

**Ganpat University**  
**M. Tech. III Sem. (AMT and CAD/CAM) Regular Examination Nov. 2014**  
**3ME301/3ME311 Research Methodology**

**Time: 3 hr**

**Marks: 70**

**Instructions:**

- (1) All questions are compulsory.
- (2) Right figure indicate full marks.
- (3) Only scientific calculator is allowed.
- (4) Use tables provided at the end of paper for appropriate question.

**SECTION-I**

**Que.1 Attempt the followings.**

- (a) Explain significance of research in detail. [4]
- (b) Distinguish clearly between research methods and methodology. [4]
- (c) Give your understanding of a good research design. Is single research design suitable in all research studies? If not, why? [4]

**OR**

**Que.1 Attempt the followings.**

- (a) Explain research process stepwise with the help of flow chart in detail. [6]
- (b) Write a short (1-2) page paper on the literature review in your area of research. Also explain the outcome of your literature review in brief. [6]

**Que.2 Attempt the followings.**

- (a) Define how you will define your research problem. [4]
- (b) Explain the technique involved in defining a research problem. [4]
- (c) What do you mean by research design? Explain need for research design. [3]

**OR**

**Que.2 Attempt the followings.**

- (a) Explain Delphi method as a problem solving technique used for idea generation. [4]
- (b) Explain different categories of research design in brief. [4]
- (c) Explain different steps involved in sample design. [3]

**Que.3 Attempt any three.**

- (a) Explain personal interview method for data collection with their chief merits and weaknesses. [4]
- (b) Explain sources of error in measurement. Also explain test of reliability. [4]
- (c) Differentiate between model and mathematical model. Explain importance of mathematical model. Also explain model classification in mathematics. [4]
- (d) Define heuristic. Explain trade off criteria for deciding whether to use a heuristic for solving a given problem. [4]

**SECTION-II**

**Que.4 Attempt the followings.**

- (a) The following are the numbers of artefacts dug up by two archaeologists at an ancient cliff dwelling on 30 days. [4]

X	1	0	2	3	1	0	2	2	3	0	1	1	4	1	2	1	3	5	2	1	3	2	4	1	3	2	0	2	4	2
Y	0	0	1	0	2	0	0	1	1	2	0	1	2	1	1	0	2	2	6	0	2	3	0	2	1	0	1	0	1	0

Use the sign test at 1% level of significance to test the null hypothesis that the two archaeologists, X and Y, are equally good at finding artefacts against the alternative hypothesis that X is better.

- (b) The heights of six randomly chosen sailors are, in inches, 63, 65, 58, 69, 71 and 72. The heights of 10 randomly chosen soldiers are, in inches, 61, 62, 65, 66, 69, 69, 70, 71, 72 and 73. Do these figures indicate that soldiers are on an average shorter than sailors? Test at 5% level of significance. [4]
- (c) In a certain before-after experiment the responses obtained from 1000 respondents, when classified, gave the following information. [4]

Before Treatment	After Treatment	
	Unfavourable responses	Favourable responses
Favourable responses	200	300
Unfavourable responses	400	100

Test at 5% level of significance, whether there has been a significant change in people's attitude before and after the concerning experiment using McNemer Test.

**OR**

**Que.4 Attempt the followings.**

- (a) A sample of 400 male students is found to have a mean height 67.47 inches. Can it be reasonably regarded as a sample from a large population with mean height 67.39 inches and standard deviation 1.30 inches? Test at 5% level of significance. [4]
- (b) "It is only through interpretation the researcher can expose the relations and processes that underlie his findings". Explain, giving examples. [4]
- (c) Write down limitations of hypothesis testing. [4]

**Que.5 Attempt the followings.**

- (a) Present your conclusions after doing analysis of variance to the following results of the Latin-square design experiment conducted in respect of five fertilizers which were used on plots of different fertility. [5]

A	B	C	D	E
16	10	11	9	9
E	C	A	B	D
10	9	14	12	11
B	D	E	C	A
15	8	8	10	18
D	E	B	A	C
12	6	13	13	12
C	A	D	E	B
13	11	10	7	14

- (b) Setup ANOVA table for the following information relating to three drugs testing to judge the [6]

effectiveness in reducing blood pressure for three different groups of people:

Group of People	Drugs		
	X	Y	Z
	A	14	10
B	15	9	11
	12	7	10
C	11	8	11
	10	11	8
	11	11	7

- Do the drugs act differently?
- Are the different groups of people affected differently?
- Is the interaction term significant?

Answer the above questions taking a significant level of 5%.

OR

Que.5 Attempt the followings.

- (a) Present your conclusions after doing analysis of variance to the following results of the Latin-square design experiment conducted in respect of five fertilizers which were used on plots of different fertility. [5]

<sup>12</sup> A	B	C	D	<sup>8</sup> E
<del>12</del>	10	11	9	<del>8</del>
E	C	A	B	D
10	9	14	12	11
B	D	E	C	A
15	8	18	10	18
D	E	B	A	C
12	6	13	13	12
C	A	D	E	B
13	11	10	7	14

- (b) Setup ANOVA table for the following information relating to three drugs testing to judge the effectiveness in reducing blood pressure for three different groups of people: [6]

Group of People	Drugs		
	X	Y	Z
	A	14	10
B	15	9	11
	12	7	10
C	11	8	11
	10	11	8
	11	11	7

- Do the drugs act differently?
- Are the different groups of people affected differently?
- Is the interaction term significant?

Answer the above questions taking a significant level of 1%.

Que.6 Attempt any three

- Write a short note on ANCOVA technique.
- Enlist the precautions to be taken care of while writing research reports.

[12]

- (c) Explain the following with an example.
- (i) One-tailed and two-tailed tests
  - (ii) Type I and Type II errors in hypothesis testing
  - (iii) Power of hypothesis test
  - (iv) Parametric and non-parametric tests
- (d) What is Experimental design? Explain inter-related activities involved in design of an experiments.

Table:1 z-distribution

z	0	001	02	03	04	05	06	07	08	09
0	0000	0040	0080	0120	0160	0199	0239	0279	0319	0359
1	0398	0438	0478	0517	0557	0596	0636	0675	0714	0753
2	0793	0832	0871	0910	0948	0987	1026	1064	1103	1141
3	1179	1217	1255	1293	1331	1368	1406	1443	1480	1517
4	1554	1591	1628	1664	1700	1736	1772	1808	1844	1879
5	1915	1950	1985	2019	2054	2088	2123	2157	2190	2224
6	2257	2291	2324	2357	2389	2422	2454	2486	2517	2549
7	2580	2611	2642	2673	2703	2734	2764	2794	2823	2852
8	2881	2910	2939	2967	2995	3023	3051	3078	3106	3133
9	3159	3186	3212	3238	3264	3289	3315	3340	3365	3389
10	3413	3438	3461	3485	3508	3531	3554	3577	3599	3621
11	3643	3665	3686	3708	3729	3749	3770	3790	3810	3830
12	3849	3869	3888	3907	3925	3944	3962	3980	3997	4015
13	4032	4049	4066	4082	4099	4115	4131	4147	4162	4177
14	4192	4207	4222	4236	4251	4265	4279	4292	4306	4319
15	4332	4345	4357	4370	4382	4394	4406	4418	4429	4441
16	4452	4463	4474	4484	4495	4505	4515	4525	4535	4545
17	4554	4564	4573	4582	4591	4599	4608	4616	4625	4633
18	4641	4649	4656	4664	4671	4678	4686	4693	4699	4706
19	4713	4719	4726	4732	4738	4744	4750	4756	4761	4767
20	4772	4778	4783	4789	4793	4798	4803	4808	4812	4817
21	4821	4826	4830	4834	4838	4842	4846	4850	4854	4857
22	4861	4864	4868	4871	4875	4878	4881	4884	4887	4890
23	4893	4896	4899	4901	4904	4906	4909	4911	4913	4916
24	4918	4920	4922	4925	4927	4929	4931	4932	4934	4936
25	4938	4940	4941	4943	4945	4946	4948	4949	4951	4952
26	4953	4955	4956	4957	4959	4960	4961	4962	4963	4964
27	4965	4966	4967	4968	4969	4970	4971	4972	4973	4974
28	4974	4975	4976	4977	4977	4978	4979	4979	4980	4981
29	4981	4982	4982	4983	4984	4984	4985	4985	4986	4986
30	4987	4987	4987	4988	4988	4989	4989	4989	4990	4990

Table:2 t-distribution

Critical Values of Student's t-Distribution						
d.f.	Level of significance for two-tailed test					d.f.
	0.20	0.10	0.05	0.02	0.01	
	Level of significance for one-tailed test					
	0.10	0.05	0.025	0.01	0.005	
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.131	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
Infinity	1.282	1.645	1.960	2.326	2.576	Infinity

Table:3 F-distribution

Critical Values of F-Distribution (at 5 per cent)										
$v_1 \backslash v_2$	1	2	3	4	5	6	8	12	24	$\infty$
1	161.4	199.5	215.7	224.6	230.2	234.0	238.9	243.9	249.1	253.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.37	19.41	19.45	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.85	8.74	8.64	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.04	5.91	5.77	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.82	4.68	4.53	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.15	4.00	3.84	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.73	3.57	3.41	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.44	3.28	3.12	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.23	3.07	2.90	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.07	2.91	2.74	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	2.95	2.79	2.61	2.40
12	4.75	3.88	3.49	3.26	3.11	3.00	2.85	2.69	2.51	2.30
13	4.67	3.80	3.41	3.18	3.02	2.92	2.77	2.60	2.42	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.70	2.53	2.35	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.64	2.48	2.29	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.59	2.42	2.24	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.55	2.38	2.19	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.51	2.34	2.15	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.48	2.31	2.11	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.45	2.28	2.08	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.42	2.25	2.05	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.40	2.23	2.03	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.38	2.20	2.01	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.36	2.18	1.98	1.73
25	4.24	3.38	2.99	2.76	2.60	2.49	2.34	2.16	1.96	1.71
26	4.22	3.37	2.98	2.74	2.59	2.47	2.32	2.15	1.95	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.31	2.13	1.93	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.29	2.12	1.91	1.65
29	4.18	3.33	2.93	2.70	2.54	2.43	2.28	2.10	1.90	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.27	2.09	1.89	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.18	2.00	1.79	1.51
60	4.00	3.15	2.76	2.52	2.37	2.25	2.10	1.92	1.70	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.02	1.83	1.61	1.25
$\infty$	3.84	2.99	2.60	2.37	2.21	2.10	1.94	1.75	1.52	1.00

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