UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Pertama
Sidang Akademik 2005/2006

November 2005

EPP 201/3 -Teknologi Pembuatan 1

Masa : 3 jam

ARAHAN KEPADA CALON :

Sila pastikan bahawa kertas soalan ini mengandungi **DUA PULUH DUA (22)** mukasurat dan **TIGA (3)** lampiran serta **ENAM (6)** soalan yang bercetak sebelum anda memulakan peperiksaan.

Sila jawab **LIMA (5)** soalan sahaja.

Bahagian A merupakan soalan **WAJIB** dan mengandungi **SATU (1)** set soalan pelbagai pilihan..

Bahagian B pula mengandungi LIMA (5) soalan subjektif. Anda perlu menjawab **TIGA (3)** soalan sahaja di bahagian ini.

Jika calon ingin menjawab dalam **Bahasa Inggeris** sekurang-kurangnya **SATU (1)** soalan perlu dijawab dalam **Bahasa Malaysia.**

KERTAS JAWAPAN OMR akan dibekalkan.

Setiap soalan mestilah dimulakan pada mukasurat yang baru.

...2/-

BAHAGIAN A (Soalan WAJIB)
Bahagian ini mempunyai 50 soalan aneka pilihan.

Jawapan anda mesti mengikut format seperti berikut dan menjawab di KERTAS OMR yang disediakan. Markah akan ditolak pada jawapan yang salah.

A = I & III
B = II & IV
C = I, II, III
D = IV sahaja/*only*
E = Kombinasi di atas tidak benar
The above combination is not correct

1. **Proses berikut bukan proses pengubah bentuk (deformasi) pukal.**
   [I] pembengkokan
   [II] penyemperitan
   [III] penarikan dalam
   [IV] tempaan

   The following is (are) NOT bulk deformation processes.
   [I] Bending
   [II] extrusion
   [III] deep drawing
   [IV] forging,

2. **Kebaikan kerja panas relatif pada kerja sejuk adalah**
   [I] tambah kekuatan bahan
   [II] kurang berlaku retakan
   [III] keseluruhannya perlukan kurang tenaga
   [IV] kurang daya deformasi di perlukan

   The advantage(s) of hot working relative to cold working is (are)
   [I] increased strength
   [II] less likely of fracture
   [III] require less overall energy
   [IV] require less deformation forces

3. **Kerja suam pada logam adalah berdasarkan lingkungan suhu relative pada suhu lebur dalam skala suhu absolut (beri dua suhu sebagai julat)**
   [I] suhu bilik
   [II] 0.2 suhu lebur
   [III] 0.5 suhu lebur
   [IV] 0.7 suhu lebur

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Warm working of metals refers to the following temperature regions relative to the metal melting point on an absolute temperature scale. (Give two points for range)
[I] room temperature
[II] 0.2Tm
[III] 0.5Tm
[IV] 0.7Tm.

4. **Proses biasa bagi pembuatan paip dan tiub adalah:**
[I] penyemperitan
[II] penarikan
[III] tempaan gelek
[IV] pembengkokan tiub

The common methods of production of pipes and tubes are:
[I] extrusion
[II] drawing
[III] roll forging
[IV] tube bending

5. **Proses berikut menggunakan daya mampatan bagi mengubah bentuk**
[I] penyemperitan
[II] penarikan dalam
[III] tempaan
[IV] ricih

The following processes use compression to effect shape change
[I] deep drawing
[II] extrusion
[III] forging
[IV] shearing

6. **Proses berikut merupakan sebahagian operasi tempaan**
[I] fullering
[II] hobbing
[III] penegalan
[IV] reaming

The following is(are) classified as forging operation(s)
[I] fullering
[II] hobbing
[III] cogging
[IV] reaming

7. **Proses lazim dalam pembuatan paku adalah ;**
[I] tarikan
[II] penyemperian
[III] pengkepalaan
[IV] mejam

...4/-

The normal process (es) for the production of nails are:
[I] drawing
[II] extrusion
[III] heading
[IV] spinning

8. **Dalam kerja kepingan logam, peningkatan kekerasan benda kerja, maka kelegaan antara penghentak dan acuan:**
[I] perlu dikecilkan
[II] perlu dibesarkan
[III] dijadikan tirus
[IV] tidak perlu buat apa-apa

As the hardness of sheet metal stock increase, the clearance between punch and die should:
[I] be decreased
[II] be increased
[III] made into cone shape
[III] not do anything

9. **Dalam operasi penyontoh-kosongan, kepingan logam bulat yang terhasil akan**
[I] menurut garispusat acuan
[II] menurut garispusat penghentak
[III] akan menambah saiz akibat kesan tarikan
[IV] akan melengkung akibat tekanan penghentak

In a blanking operation, a round sheet metal produced will have
[I] the same diameter as the die opening
[II] the same diameter as the punch
[III] increment in size due to stretching effect
[IV] slightly concave due to the punch force

10. **Terikan dan tegasan yang berlaku semasa kerja pembengkokan kepingan logam ialah:**
[I] mampatan
[II] ricih
[III] tegangan
[IV] alah

The stress and strains that occurs during sheet metal bending are:
[I] compressive
[II] shear
[III] tensile
[IV] Yield

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11. Berikut merupakan variasi operasi pembengkokan kepingan logam:
[I] pensyilingan
[II] membibir
[III] mengosok
[IV] mengelim

The following are variations of sheet metal bending operations:
[I] coining
[II] flanging
[III] ironing
[IV] hemming.

12. Mesin larik boleh melakukan operasi
[I] membenang luar
[II] mengalur
[III] menampang
[IV] membenang dalam

A lathe can perform the operation(s) of
[I] external threading
[II] slotting
[III] facing
[III] internal threading

13. Bentuk geometrik yang sering di kaitan dengan proses pengerekan ialah
[I] bebenang dalam
[II] bentukan prismatik
[III] rongga bulat
[IV] bebenang skru

The geometric form(s) closely associated to boring operation is (are):
[I] internal threading
[II] prismatic shaping
[III] round cavity
[IV] screw threads

14. Keadaan pemotongan dalam proses pemesinan amat dipengaruhi oleh
[I] kadar suapan
[II] kelajuan pemotongan
[III] bahan mata alat
[IV] bahan benda kerja

The cutting condition that has the strongest effect on cutting temperature is
[I] feed rate
[II] speed
[III] tool material
[IV] work-piece material

...6/-

15. **Pemesinan pemukaan benda kerja sebagai sebahagian process pemesinan sering dilakukan pada mesin berikut:**
    [I] pembentuk
    [II] pelarik
    [III] pemilan
    [IV] pencanai

    Facing operations as part of machining process is (are) normally performed on the following machine(s):
    [I] planer
    [II] lathe
    [III] milling
    [IV] grinding

16. **Operasi memilan hujung paling mirip dengan**
    [I] memilan slab
    [II] memilan plain
    [III] memilan tepian
    [IV] memilan permukaan

    End milling is most similar to
    [I] slab milling
    [II] plain milling
    [III] peripheral milling
    [IV] face milling

17. **Keadaan pemotongan yang memberi kesan yang signifikan pada kehausan mata alat adalah:**
    [I] kelajuan pemotongan
    [II] dalaman pemotongan
    [III] kadar suapan
    [IV] bahan benda kerja

    The cutting condition(s) that has the significant effect on tool wear is:
    [I] cutting speed,
    [II] depth of cut
    [III] feed
    [IV] material of work-piece

18. **Fungsi utama cecair pemotongan dalam melarik ialah:**
    [I] mengalir keluar bahan serpihan
    [II] mengurang geseran
    [III] menambahkan kekemasan permukaan
    [IV] mengurangkan haba

...7/-

The main functions of cutting fluid in lathe work are:
[I] wash away chips
[II] reduce friction
[III] improve surface finish
[IV] remove heat

19. Kriteria yang menunjukkan keadaan boleh di mesin ialah :
[I] sudut satah ricih yang rendah
[II] hayat mata alat yang lama
[III] daya pemotongan tinggi
[IV] serpihan mudah dibuang

Criteria(s) used to indicate good machinability are:
[I] low shear plane angle
[II] longer tool life
[III] high cutting forces
[IV] ease of chip disposal

20. Semakin kecil saiz butir bahan lelas pada roda pencanai akan:
[I] mengurangkan kemasan permukaan
[II] memanjangkan hayat roda
[III] mematahkan mata alat
[IV] mencantikkan kemasan permukaan

The smaller the grain size of the abrasive material in a grinding wheel will tends to
[I] degrade surface finish
[II] increases tool life
[III] cause cutting tool breakage
[IV] improve surface finish

21. Keadaan yang akan meningkatkan kekemasan permukaan dalam pencanaian adalah:
[I] suapan dalam lebih besar
[II] pusingan roda lebih laju
[III] pusingan roda lebih perlahan
[IV] kelajuan benda kerja lebih rendah

The conditions that will improve surface finish in grinding are
[I] larger in-feed
[II] higher wheel speed
[III] lower wheel speed
[IV] lower work piece speed

22. Kerja kimpalan boleh dilakukan pada logam benda kerja yang
[I] mempunyai suhu lebur yang lebih rendah
[II] mempunyai suhu lebur yang lebih tinggi
[III] mempunyai suhu lebur yang sama
[IV] mulur

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Welding can be performed on work piece metals that
[I] have lower melting points
[II] have higher melting points
[III] have same melting points
[IV] are ductile

23. Ciri yang menentukan jumlah haba yang diperlukan bagi melebur sesuatu logam ialah
[I] pekali pengembangan terma
[II] haba pelakuran
[III] suhu lebur
[IV] keberaliran terma.

The properties that determine the amount of heat required to melt a given volume of metal are:
[I] coefficient of thermal expansion
[II] heat of fusion
[III] melting temperature
[IV] thermal conductivity

24. Kimpalan kambi boleh di gunakan bagi menyambung jenis sambungan berikut :
[I] temu
[II] tee
[III] tindih
[IV] bucu

Fillet weld can be used to join the following joint types
[I] butt
[II] tee
[III] lap
[IV] corner

25. Kaedah biasa yang diguna untuk membuat pengikat berbenang luaran adalah:
[I] tempaan
[II] pemesinan
[III] tuangan
[IV] tarikan

The common process to produce fasteners with external thread is (are):
[I] forging
[II] machining
[III] casting
[IV] drawing

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26. Antara Kaedah kimpalan keadaan pepejal adalah
[I] kimpalan geseran
[II] kimpalan bintik rintangan
[III] kimpalan gelek
[IV] kimpalan Thermit

Among solid states welding are:
[I] friction welding
[II] resistance spot welding
[III] roll welding
[IV] Thermit welding

27. Kelebihan pateri keras berbanding kimpalan adalah
[I] penyambungan logam yang berbeza
[II] kurang haba dan tenaga diperlukan
[III] penyambungan tunggal
[IV] penyambungan lebih kukuh

The advantage(s) of brazing to welding are:
[I] joining of dissimilar metals
[II] less heat and energy required
[III] single joining
[IV] stronger joint

28. Fungsi bahan lakur dalam kerja pateri ialah
[I] mengalakkan punaran kimia
[II] mengalakkan permukaan kerja menjadi "basah'
[III] melicinkan permukaan yang akan bersentuh
[IV] menyahkan atau menghalang terjadinya selaput oksida.

The function(s) of a flux in soldering are to
[I] promote chemical etching
[II] promote wetting of the surfaces,
[III] smoothen the faying surfaces
[IV] remove or inhibit oxide films formation

29. Sebab-sebab biasa bagi pengikat bebenang gagal semasa di ketatkan adalah
[I] tekanan keterlaluan dilakukan
[II] tegasan ricih keterlaluan berlaku pada bebenang
[III] tegasan tegangan keterlaluan
[IV] saiz tidak sesuai digunakan pada bebenang luaran atau bebenang dalaman

The common reason(s) for threaded fasteners failed during tightening are
[I] excessive pressure applied
[II] excessive shearing stresses on the threads
[III] excessive tensile stresses
[IV] inappropriate sizing of internal or external threads

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30. **Meningkatkan kelajuan pemotongan pada bahan kerja mulur sering akan :**
[I] mengurangkan kemasan permukaan
[II] mencantikkan kemasan permukaan
[III] mematahkan mata alat
[IV] memanjangkan hayat mata alat

Increasing the cutting speed for working ductile material will generally:
[I] degrade surface finish,
[II] improve surface finish
[III] cause cutting tool breakage
[IV] prolong tool life

31. **Manakah diantara logam-logam berikut adalah penghantar elektrik yang yang baik?**

[I] kuprum
[II] mas
[III] perak
[IV] tungsten

Which of the following metals prosess good electrical conductivity?
[I] copper
[II] gold
[III] silver
[IV] tungsten

32. **Apakah logam-logam yang selalunya digunakan sebagai bahan matrik di dalam MMCs bertetulang-gentian?**
[I] aluminum
[II] magnesium
[III] titanium
[IV] kuprum

Which of the following metals are most commonly used as the matrix material in fiber-reinforced MMCs?
[I] aluminum
[II] magnesium
[III] titanium
[IV] copper

33. **Manakah di antara berikut yang menerangkan penaik dalam penuangan?**
[I] logam yang bukan bahagian daripada penuangan,
[II] sumber daripada logam lebur untuk suapan penuangan dan terpampas untuk pengecutan semasa pemejalan, dan
[III] logam buangan yang dikitar semula
[IV] sistem penggetan di mana spru disuap terus ke dalam rongga,

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A riser in casting is described by which of the following?
[I] metal that is not part of the casting,
[II] source of molten metal to feed the casting and compensate for shrinkage during solidification, and
[III] waste metal that is usually recycled.
[IV] gating system in which the sprue feeds directly into the cavity,

34. Manakah di antara proses penuangan berikut adalah operasi acuan gunahabis?
[I] penuangan pasir,
[II] penuangan lilin,
[III] penuangan tekanan rendah,
[IV] acuan kelompang,

Which of the following casting processes are expendable mold operations?
[I] sand casting
[II] investment casting,
[III] low pressure casting,
[IV] shell molding,

35. Manakah di antara berikut yang merupakan proses penuangan tepat?
[I] penuangan jongkong,
[II] penuangan lilin,
[III] penuangan acuan lepa,
[IV] acuan kelompang.

Which of the following qualifies as a precision casting process?
[I] ingot casting,
[II] investment casting,
[III] plaster mold casting,
[IV] shell molding.

36. Diantara logam-logam berikut, apakah logam-logam yang biasanya digunakan untuk penuangan acuan?
[I] aluminum,
[II] tin,
[III] zink.
[IV] besi tuang,

Which of the following metals would typically be die casted?
[I] aluminum,
[II] tin,
[III] zinc.
[IV] cast iron,

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37. **Manakah diantara berikut merupakan kebaikan penuangan beracuan berbanding penuangan pasir?**
[I] kemasan permukaan yang bagus,
[II] kadar pengeluaran yang tinggi,
[III] acuan yang boleh digunakan semula.
[IV] bahagian produk yang lebih besar dapat dihasilkan,

Which of the following are advantages of die casting over sand casting?
[I] better surface finish,
[II] higher production rates,
[III] mold can be reused.
[IV] larger parts can be casted,

38. **Diantara bahagian-bahagian yang berikut, apakah bahagian-bahagian yang lazimnya merupakan tong penyemperit untuk termoplastik?**
[I] bahagian mampatan,
[II] bahagian suapan,
[III] bahagian permeteran,
[IV] bahagian pemanasan,

Which of the following are sections of a conventional extruder barrel for thermoplastics?
[I] compression section,
[II] feed section,
[III] metering section,
[IV] heating section,

39. **Manakah di antara berikut merupakan prinsip komponen mesin pengacuan suntikan?**

[I] unit pengapitan,
[II] corong tuang,
[III] unit suntikan,
[IV] acuan,

The principal components of an injection molding machine are which of the following?
[I] clamping unit,
[II] hopper,
[III] injection unit,
[IV] mold,

40. **Apakah kelebihan acuan tiga-plat apabila dibandingkan dengan acuan dua-plat?**
[I] pemisahan bahagian daripada *runner* secara automatik
[II] spru tidak memejal,
[III] mengurangkan garisan kimpalan melalui pengegetan pada dasar bahagian,

[IV] bahagian yang teracu lebih kuat,

...13/-

A three-plate mold offers which of the following advantages when compared to a two-plate mold?

[I] automatic separation of parts from runners,
[II] sprue does not solidify,
[III] gating is usually at the base of the part to reduce weld lines,
[IV] stronger molded parts,

41. Manakah di antara masalah kecacatan berikut berhubungkait dengan pengacuan suntikan?

[I] pembuluhan,
[II] das pendek,
[III] tanda-tanda lekuk.
[IV] kilat,

Which of the following defects or problems is associated with injection molding?

[I] bambooing,
[II] short shots,
[III] sink marks.
[IV] flash,

42. Manakah di antara sifat berikut dikategori sebagai bahagian plastik berbanding logam?

[I] rintangan hentaman,
[II] rintangan kepada radiasi ultraungu,
[III] nisbah kekuatan-berat,
[IV] kekuatan,

In which of the following property categories do plastic parts compare favorably with metals?

[I] impact resistance,
[II] resistance to ultraviolet radiation,
[III] strength-to-weight ratio,
[IV] strength,

43. Manakah di antara proses-proses berikut dihadkan kepada polimer termoplastik?

[I] pengacuan tiup,
[II] pengacuan mampatan,
[III] pembentukan berhaba,
[IV] tindakbalas pengacuan suntikan,

Which of the following processes are generally limited to thermoplastic polymers?

[I] blow molding,
[II] compression molding,
[III] thermoforming,
[IV} reaction injection molding,

...14/-

44. **Manakah di antara berikut yang tidak digunakan dalam memproses elastomer termoplastik?**
[I] pengacuan tiup,
[II] pengacuan mampatan,
[III] penyemperitan,
[IV] pemvulkanan.

Which of the following are not normally used in the processing of thermoplastic elastomers?
[I] blow molding,
[II] compression molding,
[III] extrusion,
[IV] vulcanization.

45. **Manakah di antara berikut mengklasifikasikan *Hand lay-up* yang umumnya dikategorikan sebagai proses pembentukan PMC?**
[I] pengacuan sentuh,
[II] proses pengacuan tertutup,
[III] proses pengacuan terbuka.
[IV] pengacuan mampatan,

Hand lay-up could be classified in the following general categories of PMC shaping processes?
[I] contact molding,
[II] closed mold process,
[III] open mold process.
[IV] compression molding,

46. **Kenalpasti manakah keadaan yang membuatkan kenyataan berikut adalah betul: Daripada berat untuk serbuk metalik yang diberi, jumlah luas permukaan serbuk adalah meningkat dengan:**
[I] saiz zarah yang kecil,
[II] faktor bentuk yang besar,
[III] kebulatan bentuk partikel
[IV] saiz zarah yang besar,

Identify which of the phrases make the following statement correct: For a given weight of metallic powders, the total surface area of the powders is increased by:
[I] smaller particle size,
[II] higher shape factor,
[III] sphericity of the particle form.
[IV] larger particle size,

47. **Manakah diantara kenyataan berikut adalah benar di dalam kontek serbuk metalik?**

[I] keliangan + faktor padatan = 1.0,
[II] faktor padatan = 1.0 - keliangan,
[III] faktor padatan = ketumpatan pukal/ketumpatan sebenar.
[IV] faktor padatan = - keliangan,

...15/-

Which of the following statements is correct in the context of metallic powders?
[I] porosity + packing factor = 1.0,
[II] packing factor = 1.0 - porosity,
[III] packing factor = bulk density/true density.
[IV] packing factor = - porosity,

48. **Manakah di antara proses-proses berikut merupakan kombinasi penekanan dan pensinteran terhadap serbuk logam?**
[I] penekanan panas,
[II] pensinteran bunga api,
[III] penekanan panas isostatik.
[IV] penekanan sejuk isostatik

Which of the following processes combines pressing and sintering of the metal powders?
[I] hot pressing,
[II] spark sintering,
[III] hot isostatic pressing.
[IV] cold isostatic pressing

49. **Manakah di antara rekabentuk berikut adalah sukar atau mustahil untuk dicapai dengan pensinteran dan penekanan?**
[I] lubang tepi,
[II] lubang bebenang,
[III] bucu luaran,
[IV] lubang berlangkah menegak,

Which of the following design features would be difficult or impossible to achieve by conventional pressing and sintering?
[I] side holes,
[II] threaded holes,
[III] outside rounded corners,
[IV] vertical stepped holes,

50. **Manakah di antara berikut merupakan bukan tujuan operasi kemasan untuk bahagian yang diperbuat daripada seramik baru?**
[I] mengenakan salutan permukaan,
[II] memperbaiki kemasan permukaan,
[III] work harden the surface
[IV] meningkatkan kejituan mendimensi,

Which of the following are not the purposes of finishing operations used for parts made of the new ceramics?
[I] apply a surface coating,
[II] improve surface finish,
[III] work harden the surface.
[IV] increase dimensional accuracy,

(200 markah)

...16/-

BAHAGIAN B

S1. **[a]** **Berapakah rintangan R wayar kuprum yang mempunyai panjang 10m dan garis pusat 0.10mm? (Kerintangan kuprum = 1.7×10^{-8} $\Omega m^2/m$).**

What is the resistance R of a length of copper wire whose length = 10m and diameter = 0.10mm? (Resistivity of copper = 1.7×10^{-8} $\Omega m^2/m$).

(10 markah)

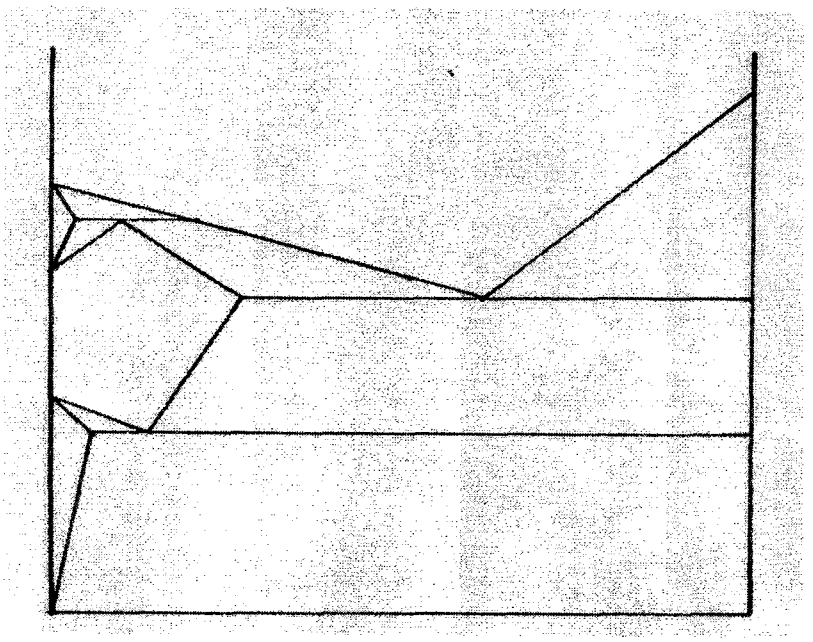
[b] **Dalam gambarajah fasa besi-besi karbida dalam Rajah S1[b] tentukan fasa-fasa yang wujud pada suhu dan kandungan karbon nominal yang berikut?**

(i) 650°C dan 2% C,
(ii) 760°C dan 2% C, dan
(iii) 1095°C dan 1% C.

In the iron-iron carbide phase diagram of Figure Q1[b] *identify the phases present at the following temperatures and nominal carbon contents?*

(i) 650°C and 2% C,
(ii) 760°C and 2% C, and
(iii) 1095°C and 1% C

(20 markah)



Rajah S1[b]
Figure Q1[b]

...17/-

[c] **Spru-turun mendulu ke dalam corong bagi sebuah acuan mempunyai panjang 175 mm. Luas keratan rentas bagi tapak spru 400 mm^2. Rongga acuan mempunyai isipadu 0.001 m^3.**
Tentukan:

(i) Halaju logam lebur yang mengalir melalui tapak spru-turun tersebut,
(ii) Kadar aliran isipadu, dan masa yang diperlukan untuk memenuhi rongga acuan.
(iii) Nyatakan mana-mana DUA anggapan yang dibuat dalam pengiraan.

The downsprue leading into the runner of a mold has a length 175 mm. The cross-sectional area at the base of the sprue is 400 mm^2. The mold cavity has a volume 0.001 m^3.
Determine:

(i) the velocity of the molten metal flowing through the base of the downsprue,
(ii) the volume rate of flow, and the time required to fill the mold cavity.
(iii) state any TWO assumption made in the equations used in your calculations.

(30 markah)

[d] **Operasi penuangan empar sebenar dilakukan secara mendatar dalam menghasilkan bahagian diameter tiub kuprum yang besar. Tiub tersebut mempunyai panjang 1.0 m, diameter 0.25 m, dan ketebalan dinding 15 mm. Jika laju putaran paip 700 rèv/min,**

(i) tentukan faktor-G untuk logam lebur.
(ii) Adakah laju putaran memadai untuk menghindari "hujan?"
(iii) Berapakah isipadu logam lebur yang harus dituang ke dalam acuan untuk mendapatkan penuangan jika pengecutan pemejalan dan pengecutan selepas pemejalan diambilkira?

True centrifugal casting operation is performed horizontally to make large diameter copper tube sections. The tubes have a length 1.0 m, diameter 0.25 m, and wall thickness 15 mm. If the rotational speed of the pipe 700 rev/min,

(i) determine the G-factor on the molten metal.
(ii) Is the rotational speed sufficient to avoid "rain?"
(iii) What volume of molten metal must be poured into the mold to make the casting if solidification shrinkage and contraction after solidification are considered?

(40 markah)

...18/-

Jadual S2[d] Pengecutan Isipadu Aneka Logam
Table Q2[d] The Volumetric Contraction for Various Metal

Metal	Volumetric contraction due to: Solidification Shrinkage, %	Solid Thermal Contraction, %
Aluminum	7.0	5.6
Al alloy (typical)	7.0	5.0
Gray cast iron	1.8	3.0
Gray cast iron, high C	0	3.0
Low C cast steel	3.0	7.2
Copper	4.5	7.5
Bronze (Cu-Sn)	5.5	6.0

S2. [a] Garispusat sebuah tong penyemperit ialah 65 mm dan panjangnya 1.75 m. Skru berputar pada 55 putaran/min. Kedalaman saluran skru ialah 5.0 mm, dan sudut 18°. Tekanan pada hujung acuan tong 5.0 x 10^6 Pa. Kelikatan polimer yang cair diberi sebagai 100 Pa saat. Dapatkan isipadu kadar aliran isipadu plastik di dalam tong tersebut.

The diameter of an extruder barrel is 65 mm and its length is 1.75 m. The screw rotates at 55 rev/min. The screw channel depth 5.0 mm, and the flight angle 18°. The head pressure at the die end of the barrel is 5.0 x 10^6 Pa. The viscosity of the polymer melt is given as 100 Pa s. Find the volume flow rate of the plastic in the barrel.

(20 markah)

[b] Sebuah tong penyemperit mempunyai garis pusat 120 mm dan panjang 3.0 m. Kedalaman saluran skru ialah 8.0 mm dengan pitch 95 mm. Kelikatan polimer cair ialah 75 Pa saat, dan tekanan pada hujung tong ialah 4.0 MPa. Berapakah halaju putar skru yang diperlukan untuk mencapai kadar aliran isipadu 90 cm^3/s?

An extruder barrel has a diameter of 120 mm and a length 3.0 m. The screw channel depth is 8.0 mm, and its pitch is 95 mm. The viscosity of the polymer melt is 75 Pa s, and the head pressure in the barrel is 4.0 MPa. What rotational speed of the screw is required to achieve a volumetric flow rate of 90 cm^3/s?

(30 markah)

...19/-

[c] **Operasi penyemperitan digunakan untuk menghasilkan parison yang mempunyai garis pusat min 27 mm. Garispusat dalam dan luar acuan yang menghasilkan parison tersebut masing-masing ialah 18 mm dan 22 mm. Jika ketebalan minimum dinding kontena tiub teracu adalah 0.40 mm, apakah garispusat maksimum yang mungkin bagi acuan tiub tersebut?**

An extrusion operation is used to produce a parison whose mean diameter is 27 mm. The inside and outside diameters of the die that produced the parison are 18 mm and 22 mm, respectively. If the minimum wall thickness of the blow molded container is to be 0.40 mm, what is the maximum possible diameter of the blow mold?

(20 markah)

[d] **Suatu kiub pepejal aluminium yang mempunyai sisi 1.0 m diubah kepada serbuk berbentuk sfera dengan pengabusan gas. Berapakah jumlah luas permukaan yang telah ditambah semasa pemprosesan jika garispusat setiap zarah adalah 100 mikron (anggap semua zarah mempunyai saiz yang sama)?**

A solid cube of aluminum with each side 1.0 m is converted into metallic powders of spherical shape by gas atomization. How much total surface area does the process add if the diameter of each particle is 100 microns (assume that all particles are the same size)?

(30 markah)

S3. [a] **Berikan DUA kelebihan dan DUA keburukan pada proses deformasi pukal pada logam secara kerja panas.**

Provide TWO advantages and TWO disadvantages of hot working for bulk deformation processes of metal.

(20 markah)

[b] **Berbantukan gambarajah, terangkan secara ringkas TIGA proses tempaan asas. Berikan SATU perbezaan di antara tiga jenis proses asas tempaan tersebut.**

With the aid of diagrams, explain briefly the THREE basic forging processes. Give ONE difference among the three basic type of forging.

(35 markah)

...20/-

[c] **Sebatang bar satu meter panjang berbentuk silinder disemperit tujuh kali menerusi satu set acuan penyemperitan berbentuk bulat di mana garispusat setiap acuan semakin berkurangan. Ini bertujuan untuk mengurangkan saiz bar tersebut berperingkat-peringkat. Setiap laluan acuan penyemperitan menyebabkan pengurangan sebanyak 35% pada keluasan pemukaan bar itu.**

i) Nyatakan DUA andaian anda
ii) Kira jumlah terikan sebenar yang digunakan
iii) Kira panjang akhir bar tersebut.

A one-meter length cylindrical bar is reduced in cross section by extruding it seven times through sets of round shaped dies of decreasing diameter. This is to reduce the bar in stages. Each pass of extrusion operation causes the reduction of the bar's cross sectional area by 35%.

i) Give TWO assumptions you will make:
ii) Calculate the applied total true strain
iii) Calculate the final length of the bar.

(45 markah)

S4. [a] **Terangkan secara ringkas DUA (2) kesan geseran antara mata alat dengan benda kerja semasa pelarikan, Cadangkan TIGA cara untuk mengurangkan kesan negatif geseran tersebut.**

Explain briefly TWO effects of friction between the tool tip and work piece during lathe work. Propose THREE methods to reduce its negative effect.

(25 markah)

[b] **Terangkan secara ringkas, dengan bantuan gambarajah, bagaimana rupa bentuk serpihan berubah dengan perubahan pada kelajuan pemotongan semasa operasi melarik.**

With the aid of diagram, explain briefly how chip/swarf formation changes with the change of cutting speed while turning operation is done.

(35 markah)

...21/-

[c] **Satu proses memilan dilakukan pada sebongkah keluli yang lebarnya 50 mm. Lapisan sebanyak 5.0 mm akan di buang dengan sekali laluan mata alat. Kadar suapan pemotongan adalah 2 mm/saat. Mata alat yang diguna bergarispusat 40 mm, dan mempunyai 10 bilah mata. Ia berputar pada kadar 150 PSM. Anda perlu:**

[i] Nyatakan DUA andaian yang akan di guna dalam pengiraan berikut.
[ii] Kira tebal serpih yang tak terbentuk
[iii] Kira kadar pembuangan bahan
[iv] Anggar kuasa yang diperlukan (watt)

A milling process is carried out on a 50 mm wide steel slab. 5.0 mm layer is to be removed in one pass of the tool. The cutting feed rate is 2 mm/second. The tool has of diameter is 40 mm and has 10 teeth. It rotates at 150 RPM. You have to:

[i] Provide TWO assumptions you would use for the following calculation
[ii] Calculate the undeformed chip thickness.
[iii] Calculate the metal removal rate
[iv] Estimates the power requirement (watt)

(40 markah)

S5. [a] **Nyatakan EMPAT keadaan dimana pengikat mekanikal merupakan pilihan lebih baik untuk menyambung dua atau lebih bahagian logam.**

Provide FOUR situations when mechanical fasteners are the better choice for joining two or more metal parts

(25 markah)

[b] **Terangkan secara ringkas proses pateri keras, proses kimpalan gas, dan proses pateri. Keterangan anda perlu menyatakan peralatan, ciri bahan benda kerja yang boleh sambung, sumber haba dan bagaimana proses tersebut dilakukan.**

Briefly explain the processes of brazing, gas welding and soldering. Your explanations should include the equipment used, the characteristics of the work-piece material to be joined, source of heat and the method in performing the process.

(40 markah)

...22/-

[iii] **Permukaan sebuah benda kerja menerima 3 kilojoule/saat dari satu punca haba ketika ia sedang dikimpal gas. Andaikan kawasan yang dipanaskan berbentuk bulat dan 60% dari haba tertumpu tersebut pada bulatan bergarispusat 3mm. Andaikan juga keamatan haba menurun jika garispusat kawasan permukaan meningkat dan ketumpatan kuasa minimum bagi melebur bahan kerja tersebut adalah 10 Watt/saat.**

(a) Kira ketumpatan kuasa dalam bulatan bergarispusat 3 mm tersebut.
(b) Kira garispusat maksimum untuk kawasan lebur logam itu.
(c) Beri SATU andaian untuk bahagian (b) di atas.

A metal part surface is transfers 3 kilojoules/sec from a heat source during a gas welding operation. Assume the heated area is circular and 60% of the heat is concentrated in a circular of 3mm diameter. Also assume that heat intensity decrease as the surface area diameter increase and the minimum power density to melt the metal is 10 w/mm2.

(a) Calculate the power density in the 3mm diameter circle.
(b) Calculate the maximum diameter for the metal to melt
(c) Give ONE assumption for part (b) above.

(35 markah)

-oooOOOooo-

$\sigma_e = \frac{F}{A_o}$	$e = \frac{L - L_o}{L_o}$	$\sigma_e = E\ell$	$EL = \frac{L_f - L_o}{L_o}$	$AR = \frac{A_o - A_f}{A_o}$
$\sigma = \frac{F}{A}$	$\epsilon = \int_{L_o}^{L} \frac{dL}{L} = \ln\frac{L}{L_o}$	$\epsilon = \ln(1+\ell)$	$\sigma = \sigma_e(1+\ell)$	$\tau = \frac{F}{A}$
$\gamma = \frac{\delta}{b}$	$\tau = \frac{T}{2\pi R^2 t}$	$\gamma = \frac{R\alpha}{L}$	$\tau = G\gamma$	$\gamma = \frac{dv}{dy}$
$HB = \frac{2F}{\pi D_b(D_b - \sqrt{D_b^2 - D_i^2})}$		$HV = \frac{1.854F}{D^2}$	$HK = 14.2\frac{F}{D^2}$	$TS = K_h(HB)$
$\eta = \frac{\tau}{\dot{\gamma}}$	$L_2 - L_1 = \alpha L_1(T_2 - T_1)$		$H = C\,W\,(T_2 - T_1)$	
$K = \frac{k}{\rho C}$	$dm = -D\left(\frac{dc}{dt}\right)Adt$	$I = \frac{E}{R}$	$R = r\frac{L}{A}$	$h_1 = \frac{v_2^2}{2g}$
L phase propotion $= \frac{CS}{(CS + CL)}$		S phase propotion $= \frac{CL}{(CS + CL)}$		$v = \sqrt{2gh}$
$H = \rho V\{C_s(T_m - T_o) + H_f + C_l(T_p - T_m)\}$			$Q = v_1 A_1 = v_2 A_2$	$V = \frac{\pi D^2 h}{4}$
$h_1 + \frac{p_1}{\rho} = \frac{v_1^2}{2g} + F_1 = h_2 + \frac{P_2}{\rho} + \frac{v_2^2}{2g} + F_2$			$MFT = \frac{V}{Q}$	$F_b = W_m - W_c$
$TST = C_m\left(\frac{V}{A}\right)^n$		$A = \pi Dh + \frac{2\pi D^2}{4}$		$F = \frac{mv^2}{R}$
$GF = \frac{F}{W} = \frac{mv^2}{Rmg} = \frac{v^2}{Rg}$		$v = \frac{\pi RN}{30}$	$N = \frac{30}{\pi}\sqrt{\frac{2gGF}{D}}$	$\tau = \eta\dot{\gamma}$
$N = \frac{30}{\pi}\sqrt{\frac{2gL}{R_t^2 - R_b^2}}$		$\tau = k(\gamma)^n$	$r_s = \frac{D_x}{D_d}$	$\tan A = \frac{p}{\pi D}$
$Q_d = 0.5vdw$	$v = \pi DN\cos A$	$w = w_c = (\pi D\tan A - w_f)\cos A$		$Q_x = Q_d - Q_b$
$Q_d = 0.5\pi^2 D^2 N d_c \sin A\cos A$		$Q_b = \frac{p\pi D d_c^3 \sin^2 A}{12\eta L}$		$Q_x = K_s p$
$Q_{max} = 0.5\pi^2 D^2 N d_c \sin A\cos A$		$p_{max} = \frac{6\pi DNL\eta\cot A}{d_c^2}$		$K_s = \frac{\pi D_d^4}{128\eta L_d}$
$D_c = D_p + D_p S + D_p S^2$		$r_{sd} = \frac{D_p}{D_d}$	$r_{st} = \frac{t_p}{t_d}$	$r_{st} = r_{sd}^2$
$t_m = \frac{D_p t_p}{D_m}$	$t_m = \frac{r_{sd}^3 t_d D_d}{D_m}$	$\sigma = \frac{pD}{2t}$	$p = \frac{2\sigma t_m}{D_m}$	$PS = \frac{1}{MC} - t_w$
$A = \pi D^2$	$V = \frac{\pi D^3}{6}$	$\frac{A}{V} = \frac{6}{D}$	$K_s = \frac{AD}{V}$	$F = A_p P_c$

$\sigma = K\epsilon^n$	$Y_f = K\epsilon^n$	$\bar{Y}_f = \frac{K\epsilon^n}{1+n}$	$\dot{\epsilon} = \frac{v}{h}$	$Y_f = C\dot{\epsilon}^m$
$Y_f = A\epsilon^n\dot{\epsilon}^m$	$d = t_o - t_f$	$r = \frac{d}{t_o}$	$t_o w_o L_o = t_f w_f L_f$	$t_o w_o v_o = t_f w_f L_f$
$s = \frac{v_f - v_r}{v_r}$	$\epsilon = \ln\frac{t_o}{t_f}$	$\bar{Y}_f = \frac{K\epsilon^n}{1+n}$	$d_{max} = \mu^2 R$	$F = w\int_0^L pdL$
$F = \bar{Y}_f wL$	$L = \sqrt{R(t_o - t_f)}$	$T = 0.5FL$	$P = 2\pi NFL$	$\epsilon = \ln\frac{h_o}{h}$
$F = Y_f A$	$F = K_f Y_f A$	$K_f = 1 + \frac{0.4\mu D}{h}$	$r_x = \frac{A_o}{A_f}$	$\epsilon = \ln r_x = \ln\frac{A_o}{A_f}$
$p = \bar{Y}_f \ln r_x$	$\epsilon_x = a + b\ln r_x$	$p = Y_f \epsilon_x$	$\frac{p_f \pi D_o^2}{4} = \mu p_c \pi D_o L$	$\mu p_c \pi D_o L = Y_s \pi D_o L$
$p_f = \bar{Y}_f \frac{2L}{D_o}$	$p = \bar{Y}_f\left(\epsilon_x + \frac{2L}{D_o}\right)$		$F = pA_o$	$P = Fv$
$K_x = 0.98 + 0.02\left(\frac{C_x}{C_c}\right)^{2.25}$	$p = K_x \bar{Y}_f$		$p = K_x \bar{Y}_f\left(\epsilon_x + \frac{2L}{D_o}\right)$	
$r = \frac{A_o - A_f}{A_o}$	$\epsilon = \ln\frac{A_f}{A_o} = \ln\frac{1}{1-r}$		$\sigma = \bar{Y}_f \epsilon = \bar{Y}_f \ln\frac{A_o}{A_f}$	$\phi = 0.88 + 0.12\frac{D}{L_c}$
$\sigma_d = \bar{Y}_f\left(1 + \frac{\mu}{\tan\alpha}\right)\phi\frac{A_o}{A_f}$	$D = \frac{D_o + D_f}{2}$		$L_c = \frac{D_o - D_f}{2\sin\alpha}$	$F = StL$
$F = A_f\sigma_d = A_f\bar{Y}_f\left(1 + \frac{\mu}{\tan\alpha}\right)\phi\ln\frac{A_o}{A_f}$			$c = at$	$F = 0.7TStL$
$BA = 2\pi\frac{A}{360}(R + K_{ba}t)$	$SB = \frac{A' - A_b'}{A_b'}$		$F = \frac{K_{bf}TSwt^2}{D}$	$c = 1.1t$
$DR = \frac{D_b}{D_p}$	$r = \frac{D_b - D_p}{D_b}$	$F = \pi D_p t(TS)\left(\frac{D_b}{D_p} - 0.7\right)$		$F = LtY_f$
$F_h = 0.015Y\pi\left\{D_b^2 - \left(D_p + 2.2t + 2R_d\right)^2\right\}$			$t_f = t\sin\alpha$	$r = \frac{t - t_f}{t}$
$MRR = vfd$	$r = \frac{t_o}{t_c}$	$r = \frac{l_s\sin\phi}{l_s\cos(\phi - \alpha)} = \frac{\sin\phi}{\cos(\phi - \alpha)}$		$\tan\phi = \frac{r\cos\alpha}{1 - r\sin\alpha}$
$\gamma = \frac{AC}{BD} = \frac{AD + DC}{BD}$		$\gamma = \tan(\phi - \alpha) + \cot\phi$		$\mu = \tan\beta$
$S = \frac{F_s}{A_s}$	$A_s = \frac{t_o w}{\sin\phi}$	$\mu = \frac{F}{N}$	$P_c = F_c v$	$HP_c = \frac{F_c v}{33000}$
$F_c = \frac{St_o w\cos(\beta - \alpha)}{\sin\phi\cos(\phi + \beta - \alpha)} = \frac{F_s\cos(\beta - \alpha)}{\cos(\phi + \beta - \alpha)}$			$HP_g = \frac{HP_c}{E}$	$T = \frac{0.4U}{\rho C}\left(\frac{vt_o}{K}\right)^{0.333}$

$F_t = \frac{St_o w \sin(\beta-\alpha)}{\sin\phi\cos(\phi+\beta-\alpha)} = \frac{F_s \sin(\beta-\alpha)}{\cos(\phi+\beta-\alpha)}$		$\tau = \frac{F_c\cos\phi - F_t\sin\phi}{(t_o w/\sin\phi)}$	
$P_u = \frac{P_c}{MRR} = U$	$N = \frac{v}{\pi D_o}$	$D_o - D_f = 2d$	$f_r = Nf$
$T_m = \frac{L}{f_r} = \frac{d}{f_r}$	$MRR = vfd$	$T_m = \frac{t+A}{f_r}$	$MRR = \frac{\pi D^2 f_r}{4}$
$A = 0.5D\tan\left(90 - \frac{\theta}{2}\right)$	$f_r = Nn_t f$	$MRR = wd f_r$	$A = \sqrt{d(D-d)}$
$vT^n = C(T_{ref}{}^n)$	$V T^n f^m d^p H^q = KT_{ref}{}^n f_{ref}{}^m d_{ref}{}^p H_{ref}{}^q$	$f_r = \pi D_r N_r \sin I$	$R_i = \frac{f^2}{32NR}$
$R_i = \frac{0.125 f^2}{(D/2) \pm (fn_t/\pi)}$	$T_c = T_h + T_m + \frac{T_t}{n_p}$	$T_m = \frac{\pi DL}{vf}$	$n_p = \frac{T}{T_m}$
$n_p = \frac{fC^{1/n}}{\pi DLv^{1/n-1}}$	$T_c = T_h + \frac{\pi DL}{fv} + \frac{T_t(\pi DLv^{1/n-1})}{fC^{1/n}}$	$v_{\max} = \frac{C}{\left[\left(\frac{1}{n}-1\right)T_t\right]^n}$	$T_{\max} = \left(\frac{1}{n}-1\right)T_t$
$C_t = \frac{P_t}{n_e}$	$C_c = C_o T_h + C_o T_m + \frac{C_o T_t}{n_p} + \frac{C_t}{n_p}$	$C_t = \frac{P_t}{n_g} + T_g C_g$	$MRR = v_w wd$
$v_{\min} = C\left(\frac{n}{1-n}\cdot\frac{C_o}{C_o T_t + C_t}\right)^n$	$T_{\min} = \left(\frac{1}{n}-1\right)\left(\frac{C_o T_t + C_t}{C_o}\right)$	$v = \pi DN$	$l_c = \sqrt{Dd}$
$n_c = vwC$	$r_g = \frac{w'}{t}$	$U = \frac{F_c v}{v_w wd}$	$F_c' = K_1\left(\frac{r_g v_w}{vC}\right)^{0.5}\left(\frac{d}{D}\right)^{0.25}$
$GR = \frac{V_w}{V_g}$	$V = CIt$	$V = \frac{C(EAt)}{gr}$	$MRR = \frac{KI}{T_m{}^{1.23}}$ $f_r = \frac{CI}{A}$
$I = \frac{EA}{gr}$	$R = \frac{gr}{A}$	$p_f = \frac{Ei(D_c^2 - D_p^2)}{D_p D_c^2}$	$PD = \frac{f_1 EI}{A}$ $F_e = \frac{d}{u}$
$PD = \frac{P}{A}$	$H R_w = U_m A_w v = f_1 f_2 HR = f_1 f_2 IE$	$T = C_t DF$	$H_w = U_m V$
$U_m = KT_m{}^2$	$H = I^2 Rt$	$A_s = 0.25(D - 0.9382p)^2$	$D_2 - D_1 = \alpha D_1(T_2 - T_1)$
$H_w = f_1 f_2 H$	$\sigma = \frac{F}{A_s}$	$A_s = 0.25\left(D - \frac{0.9743}{n}\right)^2$	$Max\ \sigma_e = \frac{2p_f D_c^2}{D_c^2 - D_p^2}$