SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology
Instrumentation and Control

B. Tech. III Semester –V
Program: Honors- Control System and Sensor Technology

Subject Name: Measurement Data Analysis **Subject Code: BTIC19522**

Type of course: Honors

Prerequisite (if any): Basic knowledge of Mathematics, especially integration, differentiation and control theory, instrumentation, probability

List of Courses where this course will be prerequisite: --

Rationale:

This course will provide the students (i) importance of measurement and analysis (ii) correlate the data and system behavior (iii) to derive the system function.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

BSC: basic science course /ESC: Engineering Science Course /HSM: Humanities and management /PCC: Professional Core course /PEC: professional Elective course /OEC: Open Elective course/ MD: mandatory noncredit course

Content:

Sr. No.	Content	Total Hrs	Percentage weightage
1	**Introduction** Measurement data accuracy, precision, errors and uncertainty, calibration, units of measurement, uncertainty analysis and propagation of uncertainty, evaluation of uncertainty for complicated data reduction, probability theory	5	11
2	**Computer generation of random numbers (Monte Carlo method)** random numbers and distribution, Linear congruential generation, generation of normally distributed numbers, the Monte Carlo method, central limit theorem, multivariate normal distribution, convolutions of distribution	12	27
3	**Samples and method of maximum likelihood** Degrees of freedom, X^2 distribution, X^2 and empirical variance, determining ration of small numbers of events, likelihood ratio, likelihood function, method of maximum likelihood, simultaneous estimation,	12	27
5	**Hypothesis testing** F-test on equality of variances, X^2-test for goodness-of-fit, Student's test, likelihood ratio method, chi-square test	5	11
6	**Method of Least square** method of least square, weighted least square, multivariable regression, trade off in number of measurement, t-test analysis, causation, correlation and curve fit, Polynomial regression, algorithms for fitting non-linear functions, constrained measurements, method of elements and Lagrange multipliers	6	11

7	**Function minimization** Overview, numerical accuracy, bracketing the minimum, minimum search with golden sections, minimum search with quadratic interpolation, simplex minimization, gradient and steepest descent, minimization with quadratic form.	**5**	**11**

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	**10%**	**30%**	**30%**	**10%**	**10%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr no	**Title of book /article**	**Author(s)**	**Publisher and details like ISBN**	**Year of publication**	**Publication Edition**
1	Experimental Methods for engineers	J P Holman	McGraw Hill Education • ISBN-10 : 0070647763	2017	7th
2	Measurement Systems	E O Doebelin	McGraw Hill Education • ISBN-10 :	2019	7th

			9353168716		
3	Data Analysis	Siegmund Brandt	Springer • ISBN 978-3-319-03761-5	2014	4th
4	Statistical Analysis of Experimental data	John Mandel	Interscience Publishers, • Library of Congress Catalog Card Number: 64-23851	1964	--

Course Outcomes: after successful completion of this course the students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	apply statistical analysis for experimental data	20%
CO-2	use the graphical methods for comparison	20%
CO-3	apply statistical algorithms for curve fitting	20%
CO-4	analyze the data and function minimization	10%

CO-PO_PSO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2										1		
CO2				1	2	2	2							1	1
CO3								1	1	1			3	2	2
CO4											2	2	1	1	1

List of learning website:

NPTEL, SWAYAM, EDX, Coursera websites

NPTEL lectures control systems design
List of Open Source Software: Scilab simulation software

FOR LAB SESSIONS:

List of Experiments:

1. To generate random numbers with software and check probability distribution.
2. To implement numerical integration and differentiation with software tools.
3. To implement least square method for a given data.
4. To implement polynomial regression /least square method for a given data.
5. To implement moving average with available software tool.
6. To implement chi-square goodness of fit with available software.
7. To implement t-test with available software.
8. To implement F-test with available software.
9. To implement steepest descent method with available software.
10. To implement gradient descent method with available software.
11. To implement monte carlo method with available software.

Major Equipment Needed:

Computer Lab
MATLAB/Scilab software/C/C++/Java software