MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE101: ENGINEERING DRAWING AND DESIGN II

DATE: 21/6/2021 **TIME: 8:30 – 11:30 AM**

INSTRUCTIONS:

1. This paper contains FIVE questions.
2. Answer Question **ONE** and any other **TWO** questions
3. Allow $1^1/_2$ Hours for question 1 and 45 minutes for each of the other two questions.
4. All dimensions are in millimetres unless otherwise stated.
5. Construction lines should be faint and should not be erased.
6. Accuracy and good line work are essential.

QUESTION ONE (COMPULSORY) (30 MARKS)

The part drawings of a Machine Vice are shown in **Figure Q1(a) to (e).** Assemble the components and draw:

a) **Sectional view of the assembly,** through the plane X-X as shown in the Figure Q1(a) (12 marks)

b) **Top** and **End elevation of the assembly** (12 marks)

c) Projection symbol and title block (6 marks)

Use first angle projection and do not indicate the dimensions and hidden details.

QUESTION TWO (20 MARKS)

Figure Q2 shows a casting. Draw the sectional view, section XX, and the left side view. Front view is as indicated by the arrow. Indicate the dimensions.

QUESTION THREE (20 MARKS)

a) Differentiate between clearance fit and transition fit. (2 marks)

b) A journal bearing consists of a bronze bush of diameter 130mm fitted into a housing and a steel shaft of 60mm diameter, running in the bush, with oil as a lubricant. Determine the working dimensions of (a) bore of the housing (b) bush and (c) shaft. Calculate the maximum and minimum interference or clearance. Assume interference fit, H7/p6 for the bush and housing and normal running fit, H7/f7 for the shaft and the bush. Refer to Tables 1, 2 and 3. (18 marks)

QUESTION FOUR (20 MARKS)

Illustrate by using example sketches how the following features are represented in Engineering drawing: Housing, bush, boss, curved slot, rib, fillet, key, keyway, slot and flat.

QUESTION FIVE (20 MARKS)

a) Draw a double line sketch of an orthographic pipe network of the single line network shown in **Figure Q5 (a)** (14 marks)

b) **Figure Q5 (b)** shows Light-sensitive Alarm Project circuit. The circuit detects a sudden shadow falling on the light-sensor and sounds the beeper when this happens. Name **the twelve** devices indicated **1** to **12** in the circuit. (6 marks)

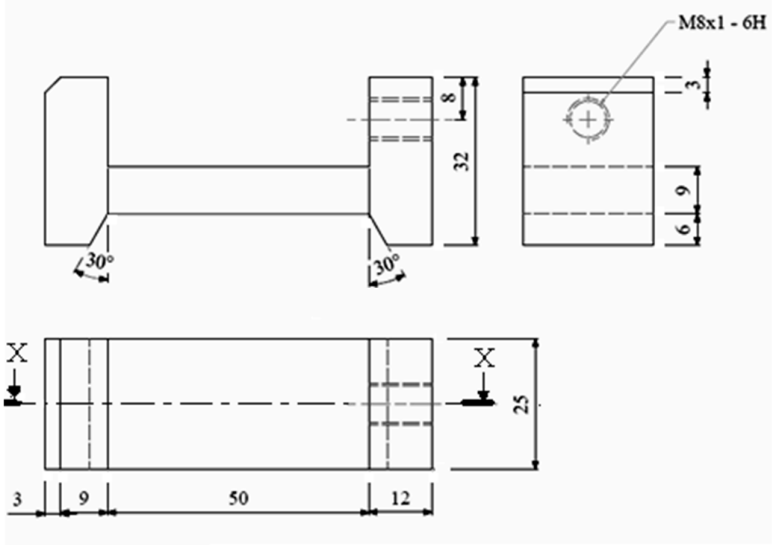

Figure Q1(a) Part 1

Figure Q1(b) Part 2

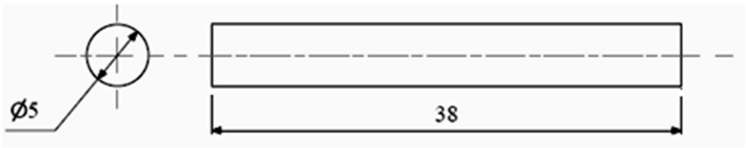

Figure Q1(c) Part 3

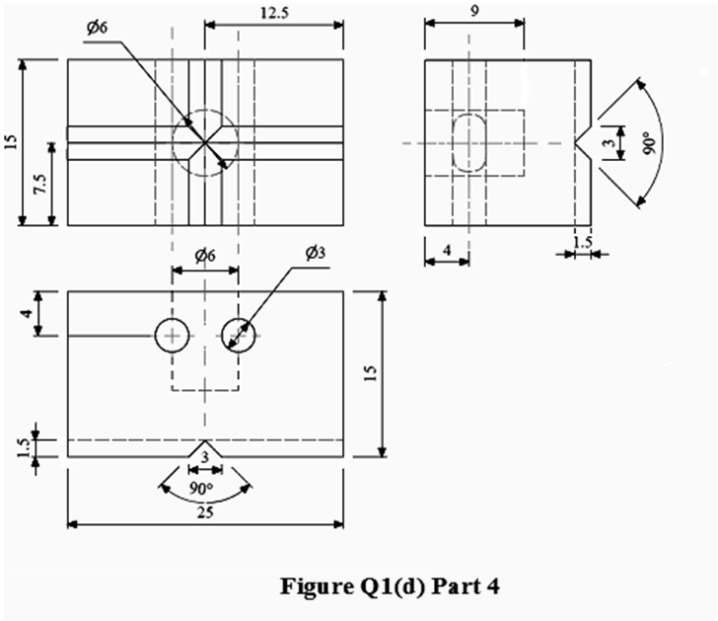

Figure Q1(d) Part 4

Figure Q1(e) Part 5

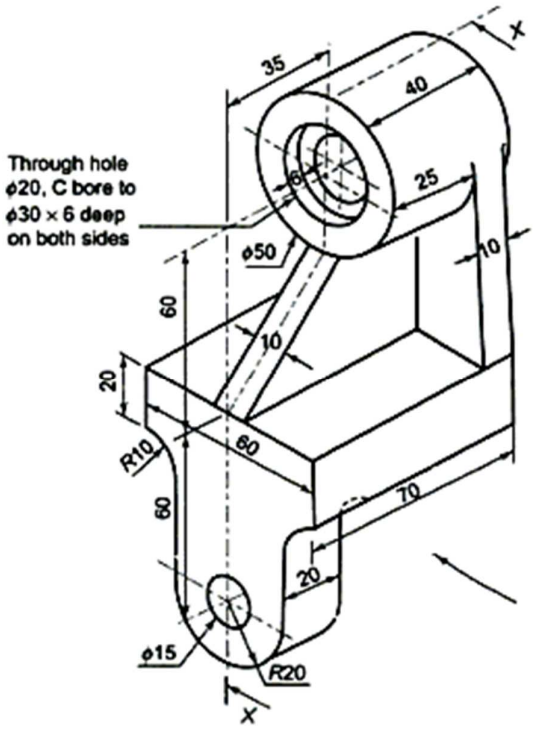

Figure Q2

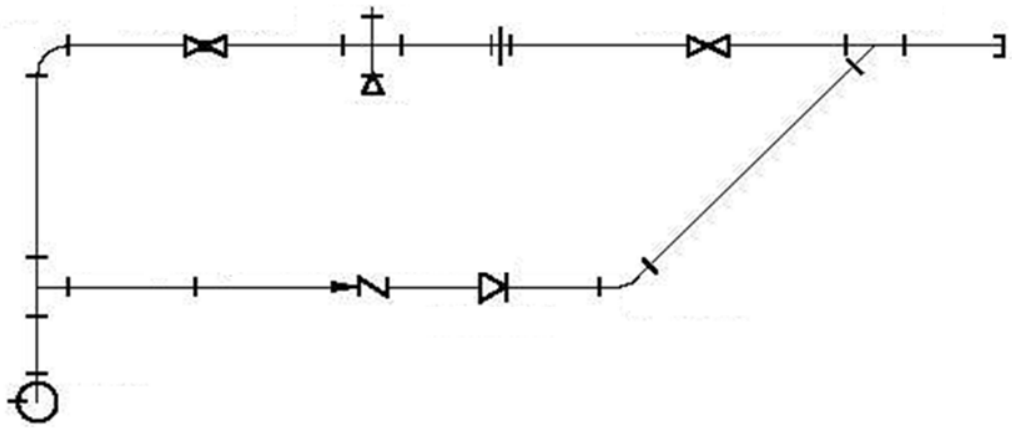

Figure Q5 (a)

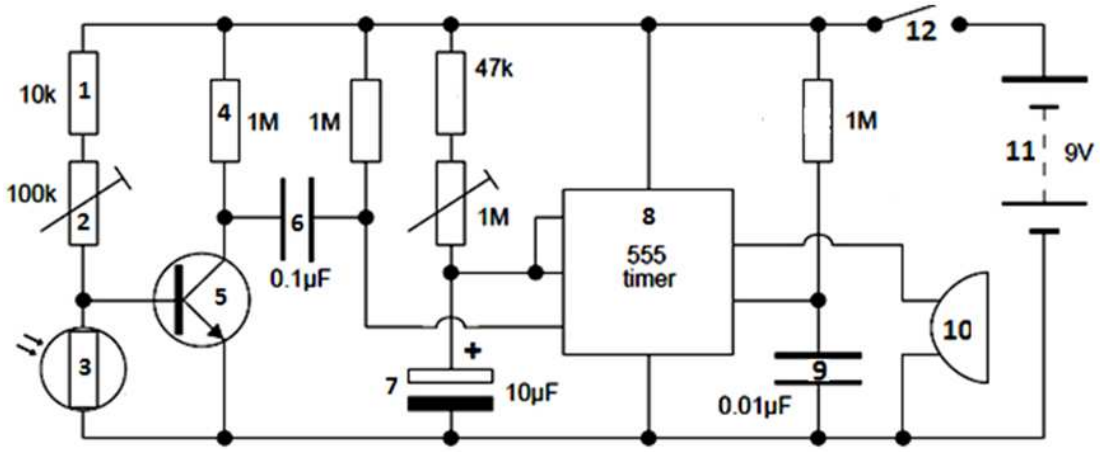

Figure Q5 (b)

Table 1 Fundamental tolerances of grades 01, 0 and 1 to 16 (values of tolerances in microns) (1 micron = 0.001 mm)

Diameter steps in mm	*Tolerance Grades*																	
	01	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14**	*15**	*16**
Over 30 To and inc 50	0.6	1	1.5	2.5	4	7	11	16	25	39	62	100	160	250	390	620	1000	1600
Over 50 To and inc 80	0.8	1.2	2	3	5	8	13	19	30	46	74	120	190	300	460	740	1200	1900
Over 80 To and inc 120	1	1.5	2.5	4	6	10	15	22	35	54	87	140	220	350	540	870	1400	2200
Over 120 To and inc 180	1.2	2	3.5	5	8	12	18	25	40	63	100	160	250	400	630	1000	1600	2500

Table 2 Fundamental deviations for shafts of types **a** to **k** of sizes upto 500mm *(contd.)*

Fundamental deviation in microns														(1 micron = 0.001 mm)
Diameter steps in mm		*Upper deviation (es)*								**js⁺**	*Lower deviation (ei)*			
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*		*j*			*k*
over	*upto*	*All grades*									5.6	7	8	4 *to* 7	≤ 3, > 7
50	65	– 340	– 190	– 140	– 100	– 60	– 30	– 10	0	± IT/2	– 7	– 12	—	+ 2	0
65	80	– 360	– 200	– 150											
80	100	– 380	– 220	– 170	– 120	– 72	– 36	– 12	0		– 9	– 15	—	+ 3	0
100	120	– 410	– 240	– 180											
120	140	– 460	– 260	– 200											
140	160	– 520	– 280	– 210	– 145	– 85	– 43	– 14	0		– 11	– 18	—	+ 3	0
160	180	– 580	– 310	– 230											

Table 2 Fundamental deviations for shafts of types **m** to **zc** of sizes upto 500 mm *(contd.)*

Fundamental deviation in microns															(1 micron = 0.001 mm)
Diameter steps in mm		*Lower deviations (ei)*													
		m	*n*	*p*	*r*	*s*	*t*	*u*	*v*	*x*	*y*	*z*	*za*	*zb*	*zc*
Over	*Upto*	*All grades*													
30	40	+ 9	+ 17	+ 26	+ 34	+ 43	+ 48	+ 60	+ 68	+ 80	+ 94	+ 112	+ 148	+ 200	+ 274
40	50						+ 54	+ 70	+ 81	+ 97	+ 114	+ 136	+ 180	+ 242	+ 325
50	65	+ 11	+ 20	+ 32	+ 41	+ 53	+ 66	+ 87	+ 102	+ 122	+ 144	+ 172	+ 226	+ 300	+ 405
65	80				+ 43	+ 59	+ 75	+ 102	+ 120	+ 146	+ 174	+ 210	+ 274	+ 360	+ 480
80	100	+ 13	+ 23	+ 37	+ 51	+ 71	+ 91	+ 124	+ 146	+ 178	+ 214	+ 258	+ 335	+ 445	+ 585
100	120				+ 54	+ 79	+ 104	+ 144	+ 172	+ 210	+ 254	+ 310	+ 400	+ 525	+ 690
120	140				+ 63	+ 92	+ 122	+ 170	+ 202	+ 248	+ 300	+ 365	+ 470	+ 620	+ 800
140	160	+ 15	+ 27	+ 43	+ 65	+ 100	+ 134	+ 190	+ 228	+ 280	+ 340	+ 415	+ 535	+ 700	+ 900
160	180				+ 68	+ 108	+ 146	+ 210	+ 252	+ 310	+ 380	+ 465	+ 600	+ 780	+ 1000

Table 3 Fundamental deviations for holes of types **A** to **N** for sizes upto 500 mm *(contd.)*

A to N

Fundamental deviation in microns																			(1 micron = 0.001 mm)
Diameter steps in mm		*Lower deviations (EI)*													*Upper deviations (ES)*				
		*A**	**B*	*C*	*D*	*E*	*F*	*G*	*H*	*Js+*	*J*			*K*		*M*		*N*		
Over	*Upto*	*All grades*									6	7	8	≤ 8	> 8	≤ 8 ‡	> 8	≤ 8	> 8*	≤ 7
30	40	+ 310	+ 170	+ 120	+ 80	+ 50	+ 25	+ 9	0	± IT/2	+ 10	+ 14	+ 24	− 2 + Δ	—	− 9 + Δ	− 9	− 17 + Δ	0	Same deviation as for grades > 7 + Δ
40	50	+ 320	+ 180	+ 130																
50	65	+ 340	+ 190	+ 140	+ 100	+ 60	+ 30	+ 10	0		+ 13	+ 18	+ 28	− 2 + Δ	—	− 11+ Δ	− 11	− 20 + Δ	0	
65	80	+ 360	+ 200	+ 150																
80	100	+ 380	+ 220	+ 170	+ 120	+ 72	+ 36	+ 12	0		+ 16	+ 22	+ 34	− 3 + Δ	—	− 13 + Δ	− 13	− 23 + Δ	0	
100	120	+ 410	+ 240	+ 180																
120	140	+ 460	+ 260	+ 200																
140	160	+ 520	+ 280	+ 210	+ 145	+ 85	+ 43	+ 14	0		+ 18	+ 26	+ 41	− 3 + Δ	—	− 15 + Δ	− 15	− 27 + Δ	0	
160	180	+ 580	+ 310	+ 230																