B.Tech. SEM -VII Mechanical 2014 Course (CBCS) : WINTER - 2018

SUBJECT: ELECTIVE – II: EXPERIMENTAL METHODS IN MECHANICAL ENGINEERING

Day : Monday **W-2018-2577** Time: 02.30 PM TO 05.30 PM
Date : 03/12/2018 Max. Marks: 60

N. B.:

1) Solve Q.1 or Q.2, Q.3 or Q.4., Q.5 or Q.6, Q.7 or Q.8., Q.9 or Q.10, Q.11 or Q.12.
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labeled diagrams **WHEREVER** necessary.
4) Assume suitable data, if necessary.

Q. 1 **a)** Name any two second order systems and formulate the governing equation for any one of such system. **(07)**

b) With the help of a neat sketch draw standard normal distribution for $\mu = 0$. Also indicate three sigma ($\pm\sigma, \pm 2\sigma, \pm 3\sigma$) limits for this distribution. **(03)**

OR

Q. 2 **a)** A first order instrument having a time constant of 0.25 seconds has been subjected to a sinusoidal input prescribed by the relation. **(05)**

$$\theta = 0.25 \sin 20t$$

Develop an expression for the corresponding output.

b) The ultimate strength of an unknown alloy is determined by pulling specimens in a tensile test machine. Seven specimens are tested with ultimate strengths of: 65340; 68188; 67723; 66453; 67702; 66954; 65945 (all in N/m^2) **(05)**
Find the tolerance interval that contains:
i) 99 % of parent population with 90 % confidence
ii) 99 % of parent population with 95 %

N	% of parent population	Confidence level	Factor for tolerance interval
7	99	90	4.521
7	99	95	5.248

Q. 3 Derive the least square fit of the following model: **(10)**

$$y = a_1 x + e$$

Fit the following experimental data with this model and display the result graphically:

x	2	4	6	7	10	11	14	17	20
y	1	2	5	2	8	7	6	9	12

OR

Q. 4 Fit the following experimental data with a power law equation. Compute the standard error of the estimate and the correlation co-efficient: **(10)**

x	0.75	2	3	4	6	8	8.5
y	1.2	1.95	2	2.4	2.4	2.7	2.6

P. T. O.

Q. 5 **a)** What are the guidelines for performing Design of Experiments (DOE)? **(05)**

b) What are the various stages in experimental investigations? **(05)**

OR

Q. 6 **a)** What do you understand by Response Surface Methodology (RSM)? **(05)**

b) With the help of an example discuss the procedure for designing the experiments by 2^2 full factorial designs. **(05)**

Q. 7 While conducting an experiment *viz.* flow through pipe, following data were obtained: **(10)**

	Parameter	Value	Uncertainty
i)	Diameter of pipe (d)	0.2 m	± 0.001 m
ii)	Length of pipe (L)	1.0 m	± 0.001 m
iii)	Pressure drop (ΔP)	45 N/m^2	± 0.1 N/m^2
iv)	Discharge (Q)	0.1 m^3/s	± 0.001 m^3/s
v)	Density (ρ)	998 kg/ m^2	± 2 kg/ m^2

Following relationship was used while calculating friction factor f :

$$f = \frac{\pi^2 d^5 (\Delta P)}{8 \rho Q^2 L}$$

OR

Q. 8 In case of a multivariable system, how is Partial Differentiation Method (PDM) used for estimation of overall uncertainty measurement? **(10)**

Q. 9 With the help of a neat sketch explain 'Shadowgraph Imagine Technique'. Also give applications of this technique. **(10)**

OR

Q.10 With the help of a block diagram explain construction working an application of a 'FFT Analyzer' in mechanical engineering. **(10)**

Q.11 What is Data Acquisition System (DAS)? What are basic components of DAS? What are characteristics of DAS? **(10)**

OR

Q.12 To develop an experimental setup for trial on a single cylinder diesel engine, suggest instruments for measurement of various quantities. If this experimental setup is to be computerized, what parameters will you consider while selection of DAS? **(10)**

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