Meterology, Instrumentation and Tribology (MET-001)

Max. Marks: 100

All questions carry equal marks

Q.1. Classify the types of error and discuss them in detail.

Q.2. Define the following terms: (a) Arithmetic mean (b) Deviation (c) Standard Deviation (d) Variance (e) Geometrical mean

Q.3. Discuss in detail the various types of 'Fits''.

Q.4. What is tolerance? Describe in detail unilateral and Bilateral tolerance with neat sketches.

Q.5. Describe 'plug''and 'snap'gauges with neat sketches.

Q.6. Explain, in detail the construction and working of a vernier calipers.

Q.7. Discuss, in detail any one of the electrical measuring devices.

Q.8. Name the parts of a universal bevel protractor and state the functions of each.

Q.9. Enlist and describe in detail the parts of a projector

Q.10. Name three types of mechanism of lubrication and discuss any one mechanism in detail.

MET 002

Mechatronics

Max. Marks: 100

1. (a)Discuss in brief about the basic requirements of a sensor/transducer. 10

    (b)Explain the specification and testing of dynamic response.   10

2. (a)Discuss the various application of photoelectric sensor with neat sketch.
                                                                                10
    (b)Describe the working of any cam controlled system with the help of suitable example.   10

3. (a)List the methods by which the efficiency of a reciprocating compressor can be improved. Explain any one of them in detail.   10

    (b)Explain the various ways of controlling the actuator speed by means of a flow control valve. Discuss their relative advantages and disadvantages.   10

4. (a)Explain the working of servo motors with the help of a neat sketch.   10
    (b)Show the binary addition and subtraction of 125 (decimal) and 200 (decimal).   10

5. Differentiate between the following   2.5*4= 10
a) an air-amplifier and intensifier.
b) Closed loop and open loop control system
c) Microprocessor and microcomputer
d) Ladder logic and relay logic

6. Write short notes on the following: 2.5*4= 10
a) Transfer systems
b) Piston pumps
c) Armature speed control
d) relay

Assignment
MET – 003

Max. Marks:100

Condition Monitoring and Maintenance.

Q.1	Define and explain the term maintenance engineering. Also explain the objectives of maintenance management	10
Q.2	What is maintenance planning? Explain different stages involved in maintenance planning.	10
Q.3	Discuss various types of maintenance strategies that are aimed to prevent the occurrence of failures.	10
Q.4	Write and explain with illustrative examples (a) A-B-C Analysis (b) V-E-D Analysis (c) C-I-N Analysis	10
Q.5	List out the Non Destructive Test (NDT) to estimate the condition of the equipment and explain any two of them in detail.	10
Q.6	Explain, why Condition Based Maintenance (CBM) is called Dynamic Predictive Maintenance (DPM). Describe the four pillars of Dynamic Predictive Maintenance.	10
Q.7	Discuss various techniques employed for monitoring the condition of the equipment.	10
Q.8	What FMEA and FMEA? Explain the applications and merits of FMEA/FMECA.	10
Q.9	When does an organization opt for contractual maintenance? Explain with example. What are its merits and demerits?	10
Q.10	What is standardization and codification? What is its significance in maintenance spare parts management? What are the advantages of codification?	10

TUTOR MARKED ASSIGNMENT
MST-005: Statistical Techniques

Note: All questions are compulsory. Answer in your own words.

1. State whether the following statements are true or false and also give the reason in support of your answer. (2×5=10)

   c) In SRSWOR, the possible numbers of sample of size n from a population of size N if sampling is done with replacement is N^n.

   d) One-way analysis of variance is a generalization of the two sample t-test.

   e) If experimental error is reduced considerably and the efficiency of the design is decreased.

   f) If strata are heterogeneous then stratified sampling schemes provides estimates with greater precision.

   g) If one wants to convert random numbers selected from two digit numbers 00-99 to uniformly distributed $U(0, 1)$ variables then one has to divide them by 99.

2. Assume that you have to perform a sample survey for Family expenditure of the faculty of Indira Gandhi National Open University. Then explain the main steps involved in the planning and execution of that sample survey. (10)

3 a) In a class of Statistics, total number of students is 30. Select the linear and circulur systematic random samples of 10 students. The age of 30 students is given below:

   Age: 22 25 22 21 22 25 24 23 22 21 20 21
   22 23 25 23 24 22 24 24 21 20 23 21 22
   20 20 21 22 25 (5)

   b) To determine the yield rate of wheat in a district of Punjab, 6 groups were constructed of 6 plots each. The data is given in the following table:

Plot No.	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
1	8	6	18	13	17	12
2	13	5	8	7	15	15
3	11	16	6	13	10	11
4	26	5	10	6	21	17
5	13	16	16	7	20	8
6	31	5	20	2	25	10

   Select a cluster sample of 3 clusters from the given data and find sample mean. (5)

4. Three varieties A, B and C of wheat are shown in five plots each of the following fields per acre as obtained:

Plots	A	B	C
1	8	7	12
2	10	5	9
3	7	10	13
4	14	9	12
5	11	9	14

Set up a table of analysis of variance and find out whether there is significant difference between the fields of these varieties. (10)

5. An experiment was planned to study the effect of Sulphate, Potash and Super Phosphate on the yield of potatoes. All the combinations of 2 levels of Super Phosphate [0 cent (p_0) and 5 cent (p_1)/ acre] and two levels of Sulphate and Potash [0 cent (k_0) and 5 cent (k_1)/acre] were studied in a randomised block design with 4 replications each. The (1/70) yields [lb per plot = (1/70) acre] obtained are given in table below:

Blocks	Yields (lbs per plot)			
I	(1) 23	k 25	p 22	kp 38
II	p 40	(1) 26	k 36	kp 38
III	(1) 29	k 20	pk 30	p 20
IV	kp 34	k 31	p 24	(1) 28

Analyse the data and give your conclusions. (10)

6. By generating 10 uniform random variate U (0, 1) estimate the integral

$$\theta = \frac{1}{\sqrt{2\pi}} \int_{-1}^{2} e^{-x^2/2} \, dx$$

Recognizing this function as probability density function of N (0, 1), compare the value of $\hat{\theta}$ with θ. (10)

7. A sample of 100 villagers is to be drawn from a population of villages A and B. The population means and population mean squares of their monthly wages are given below:

Village	N_i	$\overline{X}_i$	S_i^2
Collage A	400	60	20
Collage B	200	120	80

Find the number of samples using Proportional and Neyman allocation techniques and compare. Obtain the sample mean and variances for the Proportional Allocation and SRSWOR for the given information. Then Find the percentage gain in precision of variances of sample mean under the proportional allocation over that of SRSWOR. (20)

8. A manufacturer wishes to determine the effectiveness of four types of machines (A, B, C and D) in the production of bolts. To accumulate this, the numbers of defective bolts produced for each of two shifts in the results are shown in the following table:

Machine	First shift					Second Shift				
	M	T	W	Th	F	M	T	W	Th	F
A	6	4	5	5	4	5	7	4	6	8
B	10	8	7	7	9	7	9	12	8	8
C	7	5	6	5	9	9	7	5	4	6
D	8	4	6	5	5	5	7	9	7	10

Perform an analysis of variance to determine at 5% level of significance, whether there is a difference (a) Between the machines and (b) Between the shifts. (20)