Reg. No. MANIPAL INSTITUTE OF TECHNOLOGY A Constituent Institute of Manipal University, Manipal

V SEMESTER B.TECH (MECHANICAL/IP ENGG.) END SEMESTER MAKE-UP EXAMINATIONS, DECEMBER 2017

SUBJECT: METROLOGY & MEASUREMENTS [MME 3104] REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- Draw neat sketches wherever is required.
- 1A. (i) A pressure gauge is calibrated from 0 50 KN/m². It has a uniform scale with 100 scale divisions. One fifth of a scale division can be read with certainty. Determine the resolution of the pressure gauge.

(ii) A dial gauge is used to measure the pressure in the vessel. The pivot is not exactly centered and as a result the readings are subjected to systematic error. It was found that the imperfection makes the readings too large in a linear fashion from state1, i.e. 6.895 KN/m^2 for a dial gauge readings of zero to state 2, i.e. 27.58 KN/m² for a dial reading of 150, what would be the value of pressure for a dial reading of 100?

- **1B.** A flat circular diaphragm of mild steel has a diameter of 15 mm. For mild steel, Young's modulus, E = 200 GN/m² & Poisson's ratio, μ = 0.28. If the maximum stress [$\frac{3D^2P}{16t^2}$ where D & t: - diameter & thickness of diaphragm respectively] is not to exceed 200 MN/m² when the pressure (P) is 300 KN/m². Find the deflection at the center for a pressure of 150 KN/m². **021**/₂
- **1C.** Explain with a neat sketch the working of a pressure thermometer. The pressure thermometer has a range of 0 6 M Pa for the pointer rotation from 0 to 270°. In the temperature calibration process, the pointer movement was set to 0° rotation at 0°C and the instrument indicated 250° rotation corresponding to 200°C. Determine (i) the sensitivity of the instrument in rad/°C, (ii) the error in the observed temperature values if the bulb is raised by 60 cm from calibration elevation.
- 1D. Draw the generalized block diagram to show the functional elements of digital weighing machine in different stages with input and output parameter for each element.
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- 2A. With a neat sketch show the Bridgeman gauge using a manganin element is to measure a maximum pressure of 10^8 Pa. The wire diameter is 25 µm, length is 3 cm. Pressure sensitivity of wire material is 2.5 x 10^{-11} Ω/Ω -Pa, resistivity 45 x 10^{-6} Ω -cm. The wire forms one arm of a Wheatstone bridge, with resistance of all arms being equal. If the supply voltage is 12 V, find the output voltage due to maximum pressure.

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2B.	Explain the the deflection	basic princip on of the bime	ole on wh etallic strip	nich the bi b is related	metallic th to temper	ermomete ature char	r works. ige.	How	02
2C.	Explain with cradled dyn	h neat sketc amometer.	h how th	e torque	& power	can be m	easured u	using	02½
2D	Explain the	working of a	proving ri	ng with LV	DT is used	d to measu	ire force.		02 ½
3A.	For a metal function of I	lic resistance Poisson's ratio	e strain ga o alone.	auge prove	e that the g	gauge fact	or should	be a	03
3B.	Why shuntin A strain gau connected resistance w would be re bridge.	ng method is ige bridge co across adja /alue of 120 presented by	used to c mprises c cent arm 2 each. Τ 2 100 kΩ c	alibrate str of two fixed ns. The t he gauge calibration	ain gauge I 120Ω res wo gauge factor is 2 resistance	? istors, two es have .2. Find th shunting	active ga an unstra ne strain w one arm o	uges ained vhich of the	02
3C.	Determine given (i) Dia (ii) The func (iii) Tolerand	the dimensio meter of the lamental devi ce for shaft is	ns of the shaft falls ation of th 83.65 mi	shaft, if in the ran he shaft is crons	the shaft i ge 18-30 r 16D^{0.44} (W	s designa nm ′ith approp	ted as 30 riate sign))d10,	03
3D	Explain sy characterist	mbolic repre	esentatior texture c	n with ex on drawing	amples o s.	of indicat	ng the	main	02
4A.	Differentiate Shaft-basis	e between (i) system.	Tolerand	e and Allo	owance (ii)) Hole-bas	is system	and	03
4B.	In an assen interference parts is equ System (b)	hbly of two pa varies from al. Determin Shaft Basis S	arts of 100 0.05 mm e the size System.) mm basic to 0.12 mr es of the t	c size, the n. The tole wo mating	fit is interfe erance on parts on	erence and the two ma (a) Hole E	d the ating Basis	04
4C.	Derive an method, wh the pitch an	expression f ich depends d angle of the	for effect on the dia a screw th	ive diame ameter of t aread.	ter of sci he wires, c	rew threa limension	d by two over the w	-wire vires,	03
5A.	Calculate th 0.8 mm. T horizontal n were :	he CLA (Ra) he graph wa nagnification	value of a as drawn of 150 ar	a surface to a vert d the area	for which ical magn as above a	the sampl ification c and below	ing length f 8000 ar the datum	was nd a n line	
	Abo	ve (in mm ²)	150 80	170 60	150 80	120 40			02
		/	00		00				UZ

5B. During the straightness measurement of a planer bed using an Autocollimator and reflector, the following readings were recorded. The distance between the legs of the reflector was 127 mm. Determine the straightness error by representing the result graphically.

Position	Α	В	С	D	Е	F
Readings (Minutes)	+ 0.5	-0.3	+ 0.4	- 0.1	+ 0.5	-0.8

- **5C.** Design a plug gauge for checking the hole of 70H8, Use $\mathbf{i} = 0.45 \sqrt[5]{D} + 0.001D$, IT8 = 25i, Diameter step = 50 to 80 mm. **02**
- **5D.** List the slip gauges to be wrung together to produce an overall dimension of 92.3575mm using two protection slips of 2.5 mm size.(Use M112 Slip gauge set). Also show schematically the sequence of wrung slip gauges.

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