

**THEORY EXAMINATION – JAN 2021**

B.Tech – Mechanical Engineering

SEMESTER – VII

M.M. - 56

PAPER –ME-401

SUBJECT – MEASUREMENT & CONTROL

**INSTRUCTIONS TO BE FOLLOWED**

- Allotted time for examination is 3 hours 15 minutes that includes time for downloading the question paper, writing answers, scanning of answer sheets and E-mailing the PDF files to the designated Email ID.
- For all B Tech. Mechanical Engineering Students, the Email ID is:- [btechmechuiet@kuk.ac.in](mailto:btechmechuiet@kuk.ac.in)
- The candidates will be required to attempt 75% of the question paper (maximum) by choosing to their any best questions accumulating 56 marks.
- The PDF files should be saved as Roll No. and Subject Code. Proper attention should be given while sending the email and in the subject line, the Roll Number and Subject Code should be mentioned.
- Maximum Page Limit should be 20 (Twenty) for attempting the question paper on A4 sheets which could be downloaded and printed from the sample sheets given in the Kurukshetra University Examination guidelines.
- Over-attemptation should be avoided.
- Handwriting should be neat and clean and diagrams should be clear and contrasted.
- The candidate should not write their Mobile No. otherwise Unfair Means Case will be made.
- While attempting the paper, the candidate will use blue/black pen only.
- Before attempting the paper, the candidate will ensure that he/she has downloaded the correct question paper. No complaint for attempting wrong question paper by the candidate will be entertained.

## PART-A

**Q. No. 1 Answer the following questions (Objective/Short Answer Type Questions) (15x1=15 marks)**

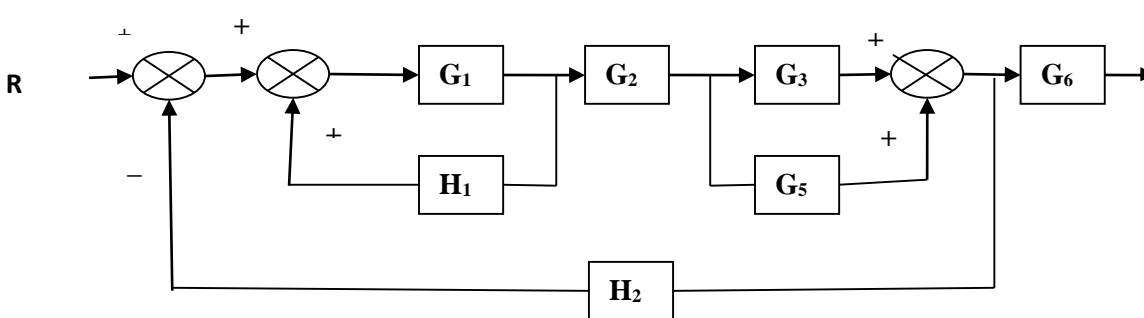
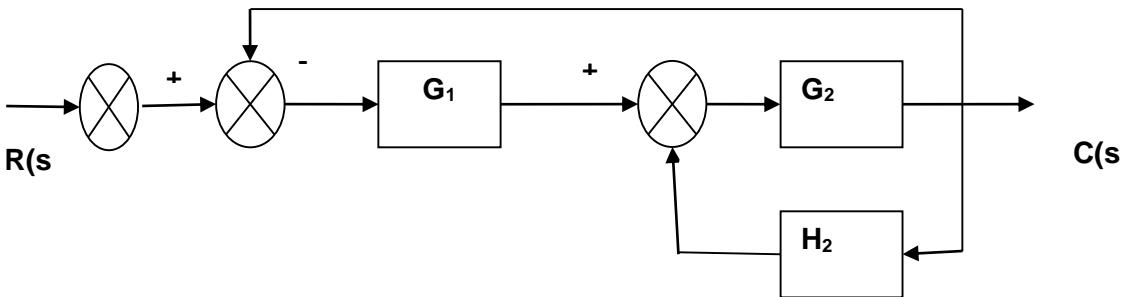
(i)	Define speed of response with regards to measurement systems.
(ii)	Classify measuring instruments.
(iii)	Differentiate backlash with drift in a measurement system.
(iv)	Define precision with regards to measuring instruments.
(v)	What is ramp input in a control system?
(vi)	Write a note on decibel meters.
(vii)	Define transducer.
(viii)	What are dynamic effects of connecting tubing?
(ix)	(a) An automatic toaster is a -----loop control system (a) Open (b) Closed (c) Partially closed (d) None of the above (b) A car is running at a constant speed of 50 km/h, which of the following is the feedback element for the driver (a) Clutch (b) Eyes (c) Needle of the speedometer (d) Steering wheel (e) None of the above
(x)	(a) In open loop system (a) the control action depends on the size of the system (b) the control action depends on the system variables (c) the control action depends on the input signal (d) the control action is independent of output (b) Which of the following statements is not necessarily correct for open loop control system? (a) Input command is the sole factor responsible for providing the control action (b) Presence of non-linearities causes malfunctioning (c) Less expensive (d) Generally free from non-linearities
(xi)	(a) Is a part of human temperature control system (a) Digestive system (b) Perspiration system (c) Ear (d) Leg movement (b) By which of the following the control system is determined when a man walks along a path? (a) Brain (b) Hands (c) Legs (d) Eyes
(xii)	Define take off point and summing point with regards to control system
(xiii)	State transfer function with regards to control system.
(xiv)	Write the Mason's gain formula with regards to control system.
(xv)	Define Reverse and forward path with regard to signal flow graph..

## PART-B

<b>2</b>	<p>Following table list the measuring instruments (left hand side column of the table) for measuring mechanical Properties (right hand side column of the table) of the system. Student shall match the measuring Instrument with the corresponding mechanical property</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Measuring Instruments</th> <th>Properties</th> </tr> </thead> <tbody> <tr> <td>Optical Pyrometer</td> <td>Temperature</td> </tr> <tr> <td>Bourdon gauge</td> <td>EMF</td> </tr> <tr> <td>Rotameter</td> <td>Pressure</td> </tr> <tr> <td>Transducer</td> <td>Flow rate</td> </tr> </tbody> </table> <p>Further, student shall explain only the working principle of the measuring instrument listed on left hand side column of the table.</p>	Measuring Instruments	Properties	Optical Pyrometer	Temperature	Bourdon gauge	EMF	Rotameter	Pressure	Transducer	Flow rate	<b>5</b>
Measuring Instruments	Properties											
Optical Pyrometer	Temperature											
Bourdon gauge	EMF											
Rotameter	Pressure											
Transducer	Flow rate											
<b>3</b>	Explain in detail propagation of uncertainties in compound quantity.	<b>5</b>										
<b>4</b>	Describe in brief positive displacement meters.	<b>5</b>										
<b>5</b>	<p>The characteristic equations for certain feedback control system are given below: In each case, determine the range of values of K for the system to be stable.</p> <p>(a) <math>S^4 + 10KS^3 + 2S^2 + 5S + 2 = 0</math> (b) <math>S^3 + 3KS^2 + (K+4)S + 4 = 0</math></p>	<b>5</b>										

## PART-C

<b>6</b>	<p>(a) A pressure gauge, which has linear calibration curve, has radius of scale line as 120 mm and pressure of zero to 40 Pascals is displayed over an arc of 300<sup>o</sup>C. Determine the sensitivity of the gauge as a ratio of scale length to pressure. (b) Discuss in brief sources of error and its types.</p>	<b>5</b> <b>5</b>
<b>7</b>	<p>(a) Explain in detail hysteresis, linearity, accuracy and resolution with the help of example. (b) Write a technical note on pneumatic and elastic load cells.</p>	<b>5</b> <b>5</b>
<b>8</b>	<p>(a) Describe in brief Torque Transducer and Moore fringe. (b) Write short notes on Chauvenet's criteria of rejecting a dubious data.</p>	<b>5</b> <b>5</b>

9	Write short notes on following: (3+3+4=10) (a) Dynamic error and speed of response (b) Significant figures and rounding off (c) Seismic Instruments	10
10	Obtain the transfer function $C/R$ of the block diagram as shown in figure using signal flow graph. 	10
11	(a) Write various types of strain gauges. (b) Differentiate Solid rod and bi-metallic thermometers. (c) Write short notes on dynamic effects of connecting tubing.	2 4 4
12	Obtain the transfer function for the block diagram as shown below: 	10
13	(a) Draw the signal flow graph for the following equations: (i) $X_2=2X_1+X_3+X_2$ ; $X_3=6X_1+4X_2+X^3$ ; $X_4=X_2+3X_3$ (ii) $X_2=X_1+3aX_5$ ; $X_3=4bX_2+3cX_4$ ; $X_4=3dX_2+4cX_3$ ; $X_5=3fX_4+4gX_3$ ; $X_6=5X_5$ (b) Write short notes on Stability of control system and Mason's gain formula	6 4