KOLEJ YAYASAN PELAJARAN JOHOR
ONLINE FINAL EXAMINATION

COURSE NAME	**:**	**REKABENTUK KEJURUTERAAN**
COURSE CODE	**:**	**DKM 2153**
EXAMINATION	**:**	**JUNE 2022**
DURATION	**:**	**2 HOURS 30 MINUTES**

INSTRUCTION TO CANDIDATES

1. This examination paper consists of **ONE (1)** part : / (100 Marks) /
   *Kertas soalan ini mengandungi **SATU (1)** bahagian:* ***(100 Markah)***

2. Answer ALL questions in the answer sheet which is A4 size paper (or other paper with the consent of the relevant lecturer). /
   Jawab SEMUA soalan di dalam kertas jawapan iaitu kertas bersaiz A4 (atau lain-lain kertas dengan persetujuan pensyarah berkaitan).

3. Write your details as follows in the upper left corner for each answer sheet: /
   Tulis butiran anda sepertimana berikut di penjuru atas kiri bagi setiap kertas jawapan:
   - *i.* Student Full Name / *Nama Penuh Pelajar*
   - ii. Identification Card (I/C) No. / *No. Kad Pengenalan*
   - iii. Class Section / *Seksyen Kelas*
   - iv. Course Code / *Kod Kursus*
   - v. Course Name / *Nama Kursus*
   - vi. Lecturer Name / *Nama Pensyarah*

4. Each answer sheet must have a page number written at the bottom right corner. /
   Setiap helai kertas jawapan mesti ditulis nombor muka surat di penjuru bawah kanan.

5. Answers should be **neat and clear in handwritten form**. /
   Jawapan hendaklah ditulis tangan, kemas dan jelas.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO /
JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU

This examination paper consists of **11** printed pages including front page
*Kertas soalan ini mengandungi **11** muka surat termasuk kulit hadapan*

This section consists of **FOUR (4)** questions. Answer **ALL** the questions.
*Bahagian ini mengandungi **EMPAT (4)** soalan. Jawab **SEMUA** soalan.*

QUESTION 1 / *SOALAN 1*

a. Explain the meaning of standards and codes.

Terangkan maksud piawaian dan kod.

(5 marks/ *markah*)

b. **Figure 1** shows a beam supported at point O and B with a force acting at point A. Calculate :

(i) the force acting at point O and B.

(5 marks/ *markah*)

(ii) second moment area about x-axis

(7 marks/ *markah*)

(iii) magnitudes of the maximum bending stress, σ_{max}.

(5 marks/ *markah*)

(iv) Sketch the shear forces and bending moment diagram.

(3 marks/ *markah*)

***Rajah 1** menunjukkan satu rasuk yang disokong pada O dan B beserta satu daya yang dikenakan pada titik A. Kirakan:*

(i) daya tindak balas pada titik O dan B.

(ii) momen luas kedua pada paksi x

(iii) magnitud tegasan lenturan maksimum, σ_{maks}

(iv) Lakarkan gambar rajah daya ricih dan momen lentur.

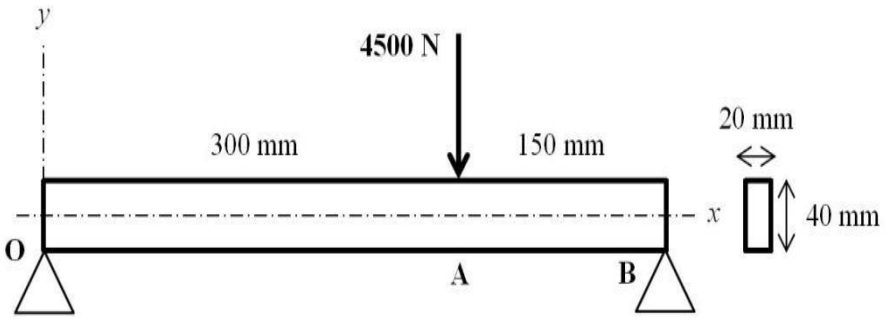


Figure 1/ *Rajah 1*

QUESTION 2/ *SOALAN 2*

a. State types of welding joint with explaination.

Nyatakan jenis-jenis sambungan kimpalan berserta penerangan.

(5 marks/ *markah*)

b. **Figure 2** shows two plates are stacked joined by using a weld method.

Given ;

b = 50 mm d = 50 mm h = 5 mm

If value of F given 30 kN, calculate:

(i) primary and secondary shear stress of the welded metal, □.

(15 marks/ *markah*)

(ii) the maximum stress welded metal that can be supported.

(5 marks/ *markah*)

Rajah 2 *menunjukkan dua keping plat yang disambung bertindih menggunakan kaedah kimpalan.*

Diberi ;

b = 50 mm *d = 50 mm* *h = 5 mm*

Sekiranya nilai F adalah 30 kN, kirakan:

(i) tegasan ricih utama dan kedua logam kimpalan, □.

(ii) stress maksimum yang ditampung oleh logam kimpalan.

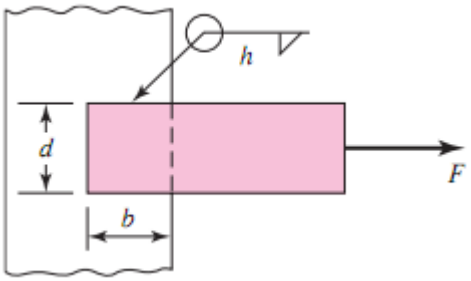


Figure 2/ *Rajah 2*

QUESTION 3/ *SOALAN 3*

a. Explain **three (3)** main categories of threaded fastener.

*Terangkan **tiga (3)** kategori utama pengikat bebenang.*

(6 marks/ *markah*)

b. A square-thread power screw has a major diameter of 36 mm and a pitch of 4 mm with double threads. Calculate:

Given; $f = f_c = 0.08$,

$d_c = 40$ mm,

$F = 6.4$ kN per screw

(i) thread depth, thread width, pitch diameter, minor diameter, and lead.

(5 marks/ *markah*)

(ii) torque required to raise and lower the load.

(6 marks/ *markah*)

(iii) efficiency during lifting the load.

(3 marks/ *markah*)

(iv) body stresses, torsional and compressive.

(5 marks/ *markah*)

Skru kuasa bebenang segi empat mempunyai diameter utama 36 mm dan satu pitch 4 mm dengan dua benang.Kirakan:

Diberi; f = f_c= 0.08,

d_c = 40 mm,

F = 6.4 kN per skru

(i) kedalaman bebenang, lebar bebenang, diameter condong, diameter kecil, dan 'lead'.

(ii) daya kilas yang diperlukan untuk menaikkan dan menurunkan beban.

(iii) kecekapan semasa mengangkat beban

(iv) tekanan, daya kilas, dan daya mampatan pada jasad.

QUESTION 4/ *SOALAN 4*

a. List the design procedure for spur gears.

*Senaraikan prosedur mereka bentuk gear pemacu***.**

(5 marks / *markah*)

b. A gearset has a module of 5 mm, a 20º pressure angle, and 24 tooth cast iron spur pinion. The pinion is a rotate at 50 rev/min. The contact stress is limited to 690 Mpa with design factor, n_d = 3 and F = 60 mm. Determine :

(i) Pitch circle diameter, d with velocity, V and velocity factor, $K_{v.}$

(9 marks / *markah*)

(ii) Tangential force, W_t

(6 marks / *markah*)

(iii) The horsepower input can be used.

(5 marks / *markah*)

Sebuah set gear mempunyai modul 5 mm, sudut tekanan 20º, dan 24 gigi besi tuang yang memacu pinion. Pinion berpusing pada kelajuan 50 putaran per minit. Sentuhan tegasan adalah 690 Mpa dengan faktor reka bentuk n_d = 3 dan F = 60 mm, Tentukan :

(i) Pitch diameter bulatan, d serta halaju, V dan faktor halaju, K_v

(ii) Daya tangen, W_t

(iii) Kuasa kuda masukan yang boleh digunakan.

[100 MARKS/ 100 *MARKAH*]

END OF QUESTION PAPER/ *KERTAS SOALAN TAMAT*

LIST OF FORMULA

(1) Screw and Fasteners

$$T_R = \frac{Fd_m}{2}\left(\frac{l + \pi f d_m}{\pi d_m - fl}\right) + \frac{Ff_c}{2} d_c \qquad T_L = \frac{Fd_m}{2}\left(\frac{\pi f d_m - l}{\pi d_m + fl}\right) + \frac{Ff_c}{2} d_c$$

$$e = \frac{Fl}{2\pi T_R} \quad \tau = \frac{16T_R}{\pi d^3{}_r} \quad \sigma = -\frac{4F}{\pi d^2{}_r}$$

(2) Welding

(i) Primary shear force

$$\tau' = \frac{F}{A}$$

(ii) Shear magnitude

$$\tau = (\tau'^2 + \tau''^2)^{1/2}$$

(iii) Secondary Shear Force

$$\tau'' = \frac{Mr}{I}$$

(iv) Second memont of area, I

$$\boldsymbol{I} = 0.707 h I_u$$

(3) Gear

(i) Pitch line velocity

$$v = \frac{\pi D_p N_p}{60} = \frac{\pi m . T_p N_p}{60}$$

(ii)Tangential tooth load

$$W_T = \frac{P}{v} x\, C_s$$

$$W_T = \frac{60000H}{\pi dn}$$

(iii) Factor Velocity, Kv

$$\boldsymbol{K_v = \frac{3.05 + V}{3.05}} \quad (\boldsymbol{cast\ iron, cast\ profile})$$

$$\boldsymbol{K_v = \frac{6.1 + V}{6.1}} \quad (\boldsymbol{cut\ or\ milled\ profile})$$

(iv) Power

$$\boldsymbol{hp = W^t V}$$

$$\boldsymbol{\sigma = \frac{K_v W^t}{FmY}}$$

APPENDIX

Values of Lewis Form Factor *Y*

Number of Teeth	Y	Number of Teeth	Y
12	0.245	28	0.353
13	0.261	30	0.359
14	0.277	34	0.371
15	0.290	38	0.384
16	0.296	43	0.397
17	0.303	50	0.409
18	0.309	60	0.422
19	0.314	75	0.435
20	0.322	100	0.447
21	0.328	150	0.460
22	0.331	300	0.472
24	0.337	400	0.480
26	0.346	Rack	0.485

Table A–20

Deterministic ASTM Minimum Tensile and Yield Strengths for Some Hot-Rolled (HR) and Cold-Drawn (CD) Steels [The strengths listed are estimated ASTM minimum values in the size range 18 to 32 mm ($\frac{3}{4}$ to $1\frac{1}{4}$ in). These strengths are suitable for use with the design factor defined in Sec. 1–10, provided the materials conform to ASTM A6 or A568 requirements or are required in the purchase specifications. Remember that a numbering system is not a specification.] Source: 1986 SAE Handbook, p. 2.15.

1	2	3	4	5	6	7	8
UNS No.	SAE and/or AISI No.	Processing	Tensile Strength, MPa (kpsi)	Yield Strength, MPa (kpsi)	Elongation in 2 in, %	Reduction in Area, %	Brinell Hardness
G10060	1006	HR	300 (43)	170 (24)	30	55	86
		CD	330 (48)	280 (41)	20	45	95
G10100	1010	HR	320 (47)	180 (26)	28	50	95
		CD	370 (53)	300 (44)	20	40	105
G10150	1015	HR	340 (50)	190 (27.5)	28	50	101
		CD	390 (56)	320 (47)	18	40	111
G10180	1018	HR	400 (58)	220 (32)	25	50	116
		CD	440 (64)	370 (54)	15	40	126
G10200	1020	HR	380 (55)	210 (30)	25	50	111
		CD	470 (68)	390 (57)	15	40	131
G10300	1030	HR	470 (68)	260 (37.5)	20	42	137
		CD	520 (76)	440 (64)	12	35	149
G10350	1035	HR	500 (72)	270 (39.5)	18	40	143
		CD	550 (80)	460 (67)	12	35	163
G10400	1040	HR	520 (76)	290 (42)	18	40	149
		CD	590 (85)	490 (71)	12	35	170
G10450	1045	HR	570 (82)	310 (45)	16	40	163
		CD	630 (91)	530 (77)	12	35	179
G10500	1050	HR	620 (90)	340 (49.5)	15	35	179
		CD	690 (100)	580 (84)	10	30	197
G10600	1060	HR	680 (98)	370 (54)	12	30	201
G10800	1080	HR	770 (112)	420 (61.5)	10	25	229
G10950	1095	HR	830 (120)	460 (66)	10	25	248

Table 9–6

Allowable Steady Loads and Minimum Fillet Weld Sizes

Schedule A: Allowable Load for Various Sizes of Fillet Welds

	Strength Level of Weld Metal (EXX)						
	60*	70*	80	90*	100	110*	120
	Allowable shear stress on throat, ksi (1000 psi) of fillet weld or partial penetration groove weld						
τ =	18.0	21.0	24.0	27.0	30.0	33.0	36.0
	Allowable Unit Force on Fillet Weld, kip/linear in						
†f =	12.73h	14.85h	16.97h	19.09h	21.21h	23.33h	25.45h
Leg Size h, in	Allowable Unit Force for Various Sizes of Fillet Welds kip/linear in						
1	12.73	14.85	16.97	19.09	21.21	23.33	25.45
7/8	11.14	12.99	14.85	16.70	18.57	20.41	22.27
3/4	9.55	11.14	12.73	14.32	15.92	17.50	19.09
5/8	7.96	9.28	10.61	11.93	13.27	14.58	15.91
1/2	6.37	7.42	8.48	9.54	10.61	11.67	12.73
7/16	5.57	6.50	7.42	8.35	9.28	10.21	11.14
3/8	4.77	5.57	6.36	7.16	7.95	8.75	9.54
5/16	3.98	4.64	5.30	5.97	6.63	7.29	7.95
1/4	3.18	3.71	4.24	4.77	5.30	5.83	6.36
3/16	2.39	2.78	3.18	3.58	3.98	4.38	4.77
1/8	1.59	1.86	2.12	2.39	2.65	2.92	3.18
1/16	0.795	0.930	1.06	1.19	1.33	1.46	1.59

*Fillet welds actually tested by the joint AISC-AWS Task Commitee.
†$f = 0.707h\,\tau_{all}$.

Schedule B: Minimum Fillet Weld Size, h

Material Thickness of Thicker Part Joined, in		Weld Size, in
*To $\frac{1}{4}$ incl.		$\frac{1}{8}$
Over $\frac{1}{4}$	To $\frac{1}{2}$	$\frac{3}{16}$
Over $\frac{1}{2}$	To $\frac{3}{4}$	$\frac{1}{4}$
†Over $\frac{3}{4}$	To $1\frac{1}{2}$	$\frac{5}{16}$
Over $1\frac{1}{2}$	To $2\frac{1}{4}$	$\frac{3}{8}$
Over $2\frac{1}{4}$	To 6	$\frac{1}{2}$
Over 6		$\frac{5}{8}$

Not to exceed the thickness of the thinner part.
*Minimum size for bridge application does not go below $\frac{3}{16}$ in.
†For minimum fillet weld size, schedule does not go above $\frac{5}{16}$ in fillet weld for every $\frac{3}{4}$ in material.

Source: From Omer W. Blodgett (ed.), *Stress Allowables AffectWeldment Design*, D412,The James F. Lincoln Arc Welding Foundation, Cleveland, May 1991, p. 3. Reprinted by permission of Lincoln Electric Company.

Table 9–4

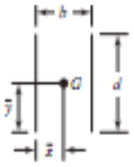
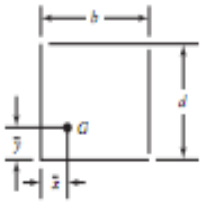
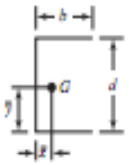
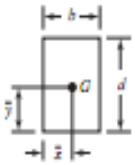
Stresses Permitted by the AISC Code for Weld Metal

Type of Loading	Type of Weld	Permissible Stress	n*
Tension	Butt	$0.60S_y$	1.67
Bearing	Butt	$0.90S_y$	1.11
Bending	Butt	$0.60–0.66S_y$	1.52–1.67
Simple compression	Butt	$0.60S_y$	1.67
Shear	Butt or fillet	$0.30S_{ut}$†	

*The factor of safety n has been computed by using the distortion-energy theory.
†Shear stress on base metal should not exceed $0.40S_y$ of base metal.

Table 9–1

Torsional Properties of Fillet Welds*

Weld	Throat Area	Location of G	Unit Second Polar Moment of Area
1. 	$A = 0.707\,hd$	$\bar{x} = 0$ $\bar{y} = d/2$	$J_u = d^3/12$
2. 	$A = 1.414\,hd$	$\bar{x} = b/2$ $\bar{y} = d/2$	$J_u = \dfrac{d(3b^2 + d^2)}{6}$
3. 	$A = 0.707h(b + d)$	$\bar{x} = \dfrac{b^2}{2(b + d)}$ $\bar{y} = \dfrac{d^2}{2(b + d)}$	$J_u = \dfrac{(b + d)^4 - 6b^2d^2}{12(b + d)}$
4. 	$A = 0.707h(2b + d)$	$\bar{x} = \dfrac{b^2}{2b + d}$ $\bar{y} = d/2$	$J_u = \dfrac{8b^3 + 6bd^2 + d^3}{12} - \dfrac{b^4}{2b + d}$
5. 	$A = 1.414h(b + d)$	$\bar{x} = b/2$ $\bar{y} = d/2$	$J_u = \dfrac{(b + d)^3}{6}$
6. 	$A = 1.414\,\pi hr$		$J_u = 2\pi r^3$

*G is centroid of weld group; h is weld size; plane of torque couple is in the plane of the paper; all welds are of unit width.