice are thrown. Find the probability that
i. Sum of the upper faces of the dice is 7 or more.
ii. First dice is twice of the second dice.
(c) Define random variable. Generate a random variable from an experiment of tossing a fair coin three times | 04
3.67
04 |
| 02. | (a) Define with examples of conditional probability and pairwise independent of two events.
(b) Explain with examples the term of mathematical expectation. Write down the properties of expectation.
(c) A continuous random variable X has a function $f(x) = kx(1-x)$, $0 < x < 1$ for what value of k f(x) will be the probability density function. Find
i. $P(0 < x < 1/2)$ and $P(1/2 < x < 1)$.
ii. $E(X)$ and $V(X)$
iii. $E(X^2+2)$ and $E(5)$ | 03
04
4.67 |
| 03. | (a) Define Poisson variable with examples. Show that four cumulates are equal.
(b) Show that for normal distribution, mean = median = mode. | 04
7.67 |
| 04. | (a) What is normal distribution? State some application of normal distribution.
(b) What is binomial distribution? Show that mean of binomial distribution is greater than its variance.
(c) A binomial variate X has a mean 4 and variance 3. Determine the parameters of the distribution. Also determine its probability function. | 3.67
05
03 |

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering Examination 2nd Year 1st Semester-2020

Course Title: Elementary Statistics and Probability

Course No: STAT 2101 (Improvement)

Time: 3.00 hours (For PART-A and PART-B)

N.B.: i) The figures in the right margin indicate full marks.

ii) Answer any THREE questions from PART A

iii) Separate answer script must be used for answering the question of PART A

PART A

Marks: 35

01. (a) Define a frequency distribution. What is the purpose of constructing a frequency distribution? **04**
- (b) Discuss the different scales of measurement with examples. **4.67**
- (c) Distinguish between histogram and bar diagram. **03**
02. (a) What do you understand by central tendency? Which measure of central tendency is the best and why? **04**
- (b) The monthly salaries (in Taka) of 7 employees are given below: **04**
950, 775, 925, 2500, 1150, 850, 975
i. Calculate the mean and median of salary.
ii. Which of the above two is preferable as a measure of center, and why?
- (c) The arithmetic mean and geometric mean of two observations are 5 and $2\sqrt{6}$, respectively. Find the two observations. **3.67**
03. (a) What is Dispersion? Show that standard deviation of first n natural number is $\sqrt{\frac{n^2-1}{12}}$. **04**
- (b) The distributions of number of e-mails received by a person in different days are given below: **7.67**

Class Interval of e-mails	2-4	4-6	6-8	8-10	10-12	12-14
No. of days (f)	8	12	16	7	6	3

I. Represent the data using histogram and ogive curve
II. What is the mean, median and mode number of e-mails?
III. Calculate standard deviation and mean deviation about mean.
04. (a) What do you mean by Skewness and Kurtosis? Show that skewness and kurtosis is independent of origin and scale measurement. **05**
- (b) What is moment? Discuss the role of raw moments in calculating central moments **03**
- (c) Suppose the first four raw moments are 5, 12, 25 and 60 respectively. Find out β_1 and β_2 . Also comment on the shape of the distribution. **3.67**

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering Examination 2nd Year 1st Semester-2021

Course Title: Elementary Statistics and Probability Course No: STAT 2101
Time: 3.00 hours (For PART-A and PART-B)

PART B

Marks 35

N.B: (i) Answer any Three questions from Part B
(ii) Figures in the right margin indicate marks

05. (a) Define sample space, event, conditional probability of an event and mutually exclusive events. 04
- (b) Explain the additive law of probability for two mutually exclusive events. 03
- (c) State and prove the Bayes theorem. 4.67
06. (a) Define random variable, expected value of a random variable and variance of random variable. 05
- (b) Let x be a random variable with probability distribution 04
- | | | | |
|------|---------------|---------------|---------------|
| X | 0 | 1 | 2 |
| P(x) | $\frac{1}{4}$ | $\frac{1}{2}$ | $\frac{1}{4}$ |
- Compute the mean and variance
- (c) Prove that the value of probability lies between 0 and 1 2.67
07. (a) Define probability distribution. Describe the types of probability function with their properties. 05
- (b) An unbiased die and a fair coin are tossed simultaneously. Find the joint probability function. Also find out the marginal distribution of X and Y. And calculate $f(x|2)$ and $f(y|1)$ 6.67
08. (a) Discuss some use of negative binomial distribution. 03
- (b) Write a short note on Hypergeometric distribution 04
- (c) In a class 10% of students get grade-A in every exam. What is the probability that 5 students need to be questioned to be sure that 2 students achieve grade-A in an exam? 4.67

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering Examination 2nd Year 1st Semester-2021

Course Title: Elementary Statistics and Probability Course No: STAT 2101

Time: 3.00 hours (For PART-A and PART-B)

PART A

Marks 35

N.B: (i) Answer any Three questions from Part A
(ii) Figures in the right margin indicate marks

01. (a) What is statistical data? Mention some of its sources. 04
(b) What do you mean by tabulation of raw data? Discuss the objectives of tabulation. 4.67
(c) Discuss secondary data with examples. 0.3
02. (a) What do you mean by central tendency? Write down the measurement of central tendency with its mathematical formula. 05
(b) Calculate the AM, GM and HM from the following information and show that $AM > GM > HM$, also find out the median and mode 6.67

Marks Obtained	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Number of students	40	60	200	180	150	110	175	60	25

03. (a) What do you mean by dispersion? Write down the classification of measures of dispersion. Define Variance and coefficient of variation. 03
(b) Find out the mean deviation and range from the following given set 2, 3, 4, 5, 6. 03
(c) Define coefficient of variation. The run scores of two cricketers for 10 innings are given below: 5.67

Cricketers A	80	65	0	31	120	195	10	2	8	110
Cricketers B	20	35	18	30	12	28	39	60	85	50

04. (a) Define Raw Moments and Central Moments. Describe thoroughly the Skewness and Kurtosis with their types and mathematical formula. 6.67
(b) By using the following data -25, -10, -5, 0, 12, 18, 30. Calculate the skewness and the kurtosis, then comment. 05

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination 2022

Course Title: Elementary Statistics and Probability

Course Code: STAT 2101

Time: 3:00 hours (For PART-A and PART-B)

Full Marks: 70

[Answer any Three questions from PART A(Q1-Q4) and any Three questions from PART B(Q5-Q8).]

PART A

Marks: 35

- 01.** (a) Define Statistics. Briefly discuss the uses of statistics. **03**
(b) Define population and sample. Distinguish between: (i) finite and infinite population (ii) qualitative and quantitative variable. **06**
(c) Define different scales of measurement with example. **2.67**
- 02.** (a) Define statistical data. Name some graphs of representing statistical data. Distinguish between frequency curve and ogive curve. **05**
(b) The following data represent the amount of insurance (1000 tk) purchased by 25 people from an insurance company in a given week: 30, 45, 100, 42, 47, 95, 50, 65, 100, 33, 85, 90, 72, 66, 76, 80, 65, 95, 64, 45, 95, 100, 86, 72, 69.
(i) Construct a frequency distribution by suitable class interval.
(ii) What % of people purchased insurance more than 75000 tk?
(iii) What is the mean amount of insurance purchased by people?
(iv) Represent the data by histogram. **6.67**
- 03.** (a) What do you mean by Correlation and Regression analysis? Differentiate with them. Write down the properties of Correlation Coefficient. **05**
(b) The following table shows the ages(X) and blood pressure (Y) of 10 women **6.67**

X	56	42	36	47	49	42	60	72	63	55
Y	147	125	118	128	145	140	155	160	149	150

Obtain the regression equation of X on Y and find out the expected blood pressure of a Women who is 45 years old.
- 04.** (a) What is the difference between skewness and kurtosis? Explain different types of skewness and kurtosis with the help of diagram. **06**
(b) Rates of return over the past six years for two mutual funds are given below: **5.67**

Fund A	8.3	-6	18.9	-5.7	23.6	20
Fund B	12	-4.8	6.4	10.2	25.3	1.4

(i) Which fund gives higher average rates of return?
(ii) Which fund has higher risk?
(iii) Comment on the shape of the fund that has higher risk.

Pabna University of Science and Technology
Department of Computer Science and Engineering
B. Sc. Engineering 2nd Year 1st Semester Examination -2022
Course Title: Elementary Statistics and Probability
Course Code: STAT 2101
Time: 3:00 hours (For PART-A and PART-B) Full Marks: 70

[Answer any Three questions from PART A(Q1-Q4) and any Three questions from PART B(Q5-Q8)]

PART B

Marks: 35

- | | | |
|-----|---|------------------|
| 01. | (a) Define (i) random experiment (ii) mutually exclusive event (iii) probability of an even.
(b) Write down the axioms of probability. If A and B are two mutually exclusive events such that $A \cup B = \Omega$ and if $P[A] = 2P[B]$. Find the probability of A and B.
(c) What is conditional probability of any event? Suppose that in a locality, on a rainy day the probability that ice-crème will be sold is 0.4, but in a sunny day the probability increases to 0.9. If the weather forecast gives a probability that it will be rained on a particular day is 0.75. Represent the information by a tree diagram. | 03
04
4.67 |
| 02. | (a) When two events are said to be independent? Show that mutually exclusive events can never be independent.
(b) Let $P[A] = 0.6$, $P[B] = 0.8$ and $P[A \cup B] = 0.9$.
(i) Find $P[AB]$ (ii) are the events A and B independent? | 04
2.67 |
| 03. | (a) Define random variables with example. Distinguish between probability mass function (pmf) and probability density function (pdf). What is mathematical expectation of a random variable?
(b) Suppose the random variable X has pdf as follows:
$f(x) = \begin{cases} kx^2 + kx + \frac{1}{8} & ; 0 < x < 2 \\ 0 & ; \text{otherwise} \end{cases}$
(i) Determine the value of k . (ii) Evaluate $P(1 < X < 2)$. (iii) calculate $P(X < 1)$
(iv) Calculate $P(X=1)$. (v) Find $E(X)$. | 05
06
5.4 |
| 04. | (a) Define Binomial distribution. Give some practical applications of this distribution.
(b) Suppose X is a binomial variate with mean 9 and variance 3.6. Now find the probability mass function of binomial distribution.
(c) A fair coin is tossed 5 times. Find the probability of (i) exactly 2 heads (ii) at least 3 heads (iii) no heads. | 04
03
4.67 |

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination-2023

Course Code: STAT 2101

Course Title: Elementary Statistics and Probability

Time: 3:00 hours (PART-A & PART-B) Full Marks: 70

PART-A

Marks 35

- Answer any three questions from PART A (Q1 to Q4).
- Figures in the right margin indicate marks.

01. (a) Define Statistics. Mention the limitations of statistics. 04
- (b) Define statistical data. What are the various methods of presenting statistical data? Describe them in brief. 05
- (c) Distinguish between nominal data and ordinal data. $2\frac{2}{3}$
02. (a) Explain the following terms: (i) class interval (ii) frequency (iii) cumulative frequency. 03
- (b) The following data represent the marks distribution of 70 students that they obtained in a class test:
- | Marks | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 |
|-----------------|-------|-------|-------|-------|-------|-------|
| No. of students | 6 | 11 | 19 | 17 | 13 | 4 |
- (i) What % of students obtained marks, less than 50?
(ii) What is the mean mark obtained by the students?
(iii) Represent the data by histogram. Find the modal value of the marks from the histogram.
- (c) The arithmetic mean and geometric mean of two observations are 5 and $2\sqrt{6}$, respectively. Find the harmonic mean of the two observations. $2\frac{2}{3}$
03. (a) What is Dispersion? Write down the uses of range and coefficient of variation. 04
- (b) Find the variance of the series 1, 2, 3, ..., 15. $3\frac{2}{3}$
- (c) What do you mean by measure of central tendency? Write down the properties of median. 04
04. (a) Define raw and central moments. Establish the relationship between them. $5\frac{2}{3}$
- (b) Define skewness and kurtosis. Draw the shapes of the distribution for the following values of skewness and kurtosis: (i) $\beta_1 = 0$ and $\beta_2 = 3$ (ii) $\beta_1 = -1$ and $\beta_2 = 5$ 06

Pabna University of Science and Technology
Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination-2023

Course Code: STAT 2101

Course Title: Elementary Statistics and Probability

Time: 3:00 hours (PART-A & PART -B) Full Marks: 70

PART-B

Marks 35

- Answer any three questions from PART B (Q5 to Q8).
- Figures in the right margin indicate marks.

05. (a) Define probability of an even with example. Prove that total probability is one. 03
 (b) An unbiased die and a coin are thrown simultaneously. Write down the sample space. Find the probability of getting odd numbers and head. $2\frac{2}{3}$
 (c) A survey among 150 students show that 95 students like ice-creme, 75 like chocolate and 135 like at least one of them. If a student selected at random, find the probability the s/he (i) likes both ice-creme and chocolate (ii) Does not like any of them (iii) likes ice-creme but not chocolate. 05
06. (a) State and prove the Bayes theorem. 05
 (b) Mr. Ali wants to build a house this year. He applied for a bank loan. The probability that he will get it is $2/3$. If he will get the loan, the probability that he will build the house is $3/4$. If he will not get the loan, the probability that he will build the house is $1/4$. What is the probability that Mr. Ali will build a house this year? $6\frac{2}{3}$
07. (a) Define random variables with example. Distinguish between probability mass function (pmf) and probability density function (pdf). 03
 (b) Suppose x be a random variable with probability functions: $4\frac{2}{3}$

x	0	2	4	11
$f(x)$	$1/10$	$2/10$	$4/10$	$3/10$

 Now evaluate the followings,
 (i) $P(1 < X < 2)$
 (ii) $P(-2 \leq x < 11)$
 (iii) $P(X > 0)$
 (iv) $P(11 \leq x)$
 (c) What are the different scales of measurement? Briefly discuss the differences between ratio and interval scale. 04
08. (a) Define Poisson distribution. Give some practical applications of this distribution. 04
 (b) Write down the properties of Poisson distribution. 03
 (c) In a Poisson distribution, $P(x = 0) = P(x = 1)$.
 (i) Find the probability mass function of this Poisson distribution.
 (ii) What is the value of $(x = 2)$? $4\frac{2}{3}$

Pabna University of Science and Technology
Department of Computer Science and Engineering
B. Sc. Engineering Examination -2020
Course Title: Data Structures
Course No: CSE-2101
Time: 3:00 hours (For PART-A and PART-B)

Full Marks: 35

N.B: (i) Answer any Three questions.
(ii) Figures in the right margin indicate marks.

PART A

- | | |
|--|----------------|
| 1. (a) Define Data Structures and Algorithms. Describe how a reference type object can be structured? | 4 |
| (b) What are linear and non-linear data structures? Can non-linear data structures be transformed in to the structured ones? Explain your opinion. | 4 |
| (c) Explain a prominent data structure that can be used in determining the merit list of students. | $3\frac{2}{3}$ |
| 2. (a) Consider the following sets of data in descending order: 45, 33, 24, 17, 15, 14, 9, 5. Explain which searching technique will provide the best performance? Explain the time complexity for the chosen technique? | 4 |
| (b) What is a sparse matrix? Describe the memory representations of array of arrays. | 4 |
| (c) Write a program that implements the overflow and underflow situations in the following STACK: 15, 20, 45, 16, - 12. Consider the stack can take 5 elements. | $3\frac{2}{3}$ |
| 3. (a) What is a polish notation? Determine the postfix and prefix notation from the following infix notation: $(A + B) * C - (D - E) * (F + G)$ | 5 |
| (b) Write a program to implement the insertion and deletion from a double ended Queue. | 4 |
| (c) Compare and contrast stack and queue. | $2\frac{2}{3}$ |
| 4. (a) What is linked list? What are the limitations of a linked list that can be solved by other data structures? | 4 |
| (b) Write a program to insert a double ended node at the middle of a double ended linked list. | 4 |
| (c) What is a circular linked list? Explain how you would insert the following data in a circular linked list: 12, 10, 5, 15, 24. | $3\frac{2}{3}$ |

Pabna University of Science and Technology
Department of Computer Science and Engineering
 B. Sc. Engineering Examination -2020
 Course Title: Data Structures
 Course No: CSE-2101
 Time: 3:00 hours (For PART-A and PART-B)

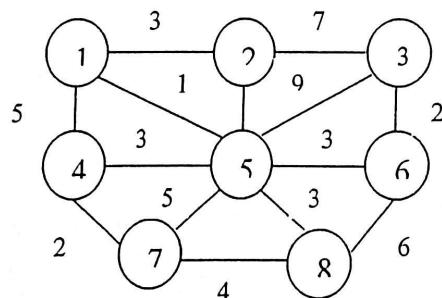
N.B: (i) Answer any **Three** questions.

Full Marks: 35

(ii) Figures in the right margin indicate marks.

PART-B

- | | | |
|----|--|----------------|
| 5. | (a) What do you understand by the rate of growth in computer algorithms? Describe graphically how the rate of growths changes for various simple to complex algorithms. | 4 |
| | (b) What are the best-case and worst-case scenarios for the bubble sort? Explain the scenarios in terms of the time complexity. | (1) |
| | (c) Write a program to implement the binary search of a character from a string. | $3\frac{2}{3}$ |
| 6. | (a) Compare and contrast the quick sort ad merge sort in terms of the procedure and time complexity. | 4 |
| | (b) What is hash table? When a collision is detected for the following sequence of keys: 80, 15, 18, 25, 22 and hash function of “ $k \bmod 10$ ”? How to solve the issue? | 5 |
| | (c) Write a program to implement the selection sort. | $2\frac{2}{3}$ |
| 7. | (a) What is sorting? Classify it in brief | $3\frac{2}{3}$ |
| | (b) What do you mean by recursion? How can you explain it? | 3 |
| | (c) Write short notes on control structure. | 3 |
| | (d) How many null nodes will a binary tree with 20 nodes have? | (1) |
| 8. | (a) What is graph and how it differs from the tree? | 3 |
| | (b) Find the minimum cost spanning tree from the following graph using Kruskal and Prims algorithms. | 6 |



- | | |
|---|----------------|
| (c) Compare and contrast the Depth-first-search and Breadth-first search. | $2\frac{2}{3}$ |
|---|----------------|

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination -2022

Course Title: Data Structures

Course Code: CSE 2101

Time: 3:00 hours (For PART-A and PART-B) Full Marks: 70

[Answer any Three questions from PART A(Q1-Q4) and any Three questions from PART B(Q5-Q8)]

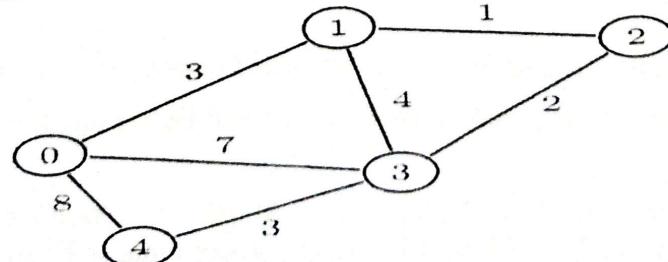
PART A

Marks: 35

1. (a) Define Data Structures. What are the purposes of data structures in problem solving? $3\frac{2}{3}$
Describe with proper example.
- (b) Write down the difference between linear and nonlinear data structure? Why graph is a nonlinear data structure. 3
- (c) Write a program to create a singly linklist that insert each element in the head of the current list. 5
2. (a) What do you mean by time complexity of algorithms? Suppose an algorithm has $O(n^2)$ time complexity another one has $O(n)$ time complexity which algorithms performs better. Describe with proper example. 3
- (b) Write down a scenario, where using doubly linklist is advantageous. $3\frac{2}{3}$
- (c) Sort the following array using insertion sort (show step-wise sorting approach using bubble sort in ascending order) 5

55	35	45	25	15
----	----	----	----	----
3. (a) Write down the difference between tree and graph. Describe two scenarios where using graph and tree data structure is advantageous. 3
- (b) Write down the usages of heap sort. Sort the following array step-wise using max heap method. $4\frac{2}{3}$

20	40	30	60	50
----	----	----	----	----
- (c) Suppose you need to solve a problem using stack but your designer solved it using queue data structure now write down possible approach to solve it. 4
4. (a) What is minimum spanning tree? What are the practical usages of minimum spanning tree? 3
- (b) Write down the process of merge sort while sorting an array descending order. $4\frac{2}{3}$
- (c) Execute Kruskal algorithms for the following graph and calculate minimum distance between node 0 to all other nodes for the following graph. 4



PART B

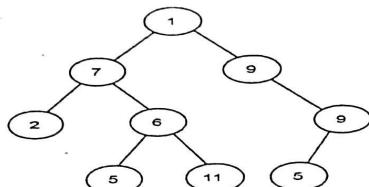
Marks: 35

5. (a) Define linklist. Write down the applications of linklist? 3
- (b) Write down a program to implement a queue using linklist with enqueue, dequeue and show operations. $5\frac{2}{3}$
- (c) Describe the scenario for a practical example where using priority queue is advantageous. 3
6. (a) A shop has a stack of chocolate boxes each containing a positive number of chocolates. Initially, the stack is empty. During the next N minutes, either of these two things may happen: (i) The box of chocolates on top of the stack gets sold (ii) You receive a box of chocolates from the warehouse and put it on top of the stack. 5

Determine the number of chocolates in the sold box each time he sells a box using stack.
Note that (i) If $C[i] = 0$, he sells a box. If (ii) $C[i] > 0$, he receives a box containing $C[i]$ chocolates. (iii) It is confirmed that he gets a buyer only when he has a non-empty stack.
The capacity of the stack is infinite.

Input: $N = 4, C = [2, 1, 0, 0]$ Output: 1 2 [where N represent time and C represent stack]

- (b) Write down one practical example of each using pre order, post order and in order traversal. 3
- (c) Why there are so many data structures techniques instead of only one, though every data structure gave the same final outcome? $3\frac{2}{3}$
7. (a) Write down a practical scenario where using array is advantageous than linklist. $2\frac{2}{3}$
- (b) Write down the travelling nodes sequence for the following tree using BFS and DFS algorithms. 3



- (c) Suppose we create a binary search tree by inserting the following values in the given order: 50, 10, 13, 45, 55, 110, 5, 31, 64 and 47. Answer the following questions: 6
- Draw the binary search tree.
 - Show the output values if we visit the tree using pre-order traversal technique.
 - Show the output values if we visit the tree using post-order traversal technique.
 - Show the resulting trees after we delete 47, 110, and 50. (Each deletion is applied on the original tree.)
8. (a) Write down three practical examples of using stack and queue data structure. 3
- (b) What is circular queue? Write pseudocodes for Insert and Delete operations of a circular queue. $5\frac{2}{3}$
- (c) Consider inserting the keys 18, 41, 22, 44, 59, 32, 31, 73 into a hash table of length $m = 13$ using double hashing with $h_1(k) = k \bmod 13$, $h_2(k) = 8 - (k \bmod 8)$. Draw the hash table. 3

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination-2023

Course Code: CSE 2101

Course Title: Data Structures

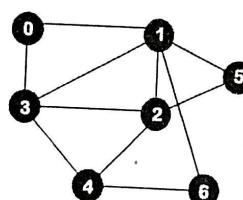
Time: 3:00 hours (PART-A & PART -B) Full Marks: 70

PART-B

Marks 35

- Answer any three questions from PART B (Q5 to Q8).
- Figures in the right margin indicate marks.

5. a. What is circular queue and state the advantage of Circular Queue over linear queue? Illustrate with any example. 4
- b. Write down the psedocode of Priority queue with explanation. 4 $\frac{2}{3}$
- c. Draw a Tree T with the following traversals:
Inorder: 10,25,35,40,45, 61,68,71
PreOrder: 45,25,10,35,40,61,71,68 3
6. a. Define the term: Tree, Binary Tree, Complete binary tree and Full binary tree. 4
- b. Draw a binary Tree for the expression: $(a-b)/((c*d)+e)$ and give the outputs when you apply inorder and preorder traversals. 4 $\frac{2}{3}$
- c. What is Binary Search tree? Construct a Binary search tree with the following list of values: 45,26,10,60,70,30,40. Delete keys 10 and 45 one after the other and show the trees at each stage. 3
7. a. What is Graph? How a Graph can be stored in computer memory? Explain with proper example. 4
- b. Apply the Depth First Search (DFS) and Breath First Search (BFS) Graph traversal methods on the following Graph with step-by-step explanation. [Consider the node 0 is starting node] 4 $\frac{2}{3}$
- c. How can you find the shortest path of a graph? 3
8. a. What is Hashing and why it is needed? Mention some techniques of hashing and explain one of them. 4
- b. What is hash collision? How can you solve it? Discuss. 2
- c. Briefly Explain the Merge sort with the following data:
6 3 8 1 9 7 5 4 $\frac{2}{3}$
3



Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination-2023

Course Code: CSE 2101

Course Title: Data Structures

Time: 3:00 hours (PART-A & PART-B) Full Marks: 70

PART-A

Marks: 35

- > Answer any three questions from PART A (Q1 to Q4).
- > Figures in the right margin indicate marks.

1. a. What do you mean by Data Structure? Suppose, you are given a List of data $A[5\ 8\ 3\ 4\ 2]$.
What are the basic Operations that can be normally performed on this Array. Explain. 4
b. Write short notes on control structure. 2
c. Explain the difference between Linear and nonlinear data structure? 3
2. a. What is linear array? What are the advantages and disadvantages of linear array? 4
b. Explain binary search with the data: [2 5 6 9 3 1 8] and write down its pseudocode. 4
c. Consider the linear arrays $A= [2\ 5\ 6\ 9\ 3\ 1\ 8]$. Perform Selection sort on it with a short explanation of each step. 3
3. a. What is a Stack? Mention some applications stack. Explain its operations with example. 4
b. How can you evaluate a postfix expression using stack? Evaluate the following postfix expression using stack (Show the step-by-step process): 5, 6, 2, +, *, 12, 4, /, - 2
c. Give the prefix and postfix form of the following given expression. 3
(i) $((A+B)*C-(D-E)^{(F+G)})$
(ii) $(A+B^D)/(E-F)+G$
4. a. What is link list? What are the advantages and disadvantages of link-list? 4
b. Explain the procedure with C code of creating a link-list and insert a new node at last position of the link list. 2
c. What are the various performance measurements for an array list? 3

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering Examination 2nd Year 1st Semester-2021

Course Title: Design Pattern and Java Programming Course No: CSE 2103

Time: 3.00 hours (For PART-A and PART-B)

PART B

Marks 35

N.B: (i) Answer any Three questions from Part B
(ii) Use separate answer script for answering Part-A
(iii) Figures in the right margin indicate marks

- | | | |
|----|---|----------------|
| 1. | a) What are Design Patterns? Why design patterns are used while developing software. | $3\frac{2}{3}$ |
| | b) Suppose you want to develop software to automate office file management in which a file can only get the permission of forwarding if it was approved by the assigned officer. Now describe which design pattern is more advantageous and why for the given scenario. | 5 |
| | c) Write down three differences between multi threaded and multi processed program in Java. | 3 |
| 2. | a) Suppose you want to create a class to solve a problem for which only a single instance (or object) should be created and that single object can be used by all other classes. Now describe which design pattern is more advantageous and why for the given scenario. | $5\frac{2}{3}$ |
| | b) Write down a Java Program to check a number is prime or not. | 3 |
| | c) Write down the relationship between creational, structural and behavioral pattern. | 3 |
| 3. | a) Define operator overloading. Describe the differences between unary and binary operator overloading with suitable examples. | 5 |
| | b) What do you mean by abstract class? What are the differences between abstract class and interface | $3\frac{2}{3}$ |
| | c) What do you mean by Java Package? How to use Java Package in program. | 3 |
| 4. | a) Suppose you want to run a Java Program in your Computer, now describe the local environment setup to run a Java Program and produce output from it. | 4 |
| | b) Write down a scenario where Iterator Pattern is more useful than Mediator Pattern describe with proper reasoning. | $4\frac{2}{3}$ |
| | c) Describe in how many ways can you create a singleton pattern? | 3 |

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering Examination 2nd Year 1st Semester-2021

Course Title: Design Pattern and Java Programming Course No: CSE 2103

Time: 3.00 hours (For PART-A and PART-B)

PART A

Marks 35

N.B: (i) Answer any Three questions from Part A
(ii) Use separate answer script for answering Part-A and Part-B
(iii) Figures in the right margin indicate marks

- | | | |
|---|--|----------------|
| 1. | a) Write down the features of Java Programming Language. Describe a scenario where using Java Programming is advantageous than C++ Programming Language. | $4\frac{2}{3}$ |
| b) What are the usages of "this" key word in Java? Describe with proper example(s). | 3 | |
| c) What are the advantages of using inheritance in Java? How is inheritance in C++ different from Java? | 4 | |
| 2. | a) How can you achieve polymorphism in Java? Write down two examples of using method overloading and method overriding. | $4\frac{2}{3}$ |
| b) Write down the output of the following program. If there is error first fix it then write down the output. | 3 | |
| <pre>class MArray {
 public static void main(String[] args) {
 int[][] a = {
 {1, -2, 3},
 {-4, -5, 6, 9},
 {7},
 };
 for (int i = 0; i < a.length; ++i) {
 for(int j = 0; j < a[i].length; ++j) {
 System.out.println(a[i][j]);
 }
 }
 }
}</pre> | | |
| c) What do you understand by copy constructor in Java? Write down a scenario where using copy constructor in Java is advantageous. | 4 | |
| 3. | a) Write down a scenario where you need to use "Builder Pattern" and how "Builder Pattern" is advantageous in your scenario. | 4 |
| b) Write short notes on (i) Proxy Pattern (ii) Composite Pattern. | $4\frac{2}{3}$ | |
| c) Describe the life cycle of thread with proper example. | 3 | |
| 4. | a) Write down the process how Java establishes connection between sockets and ports. What are the usages of Java socket Program? | 3 |
| b) Write down a Java program to find odd or even number using "Boolean Data Type". | 3 | |
| c) Write down the process you follow to design and implement an android mobile application project. | $5\frac{2}{3}$ | |

Pabna University of Science and Technology

Department of Computer Sciences and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination 2022

Course Title: Design Pattern and Java Programming

Course Code: CSE 2103

Time: 3:00 hours (PART-A & PART-B) Full Marks: 70

(Answer any Three questions from PART A(Q1-Q4) and any Three questions from PART B(Q5-Q8))

PART-A

Mark 35

- 1 (a) Why java is called fully object oriented programming (OOP)? Mention some specific limitations of OOP? 2½
- (b) Explain each of the following with proper java syntax.
Creation of object, Instance methods, Class constructor, Razzed array 6
- (c) Briefly explain java runtime environment with necessary figures. What are the roles of JVM? 5
- 2 (a) How java handles overridden methods? Differentiate abstract class and interface. 2½
- (b) Briefly explain thread priority. Assume the developer has created a thread class and the main method is as follows:
Public static void main (String [] args) { Thread Th1 = new MyThread(); Thread Th2 = new MyThread(); Th1.run(); Th2.run();} 4
- What will happen when executing the main method? Briefly describe the consequences.
- (c) Assume that, there are two different companies: one develops a Student package and the other develops a Staff package containing relevant classes. Implement a simple University system that makes use of classes/capabilities provided by these two packages. 5
- 3 (a) What is Abstract Class? "If you inherit an abstract class, you have to provide implementations to all the abstract methods in it." Explain with an example. 2½
- (b) What is interface? Why does Java allow multiple inheritance for interface? 4
- (c) What will be the output of the program? 3

```
class Super
{
    public int i = 0;
    public Super (String text)
    {
        i = 1;
    }
}
```

```
class Sub extends Super
{
    public Sub (String text)
    {
        i = 2;
    }
}
public static void main (String args[])
{
    Sub sub = new Sub ("Hello");
    System.out.println(sub.i);
}
```

- 4 (a) Briefly explain synchronization and deadlock in java. $\frac{2}{3}$
 (b) Write proper java syntax of creating server and client using socket programming. Implement java URL class to get protocol and host name from any website. 4
 (c) Differentiate TCP and UDP. Why DatagramSocket and DatagramPacket classes are required in java? Implement it and list the available methods of the above mentioned classes. 5

PART-B

Marks 35

5. (a) Make a comparative study among String, StringBuffer and StringBuilder classes. $\frac{2}{3}$
 (b) Briefly discuss the hierarchy of java swing classes. How java swing differs from AWT? Give AWT example by implementing association. 4
 (c) I. Discuss about JDBC drivers and java RMI.
 II. Discuss applet life-cycle. How you can display graphics in applet? 5
6. (a) Why design patterns are used in software development? What are J2EE patterns? $\frac{2}{3}$
 (b) Write a Java class to meet the following specifications:
The class should be able to support a 6-digit student id, student name, marks for 3 subjects. You should have methods to set and get each of the attributes, and calculate the average for the student. Write a tester program to test your class. You should create 2 or 3 students and write code to test the class. 4
 (c) How can you represent OO relationship? Consider any e-commerce ordering system and implement it using Class diagram. In the diagram, you must have to incorporate different OO relationships. 5
7. (a) Draw and explain the sequence diagram (UML) for object life spans. $\frac{2}{3}$
 (b) Make a comparative study among Creational, Structural and Behavioral patterns. 4
 (c) The Composite design pattern is used to compose classes into tree structures in order to represent containment relationships. The pattern lets you treat objects and compositions of objects in the same way.
 Use the Composite pattern, together with BON, to model the notion of a folder in Windows XP. Folders may be nested, and may also contain text files and binary files. Files may be opened, closed, and drawn on the screen. Folders may also have items added to and removed from them. Draw a static BON diagram modeling this notion. Show the interface of each class. 5
8. (a) Explain the concept of the Proxy design pattern in Java. $3\frac{2}{3}$
 (b) Provide a detailed example of a situation where a proxy could be useful in a software system. 3
 (c) Discuss the potential scenarios where different types of proxies (e.g., virtual, remote, or caching proxies) would be applicable and their respective advantages. 5

Pubna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination 2023

Course Code: CSE 2103

Course Title: Design Pattern and Java Programming

Time: 3:00 hours (PART A & PART B) Full Marks: 70

PART-B

Mark 35

- * Answer any three questions from PART B (Q5 to Q8).
- * Figures in the right margin indicate marks.

5. (a) Explain the basics of Java networking. How do Java applications communicate over the network? Describe the role of sockets in network communication and the use of IP addresses and ports in this context. 3
- (b) Discuss the Socket class in Java and its important methods such as connect(), bind(), close(), getInputStream(), and getOutputStream(). Provide a code example demonstrating the use of at least three of these methods in a simple client-server application. 4
- (c) I. Discuss about JDBC drivers and java RMI.
II. Discuss applet life-cycle. How you can display graphics in applet? 4
6. (a) Compare and contrast the Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) in the context of Java socket programming. 2
- (b) You are tasked with developing a Java application that simulates a Library Book Management System. The system should be able to store details of individual books such as a 6-character ISBN, book title, and the price of the book. The application should also be able to calculate the total price for multiple books. 4
- (c) Discuss the class formation in Java Swing for creating graphical user interfaces. Explain the role of key Swing classes like JFrame, JPanel, JButton, and JLabel. Provide an example demonstrating the creation of a simple Swing window with a button and a label. 3
7. (a) Define design patterns. State the benefits of using design patterns in Java. 2
- (b) Let, you are designing a University Course Registration System where students can search for available courses, register for courses, view their schedules, and drop courses. The system also allows administrators to add new courses and manage student registrations. Now, Draw a Use Case Diagram showing the interactions between Students, Administrators, and the system for the activities mentioned. 4
- (c) Draw and explain the Abstract Window Toolkit (AWT) class hierarchy in Java. Provide a simple example where a button click triggers an event in an AWT application. 4
8. (a) Compare and contrast AWT and Swing in Java. Why Swing is generally preferred for building modern GUI applications in Java? 2
- (b) Write a Java class using the Singleton Design Pattern to simulate an ATM machine where users can check balances, withdraw, and deposit money. Explain why the Singleton pattern is suitable for this scenario. 4
- (c) You are tasked with designing an Online Food Ordering System where a user can browse a menu, select items, place an order, make a payment, and receive confirmation. Draw an activity diagram representing the sequence of activities involved in placing an order in the system. 4

Pabna University of Science and Technology
Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination-2023

Course Code: CSE 2103 Course Title: Design Pattern and Java Programming
Time: 3:00 hours (PART-A & PART-B) Full Marks: 70

PART-A

Marks 35

- Answer any three questions from PART A (Q1 to Q4).
- Figures in the right margin indicate marks.

1. (a) Define object oriented programming. Explain the features of object oriented programming. 5 $\frac{2}{3}$
(b) JVM is platform dependent. Justify your answer with a proper explanation. 3
(c) Compare and contrast C, C++, and Java with respect to:
 - Memory management,
 - Object-oriented features,
 - Platform dependence,
 - Compilation and execution process3
2. (a) Explain the key characteristics of Java objects. How do constructors in Java help in the creation of objects? Write a Java code to demonstrate the use of parameterized and default constructors. 3 $\frac{2}{3}$
(b) Illustrate and explain the architecture of the Java Virtual Machine (JVM). Discuss how the JVM manages memory and execution, including the role of key components such as the Class Loader, Execution Engine, and Garbage Collector. 4
(c) Identify and correct the errors in the following Java code snippet. What will be the output of the corrected program? 4

package myPackage; abstract class Vehicle { public abstract void start(); public void stop() { System.out.println("Vehicle is stopping."); } }	interface Engine { void start(); void accelerate(); } public class Car extends Vehicle, Engine { public void start() { System.out.println("Car is starting."); } }	public void accelerate() { System.out.println("Car is accelerating.");} public static void main(String[] args) { Car car = new Car(); car.start(); car.accelerate(); car.stop(); }
--	--	---
3. (a) Explain the differences between multithreading, multitasking, and multiprocessing in Java. How do they improve the performance of applications? 3 $\frac{2}{3}$
(b) List and explain the various thread methods provided in Java (such as start(), sleep(), join(), yield(), etc.). Describe how Java handles thread scheduling. How does thread priority affect scheduling in Java? 4
(c) Discuss two ways to create a thread in Java. Provide code examples for each method of thread creation. 4
4. (a) Discuss the various access modifiers available in Java. Explain how access modifiers affect the visibility of a member in different access locations. 5 $\frac{2}{3}$
(b) Differentiate between method overloading and method overriding with a suitable example. 3
(c) Explain the usage of "super" and "this" keyword in Java. 3

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination -2022

Course Title: Vector, Matrices and Linear Algebra

Course Code: MATH 2101

Time: 3:00 hours (For PART-A and PART-B) Full Marks: 70

[Answer any Three questions from PART A(Q1-Q4) and any Three questions from PART B(Q5-Q8)]

PART A

Marks: 35

- 01.** (a) Define vector, collinear vectors and vector field. Prove that if \vec{a} and \vec{b} are non-collinear, than $x\vec{a} + y\vec{b} = 0$ implies $x = y = 0$. 04
- (b) Show that $\vec{A} \cdot \vec{B} \times \vec{C}$ is in absolute value equal to the volume of a parallelepiped with sides \vec{A}, \vec{B} and \vec{C} . 04
- (c) Find an equation of a plane passing through the points $p_1(2, -1, 1), p_2(3, 2, -1)$ and $p_3(-1, 3, 2)$. 3.67
-
- 02.** (a) Define gradient, divergence and curl with physical meanings. 3.67
- (b) A particle moves along a curve whose parametric equations are $x = e^{-t}, y = 2 \cos 3t, z = 2 \sin 3t$, where t is the time. (a) Determine its velocity and acceleration at any time, (b) Find the magnitudes of the velocity and acceleration at $t = 0$. 04
- (c) A vector \vec{v} is called irrotational if $\operatorname{curl} \vec{v} = 0$. (i) Find a, b, c , so that $\vec{v} = (x + 2y + az)\hat{i} + (bx + 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}$. (ii) such \vec{v} can be expressed as the gradient of a scalar function. 04
-
- 03.** (a) Define surface integral. Suppose that the surface S has projection R on the xy -plane. Show that $\iint_S \vec{A} \cdot \vec{n} ds = \iint_R \vec{A} \cdot \hat{n} \frac{dxdy}{|\hat{n} \cdot \hat{k}|}$. 03
- (b) If $\vec{F} = 3xy\hat{i} - y^2\hat{j}$, evaluate $\int_C \vec{F} \cdot d\vec{r}$, where C is the curve in the xy plane, $y = 2x^2$ from $(0,0)$ to $(1,2)$. 04
- (c) What do you mean by surface integral? If $\vec{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$, evaluate $\iint_S \vec{F} \cdot \hat{n} ds$, where S is the surface of the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$. 4.67
-
- 04.** (a) State divergence theorem. Verify the divergence theorem for $\vec{A} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ taken over the region bounded by $x^2 + y^2 = 4, z = 0$ and $z = 3$. 06
- (b) Express unit vectors in curvilinear system. Prove that a cylindrical coordinate system is orthogonal. 3.67
- (c) Represent the vector $\vec{A} = z\hat{i} - 2x\hat{j} + y\hat{k}$ in cylindrical coordinates. 02

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination -2022

Course Title: Vector, Matrices and Linear Algebra

Course Code: MATH 2101

Time: 3:00 hours (For PART-A and PART-B) Full Marks: 70

[Answer any Three questions from PART A(Q1-Q4) and any Three questions from PART B(Q5-Q8)]

PART B

Marks: 35

- 05.** (a) Define matrix and square matrix. Every square matrix can be uniquely expressed as 04
the sum of a symmetric and a skew-symmetric matrices.

- (b) Define canonical form of a matrix. By elementary operations, find the reduce 04
following the matrix to canonical form and mention its rank:

$$A = \begin{bmatrix} 1 & 2 & -1 & 4 \\ 2 & 4 & 3 & 5 \\ 1 & 2 & 3 & 4 \\ -1 & -2 & 6 & -7 \end{bmatrix}$$

Find the non-singular matrices R and S, such that RAS is the normal form, where 3.67

$$(c) \quad A = \begin{bmatrix} 2 & 2 & -6 \\ -1 & 2 & 2 \end{bmatrix}$$

- 06.** (a) Investigate for what values of λ and μ , the simultaneous equation: 5.67
 $x + 2y + z = 8$, $2x + y + 3z = 13$ and $3x + 4y - \lambda z = \mu$ have (i) no solution (ii) unique
solution and (iii) infinite solutions.

- (b) State Cayley-Hamilton theorem. Use the theorem to find the inverse of the matrix 06

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 5 \\ 1 & 5 & 12 \end{bmatrix}$$

- 07.** (a) Define characteristics equation, eigen values and eigen vector of a matrix. 3.67

04

- (b) Find the latent roots of $A = \begin{bmatrix} 8 & 6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.

- (c) What do you mean by vector space? Let V be a vector space over an arbitrary field 04
 F . Then (i) for any scalar $\alpha \in F$ and $0 \in V$, $\alpha \cdot 0 = 0$, (ii) for $\alpha \in F$ and $v \in V$,
 $(-\alpha)v = \alpha(-v) = -\alpha v$.

- 08.** (a) What do you mean by linear dependent and independent of vectors? Prove that the 3.67
set of vectors $\{(2,-1,4), (3,6,2), (2,10,-4)\}$ are linearly independent.

04

- (b) Define linear combination of vectors. Consider $v_1 = (2,1,4)$, $v_2 = (1,-1,3)$ and 04
 $v_3 = (3,9,5)$ in \mathbb{R}^3 . Show that $V = (5,9,5)$ is a linear combination of v_1, v_2 and v_3 .

- (c) What do you mean by linear span of a subset of a vector space. Show that the vectors 04
 $u = (1,2,3)$, $v = (0,1,2)$ and $w = (0,0,1)$ generate \mathbb{R}^3 .

Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination -2022

Course Title: Vector, Matrices and Linear Algebra

Course Code: MATH 2101

Time: 3:00 hours (For PART-A and PART-B) Full Marks: 70

[Answer any Three questions from PART A(Q1-Q4) and any Three questions from PART B(Q5-Q8)]

PART A

Marks: 35

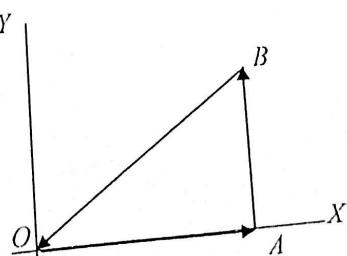
01. (a) Define vector, collinear vectors and vector field. Prove that if \vec{a} and \vec{b} are non-collinear, than $x\vec{a} + y\vec{b} = 0$ implies $x = y = 0$. 04
- (b) Show that $\vec{A} \cdot \vec{B} \times \vec{C}$ is in absolute value equal to the volume of a parallelepiped with sides \vec{A}, \vec{B} and \vec{C} . 04
- (c) Find an equation of a plane passing through the points $p_1(2,-1,1), p_2(3,2,-1)$ and $p_3(-1,3,2)$. 3.67
02. (a) Define gradient, divergence and curl with physical meanings. 3.67
- (b) A particle moves along a curve whose parametric equations are $x = e^{-t}, y = 2 \cos 3t, z = 2 \sin 3t$, where t is the time. (a) Determine its velocity and acceleration at any time, (b) Find the magnitudes of the velocity and acceleration at $t = 0$. 04
- (c) A vector \vec{v} is called irrotational if $\text{curl } \vec{v} = 0$. (i) Find a, b, c , so that $\vec{v} = (x+2y+az)\hat{i} + (bx+3y-z)\hat{j} + (4x+cy+2z)\hat{k}$. (ii) such \vec{v} can be expressed as the gradient of a scalar function. 04
03. (a) Define surface integral. Suppose that the surface S has projection R on the xy -plane. Show that $\iint_S \vec{A} \cdot \vec{n} ds = \iint_R \vec{A} \cdot \hat{n} \frac{dxdy}{|\hat{n} \cdot \hat{k}|}$. 03
- (b) If $\vec{F} = 3xy\hat{i} - y^2\hat{j}$, evaluate $\int_C \vec{F} \cdot d\vec{r}$, where C is the curve in the xy -plane, $y = 2x^2$ from $(0,0)$ to $(1,2)$. 04
- (c) What do you mean by surface integral? If $\vec{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$, evaluate $\iint_S \vec{F} \cdot \hat{n} ds$, where S is the surface of the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0, z = 1$. 4.67
04. (a) State divergence theorem. Verify the divergence theorem for $\vec{A} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ taken over the region bounded by $x^2 + y^2 = 4, z = 0$ and $z = 3$. 06
- (b) Express unit vectors in curvilinear system. Prove that a cylindrical coordinate system is orthogonal. 3.67
- (c) Represent the vector $\vec{A} = z\hat{i} - 2x\hat{j} + y\hat{k}$ in cylindrical coordinates. 02

PART-A

Marks 35

- Answer any three questions from PART A (Q1 to Q4).
- Figures in the right margin indicate marks.

- | | |
|---|--------------------------|
| 01. (a) Define vector, unit vector and vector field. Prove that if \vec{a} , \vec{b} and \vec{c} are non-coplanar vectors in three dimensional space can be expressed by another vector \vec{r} .
(b) Show that the diagonals of a parallelogram bisect each other.
(c) Find a unit vector parallel to the resultant of vectors $\vec{r}_1 = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\vec{r}_2 = \hat{i} + 2\hat{j} + 3\hat{k}$. | 5
3
$3\frac{2}{3}$ |
| 02. (a) Prove that the area of a parallelogram with sides \vec{A} and \vec{B} is $ \vec{A} \times \vec{B} $. Also show that $ \vec{A} \times \vec{B} ^2 + \vec{A} \cdot \vec{B} ^2 = \vec{A} ^2 \vec{B} ^2$. Show that the vectors $\vec{A} = 3\hat{i} - 2\hat{j} + \hat{k}$, $\vec{B} = \hat{i} - 3\hat{j} + 5\hat{k}$, $\vec{C} = 2\hat{i} + \hat{j} - 4\hat{k}$ form a right angle triangle.
(b) Define gradient, divergence and curl with physical meanings.
(c) What do you mean by directional derivative? Find the directional derivative of $\phi = x^2yz + 4xz^2$ at $(1, -2, -1)$ in the direction $2\hat{i} - \hat{j} - 2\hat{k}$. | $5\frac{2}{3}$
3
3 |
| 03. (a) State Frenet-Serret formulae. A particle move along the curve $x = 2t^2$, $y = t^2 - 4t$, $z = -t - 5$ where t is the time. Find the component of its velocity and acceleration at time $t = 1$ in the direction $\hat{i} - 2\hat{j} + 2\hat{k}$.
(b) Suppose \vec{F} is a conservative field, then prove that \vec{F} is irrotational. Show that $\vec{F} = (2xy + z^3)\hat{i} + x^2\hat{j} + 3xz^2\hat{k}$ is a conservative force field, and find the work done in moving an object in this field from $(1, -2, 1)$ to $(3, 1, 4)$. | $5\frac{2}{3}$
6 |
| 04. (a) Define surface integral and volume integral. Find the volume of the region common to the intersecting cylinders $x^2 + y^2 = a^2$ and $x^2 + z^2 = a^2$.
(b) State Green's theorem. Evaluate $\oint_C (y - \sin x)dx + \cos x dy$, where C is the following triangle with $O(0,0)$, $A(\pi/2, 0)$, $B(\pi/2, 1)$; (i) directly and (ii) by using Green's theorem in the plane. | 5
6 |



Pabna University of Science and Technology

Department of Computer Science and Engineering

B. Sc. Engineering 2nd Year 1st Semester Examination-2023

Course Code: MATH 2101 Course Title: Matrix, Linear Algebra and Vector Analysis

Time: 3:00 hours (PART-A & PART-B) Full Marks: 70

PART-B

Marks 35

➤ Answer any three questions from PART B (Q5 to Q8).

➤ Figures in the right margin indicate marks.

05. (a) Define matrix. Also define unit, upper triangular, Idempotent and Involutory matrices. 3

- (b) Define rank of a matrix. Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 1 \\ 2 & 4 & 6 & 2 \\ 1 & 2 & 3 & 2 \end{bmatrix}$. 4

- (c) Define echelon form of matrix. Reduce the $A = \begin{bmatrix} 1 & 1 & 2 & 3 \\ 1 & 3 & 0 & 3 \\ 1 & -2 & -3 & -3 \\ 1 & 1 & 2 & 3 \end{bmatrix}$ matrix in echelon form and present its rank. $\frac{4}{3}$

06. (a) Define canonical form of a matrix. By elementary operations, find the reduce 5 $\frac{2}{3}$

following the matrix to canonical form and mention its rank: $A = \begin{bmatrix} 1 & 1 & 2 & -3 \\ 4 & 1 & 0 & 2 \\ 0 & 3 & 0 & 1 \\ 0 & 1 & 0 & 2 \end{bmatrix}$

- (b) Define augmented matrix, consistency and inconsistency of a system of linear equations. Examine if the following equations are consistent? If yes, solve it:
 $x + y + 4z = 6, 3x + 2y - 2z = 9, 5x + y + 2z = 13$. 6

07. (a) Define characteristics equation, eigen values and eigen vector of a matrix. 3 $\frac{2}{3}$

- (b) State Cayley-Hamilton theorem. Using Cayley Hamilton theorem find A^{-2} , where 4

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

- (c) Find the latent roots of $A = \begin{bmatrix} 8 & 6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$. 4

08. (a) What do you mean by vector space? Let V be a vector space over an arbitrary field F . Then (i) for any scalar $\alpha \in F$ and $v \in V$, $(-\alpha)v = \alpha(-v) = -\alpha v$, (ii) If $\alpha v = 0$, where $\alpha \in F$ and $v \in V$, then $\alpha = 0$ or $v = 0$.. 3 $\frac{2}{3}$

- (b) What do you mean by linear dependent and independent of vectors? Prove that the set of vectors $\{(2,1,2), (0,1,-1), (4,3,2)\}$ are linearly dependent. 4

- (c) What do you mean by linear span of a subset of a vector space. Show that the vectors $u = (1,2,3)$, $v = (0,1,2)$ and $w = (0,0,1)$ generate \mathbb{R}^3 . 4