G.PULLAIAH COLLEGE OF ENGINEERING & TECHNOLOGY (AT)

UNIT-III

TWO MARKS QUESTIONS

1. What in meant by degree of freedom
2. Write the properties of t-distribution
3. Write the properties of F-distribution
4. Write the properties of chi-square distribution
5. Define t-test
6. Define F-test
7. Define chi-square test
8. Write the formula of t-test
9. Write the formula of F-test
10. Write the formula of chi –square test

ESSAY QUESTIONS

I. Student t-test for single mean (when the sample deviation is given directly & not given directly)

1. A sample of 26 bulbs given a mean life of 990 hours with a S.D of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours. Is the sample not up to the standard?

2 .A mechanist is making engine part s with axle diameters 0.700 inch. A random sample of 10 parts shows a mean diameter of 0.742inch with a S.D. of 0.040 inch. Compute the test statistic you would use to test whether the work is meeting specification at 0,05 level of significance

3. A machine is designed to produce insulating washers for electrical devices of average thickness of 0.025 cm. A random sample of 10 washers was found to have a thickness of 0.024 cm with a S.D of 0.02 cm. Test the significance of the deviation. Value of t for 9 degrees of freedom at 5% level is 2.262

4. The average breaking strength of the steel rod is specified to be 18.5 thousand pounds. To test this sample of 14 rods were tested. The mean and standard deviations obtained were 17.85 and 1.955 respectively. Is the result of experiment significant? .

5. A random sample of six steel beams has a mean compressive strength of 58,392 p.s.i (pounds per square inch) with a standard deviation of 648 p.s.i. Use this information and the level of significance $\propto = 0.05$ to test whether the true average compressive strength of the steel from which this sample came 58,000 p.s.i. Assume normality

6. A random sample from a company's very extensive files shows that the orders for certain kind of machinery were filled, respectively in 10, 12,19,14,15,18,11 and 13 days. Use the level of significance $\propto = 0.01$ to test the claim that on the average such orders are filled in 10.5 days. Choose the Alternative Hypothesis so that rejection of Null Hypothesis $\mu = 10.5$ days implies that it takes longer than indicated

7. Producer of 'gutkha', claims that the nicotine content in his 'gutkha' on the average is 1.83 mg. Can this claim accepted if a random sample of 8 'gutkha' of this type have nicotine contents of 2.0, 1.7, 2.1, 1.9, 2.2, 2.1, 2.0, 1.6 mg? Use a 0.05 level of significance

8. Eight students were given a test in STATISTISTICS and after one month coaching they were given another test of the similar nature. The following table gives the I their marks in the second test over the first

Student No	1	2	3	4	5	6	7	8
Increase of marks	4	-2	6	-8	12	5	-7	2

Do the marks indicated that the students have gained from the coaching

II. Student t-test for difference of means

1. Two horses A and B were tested according to the time (in seconds) to run a particular track with following results.

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	29	----

Test whether the two horses have the same running capacity

2. To examine the hypothesis that the husbands are more intelligent than wives, an investigator took a sample of 10 couples and administered them a test which measures the I.Q. The results are as follows:

Husbands	117	105	97	105	123	109	86	78	103	107
Wives	106	98	87	104	116	95	90	69	108	85

Test the hypothesis with a reasonable test at the level of significance of 0.05

3. Measuring specimens of nylon yarn, taken from two machines, it was found that 8 specimens from first machine had a mean denier of 9.67 with a S.D of 1.81 while from second machine had a mean denier of 7.43 with a S.D of 1.48. Assuming that the proportions are normal, test the hypothesis that $H_0: \mu_1 - \mu_2 = 1.5$ against the $H_1: \mu_1 - \mu_2 > 1.5$ at 0.05 level of significance

4.To compare two kinds of bumper guards , 6 of each kind were mounted on a car and then the car was run into a concrete wall. The following are the costs of repairs.

Guard 1	107	148	123	165	102	119
Guard 2	134	115	112	151	133	129

5. Random samples of specimens of coal from two mines A and B are drawn and their heat-producing capacity (in millions of calories/ton) was measured yielding the following results:

Mine A	8350	8070	8340	8130	8260	----
Mine B	7900	8140	7920	7840	7890	7950

If there significant difference between the means of these two samples at 0.01 level of significance

III. Paired sample t-test

1. The Blood Pressure of 5 women before and after intake of a certain drug are given below

before	110	120	125	132	125

after	120	118	125	136	121

Test whether there is significance change in Blood Pressure at 1% L.O.S

2. Ten workers were given a training programme with a view to study their assembly time for a certain mechanism. The results of the time and motion studies before and after the training programme are given below

Workers	1	2	3	4	5	6	7	8	9	10
X_1	15	18	20	17	16	14	21	19	13	22
Y_1	14	16	21	10	15	18	17	16	14	20

$X_1 = T$ime taken for assembly before training,
$Y_1 = T$ime taken for assembly before training,
Test whether there is significant difference in assembly times before and after training

IV. F-test of significance

1 . Pumpkins were grown under two experimental conditions. Two random samples of 11 and 9 pumpkins, Show the sample standard deviations of their weight s as 0.8 and 0.5 respectively. Assuming the weight distributions are normal, test hypothesis that the true variances are equal

2. The nicotine content in milligrams in two samples of tobacco were found to be as follows

Sample A	24	27	26	21	25	---
Sample B	27	30	28	31	22	36

Can it be said that two samples have come from the same normal population?

3. The measurements of the output of two unites have given the following results. Assuming that both samples have been obtained from the normal population at 10% significance level , test whether the two populations have the same variance

Unit- A	14.1	10.1	14.7	13.7	14.0
Unit-B	14.0	14.5	13.7	12.7	14.1

4. The following samples are measurements of the heat- producing capacity(in millions of calories per ton) of specimens of coal from two mines :

Mine 1:	8,260	8,130	8,350	8,070	8,340	---
Mine 2:	7,950	7,890	7,900	8,140	7,920	7,840

Use the 0.02 level of significance to test whether it is reasonable to assume that the variances of the populations samples are equal

V. Chi-square test as a test of goodness of fit

1. A pair of dice are thrown 360 times and the frequency of each sum is indicated below:

Sum	2	3	4	5	6	7	8	9	10	11	12
frequency	8	24	35	37	44	65	51	42	26	14	14

Would you say that the dice are fair on the basis of the chi-square test at 0,05 level of significance

2. The following table show the distribution of digits in number chosen at random from a telephone directory

Digits	0	1	2	3	4	5	6	7	8	9
frequency	1026	1107	997	966	1075	933	1107	972	964	853

VI. Chi-square test for independence of attributes

1)1000 students at college level were graded according to their I.Q and the economic conditions of their home. Use chi-square test to find out whether there is any association between condition at home and I.Q (α=0.05)

Economic condition	High	Low	Total
Rich	460	140	600
Poor	240	160	400
Total	700	300	10000

2) Four methods are under development for making discs of a super conducting material. Fifty discs are made by each method and they are checked for super conductivity when cooled with liquid

	1st method	2nd method	3rd method	4 th method
Super conductors	31	42	22	25
Failures	19	8	28	25

Test the significance difference between the proportions of super conductors at 0.05 level

3) From the following data, find whether there is any significant liking in the habit of taking soft drinks among the categories of employees

Employees

Soft drinks	Clerks	Teachers	Officers
Pepsi	10	25	65
Thumsup	15	30	65
Fanta	50	60	30

4) The following table table gives the classification of 100 workers according to sex and nature of work. Test whether the nature of work is independent of the sex of the worker

	Stable	Unstable	Total
Males	40	20	60
Females	10	30	40
Total	50	50	100

5) Given the following contingency table for hair colour and eye colour. Find the value of chi-square. Is there good association between two?

		Hair colour			
		Fair	Brown	Black	Total
Eye colour	Blue	15	5	20	40
	Grey	20	10	20	50
	Brown	25	15	20	60
	Total	60	30	60	150