

USN : _____

Course Code :18ME564

Fifth Semester B.E MAKEUP Examination, MARCH_MAY_2021

STATISTICS FOR ENGINEERS

Time: 3 hrs

Max. Marks :100

Instructions :1. Answer FIVE full Questions selecting at least ONE Question from Each Unit.

MODULE 1

L CO PO M

1a. Discuss various measures of Central tendency and their importance in statistics with suitable examples

[2] [1] [1] [8]

1b. If the mean annual salary paid to the chief executives of three engineering firms is \$125,000, can one of them receive \$400,000?

[3] [1] [1] [6]

1c. What are Stem and Leaf Diagrams. Explain with an example

[2] [1] [1] [6]

OR

2a. The following are the ignition times of certain upholstery materials exposed to a flame (given to the nearest hundredth of a second):

2.58	2.51	4.04	6.43	1.58	4.32	2.20	4.19
4.79	6.20	1.52	1.38	3.87	4.54	5.12	5.15
5.50	5.92	4.56	2.46	6.90	1.47	2.11	2.32
6.75	5.84	8.80	7.4	4.72	3.62	2.46	8.75
2.65	7.86	4.71	6.25	9.45	12.80	1.42	1.92
7.6	8.79	5.92	9.65	5.09	4.11	6.37	5.4
11.25	3.90	5.33	8.64	7.41	7.95	10.6	3.81
3.78	3.75	3.1	6.43	1.7	6.4	3.24	1.79
4.9	3.49	6.77	5.62	9.70	5.11	4.50	2.5
5.21	1.76	9.2	1.2	6.85	2.8	7.35	11.75

a) Group these figures into a table with a suitable number of equal classes.

(b) Construct a histogram

(c) Plot a less than Ogive Curve

[3] [1] [1, 2] [12]

2b. With a suitable example discuss Pareto Chart

[2] [1] [1] [8]

MODULE 2

3a. With an example explain Pascal's triangle and discuss its importance

[2] [2] [1, 2] [6]

3b. A student is to answer 8 out of 10 questions on an exam. (i) How many choices has he? (ii) How many if he must answer the first 3 questions? (iii) How many if he must answer at least 4 of the first 5 questions?

[3] [2] [1, 2] [8]

3c. Find the number 'n' of distinct permutations that can be formed from all the letters of each word

i. THOSE

ii. UNUSUAL

iii. SOCIOLOGICAL

[3] [2] [1, 2] [6]

OR

4a. Discuss Basic Counting Principles and their importance in statistics

[2] [2] [1, 2] [8]

4b. Suppose a password consists of 4 characters, the first two being letters in the (English) alphabet and last two being digits. Find the number n of

1. Passwords
2. Passwords beginning with a vowel

[3] [2] [1, 2] [12]

MODULE 3

5a. Let $U = \{1, 2, \dots, 8, 9\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$ and $C = \{3, 4, 5, 6\}$.

Find:

- (i) A^c , (ii) $A \cap C$, (iii) $(A \cap C)^c$, (iv) $A \cup B$, (v) B/C , (vi) $A * C$

[3] [3] [1, 2] [6]

5b. Let $S = \{a, b, c, d, e, f, g\}$. Determine which of the following are partitions of S

- i. $P_1 = \{\{a, c, e\}, \{b\}, \{d, g\}\}$
- ii. $P_2 = \{\{a, b, e, g\}, \{c\}, \{d, f\}\}$
- iii. $P_3 = \{\{a, e, g\}, \{c, d\}, \{b, f\}\}$
- iv. $P_4 = \{\{a, b, c, d, e, f, g\}\}$

[3] [3] [2] [4]

5c. Each student at some college has a mathematics requirement M (to take at least one mathematics course) and a science requirement S (to take at least one science course). A poll of 140 students show that: 60 completed M , 45 completed S , 20 completed both M & S

Use a Venn diagram to find the number of students who completed

- i. At least one of the two requirements
- ii. Exactly one of the requirements
- iii. Neither requirement

[3] [3] [1, 2] [10]

OR

6a. A pair of dice are tossed and the sum of the faces are recorded. Find the smallest set S which includes all possible outcomes

[3] [3] [1, 2] [4]

6b. Discuss Principles of Mathematical Induction

[2] [3] [1] [6]

6c. Suppose 50 science students are polled to see whether or not they have studied French (F) or German (G), Yielding the following data: 25 studied French, 20 studied German, 5 studied both

Find the number of students who

- a. Studied only French
- b. Did not study German
- c. Studied French or German
- d. Studied neither language

[3] [3] [1, 2] [10]

MODULE 4

7a. State Empirical and Axiomatic definitions of Probability

[2] [4] [1] [2]

7b. In a certain college 255 of boys and 10% of girls are studying mathematics. The girls constitute 60% of the student body.

- i. What is the probability that mathematics is being studied?
 - ii. If a student is selected at random and is found to be studying mathematics, find the probability that the student is a girl?
- If a student is selected at random and is found to be studying mathematics, find the probability that the student is a boy?

[3] [4] [1, 2] [12]

7c. In a race, the odds in favour of the four horses H_1, H_2, H_3, H_4 are 1:4, 1:5, 1:6, 1:7 respectively. Assuming that a dead heat is not possible, find the chance that one of them wins the race.

[3] [4] [1, 2] [6]

OR

8a. A pair of dice is tossed twice. Find the probability of scoring 7 points

- i. Once
- ii. At least once
- iii. twice

[3] [4] [1] [8]

8b. Three machines M_1, M_2 and M_3 identical items. Of their respective output 5%, 4% and 3% of items are defective. On a certain day, M_1 has produced 25% of the total output, M_2 has produced 30% and M_3 the remaining. An item selected is found to be defective. What are the chances that it was produced by the machine with highest output?

[3] [4] [1, 2] [12]

MODULE 5

9a. Assume that the reduction of a person's oxygen consumption during a period of transcendental meditation (T.M) is a continuous random variable X normally distributed with mean 37.6 cc/mt and standard deviation 4.6cc/mt. Determine the probability that during a period of T.M a person's oxygen combination will be reduced by

- i. at least 44.5cc/mt
- ii. at most 35.0 cc/mt
- iii. anywhere from 30.0 to 40.0 cc/mt

[3] [5] [1, 2] [10]

9b. The average number of phone calls/minute coming in to a switch board between 2 and 4PM is 2.5. Determine the probability that during one particular minute there will be

- i. 0
- ii. 4 or fewer
- iii. More than 6
- iv. At most 5
- v. At least 20 calls

[3] [5] [1, 2] [10]

OR

10a. A random variable X has the following probability function:

x	0	1	2	3	4	5	6	7
$P(x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

- 1. Find the value of k
- 2. Evaluate $P(X < 6)$
- 3. Evaluate $P(0 < X < 5)$

[3] [5] [1, 2] [10]

10b. Assume that 50% of all engineering students are good in mathematics. Determine the probability that among 18 engineering students

- i. Exactly 10
- ii. At least 10
- iii. At most 8
- iv. At least 2 and at most 9

Are good in maths

[3] [5] [1] [10]

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MODULE 1

L CO PO M

1a. What are dot diagrams. Explain with an example how they help in analyzing a given data.

[2] [1] [1] [8]

1b. A contract for the maintenance of a national railway's high horsepower locomotives was given to a large private company. After one year of experience with the maintenance program, those in charge of the program felt that major improvements could be made in the reliability of the locomotives. To document the current status, they collected data on the cost of materials for rebuilding traction motors. Use the data below to

(a) calculate the sample mean \bar{x} ,

(b) calculate the sample standard deviation s .

(c) Calculate Coefficient of variation

Materials costs for rebuilding traction motors (1000s of dollars):

1.41 1.70 1.03 0.99 1.68 1.09 1.68 1.94 1.53 2.25 1.60 3.07 1.78 0.67 1.76

1.17 1.54 0.99 0.99 1.17 1.54 1.68 1.62 0.67 0.67 1.78 2.12 1.52 1.01

[3] [1] [1] [12]

OR

2a. Briefly Discuss Ogive curves along with their advantages and uses

[2] [1] [1] [8]

2b. Which central measure is important or to be considered while application ? and Why? Justify your answer with an example

[2] [1] [1] [6]

2c. Discuss how Stem and Leaf diagrams help in analyzing a given data.

[2] [1] [1] [6]

MODULE 2

3a. State and prove Binomial Theorem

[2] [2] [1] [10]

3b. Find the number of arrangements of the letters of the word INDEPENDENCE. In how many of these arrangements,

i.do the words start with P

ii.do all the vowels always occur together

iii. do the vowels never occur together

iv. do the words begin with I and end in P?

(v) I and P interchangeable

[3] [2] [1, 2] [10]

OR

4a. A computer program requires the user to enter a 7-digit registration code made up of the digits 1, 2, 4, 5, 6, 7, and 9. Each number has to be used, and no number can be used more than once.

i.How many different registration codes are possible?

ii.What is the probability that the first three digits of the code are even numbers?

[3] [2] [1, 2] [8]

4b. How many different signals can be made by 3 flags from 4-flags of different colors?

[3] [2] [1, 2] [6]

4c. Discuss Tree Diagram with an example

[2] [2] [1] [6]

MODULE 3

5a. Each student at some college has a mathematics requirement M (to take at least one mathematics course) and a science requirement S (to take at least one science course). A poll of 140 students show that: 60 completed M, 45 completed S, 20 completed both M & S

Use a Venn diagram to find the number of students who completed

i. At least one of the two requirements

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Neither requirement

[3] [3] [1, 2] [10]

5b. Prove the following assertions

1. $A(n): 1+2+3+\dots+n = \frac{1}{2}n(n+1)$

2. For $n \geq 0$, $A(n) = 1+2+2^2+2^3+\dots+2^n = 2^{n+1}-1$

[3] [3] [1, 2] [10]

OR

6a. Find the power set $p(A)$ of $A = \{a, b, c, d, e\}$

[3] [3] [1, 2] [8]

6b. Let $C = \{H, T\}$, the set of possible outcomes if a coin is tossed. Find

1. $C^2 = C \times C$

2. $C^4 = C \times C \times C \times C$

[3] [3] [1, 2] [6]

6c. Determine which of the following are finite sets and justify your answers

i. $A = \{\text{Seasons in the year}\}$

ii. $B = \{\text{States in the united state}\}$

iii. $C = \{\text{Positive integers less than 1}\}$

iv. $D = \{\text{odd integers}\}$

v. $E = \{\text{Positive integral divisors of 12}\}$

$F = \{\text{cats living in the united states}\}$

[3] [3] [1, 2] [6]

MODULE 4

7a. State and Prove Additional law of Probability

[2] [4] [1] [4]

7b. Define the following

i. Mutually exclusive events (ii) Equally likely events (iii) Sample Space

(iv) Odds in favour of an event

[2] [4] [1] [4]

7c. There are three bags: first containing 1 white, 2 red, 3 green balls: second 2 white, 3 red, 1 green balls and third 3 white, 1 red, 2 green balls. Two balls are drawn from a bag chosen at random. These are found to be one white and one red. Find the probability that the balls so drawn came from the second bag?

[3] [4] [1, 2] [12]

OR

8a. Find the probability of drawing an ace or a spade or both from a deck of cards

[3] [4] [1, 2] [8]

8b. Three machines M1, M2 and M3, identical items. Of their respective output 5%, 4% and 3% of items are defective. On a certain day, M1 has produced 25% of the total output, M2 has produced 30% and M3 the remaining. An item selected is found to be defective. What are the chances that it was produced by the machine with highest output?

[3] [4] [1, 2] [12]

MODULE 5

9a. A random variable X has the following probability function:

x	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k ²	2k ²	7k ² +k

1. Find the value of k

2. Evaluate $P(X < 6)$

3. Evaluate $P(0 < X < 5)$

[3] [5] [1, 2] [10]

9b. The probability of a man hitting a target is $\frac{1}{3}$

i. If he fires 5 times, what is the probability of his hitting the target atleast twice?

ii. How many times must he fire so that the probability of hitting the target atleast once is more than 90%

[3] [5] [1, 2] [10]

OR

10a. A distributor of bean seeds determines from extensive tests that 5% of large batch of seeds will not germinate. He sells the seeds in packets of 200 and guarantees 90% germination. Determine the probability that a particular packet will violate the guarantee

[3] [5] [1, 2] [10]

10b. When the mean of marks was 50% and Standard deviation 5% then 60% of the students failed in examination. Determine the grace marks to be awarded in order to show that 70% of the students are passed. Assume that marks are normally distributed.

[3] [5] [1, 2] [10]