
UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2016/2017 Academic Session

June 2017

EKC 377 – Renewable and Alternative Energies
[Tenaga-Tenaga Alternatif dan Boleh Diperbaharu]

Duration : 3 hours
[Masa : 3 jam]

Please ensure that this examination paper contains SEVEN printed pages before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi TUJUH muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instruction: Answer **ALL** (4) questions.

Arahan: Jawab **SEMUA** (4) soalan.]

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai].

Answer ALL questions.

1.
 - [a] What govern the choices of energy source whereby certain form of energy is more preferred than the other as example gasoline for car and wood for fireplace?

[3 marks]
 - [b] Energy utilization rate is increasing at a tremendous rate even though technological advances are creating a much more efficient process of energy utilization and storage. Discuss the reasons behind this increase.

[6 marks]
 - [c] Consider a flat-plate collector from Company A having a $\rho = 0.362$ and an evacuated tube collector from Company B with $\rho = 0.689$.
 - [i] Draw a diagram and derive the heat balance on a solar water heat collector.

[4 marks]
 - [ii] Assuming the thermal resistance and total surface are the same for both the collector, determine which of the above collector has the superior application in a location where the irradiance is 1000 W/m^2 , and in a location where it is only 250 W/m^2 .

[6 marks]
 - [iii] Explain which of the solar collector would you choose based on the answer above.

[2 marks]
 - [d] Explain how a large scale solar power plant is able to operate for hours after the sun has set. Give one example of how it is able to do so.

[4 marks]
2.
 - [a] What are the impacts of photovoltaic cell towards our environment?

[4 marks]
 - [b] Gives 3 reasons that contribute to the lower efficiency of a photovoltaic cell performance.

[3 marks]
 - [c] Discuss the both advantages and disadvantages of a fuel cell?

[4 marks]
 - [d] What are the concerns of hydrogen fuel cell technology at the present time?

[4 marks]

Jawab SEMUA soalan.

1. [a] *Apakah yang menjadi penentu pilihan sumber tenaga di mana bentuk tertentu tenaga lebih diutamakan daripada yang lain sebagai contoh petrol untuk kereta dan kayu untuk pembakaran?*
[3 markah]
- [b] *Kadar penggunaan tenaga telah meningkat pada kadar yang pesat walaupun kemajuan teknologi penciptaan proses dalam penggunaan dan penyimpanan tenaga lebih cekap. Bincangkan beberapa sebab di sebalik peningkatan ini.*
[6 markah]
- [c] *Pertimbangkan pengumpul rata plat dari Syarikat A mempunyai $\rho = 0.362$ dan pengumpul tiub vakum dari Syarikat B dengan $\rho = 0.689$.*
- [i] *Lukiskan rajah dan perolehi keseimbangan haba pada pengumpul haba air solar.*
[4 markah]
- [ii] *Dengan andaian rintangan haba dan jumlah permukaan adalah sama untuk kedua-dua pengumpul, tentukan pengumpul yang mempunyai kecekapan yang lebih tinggi di lokasi sinaran 1000 W/m^2 dan 250 W/m^2 .*
[6 markah]
- [iii] *Jelaskan pengumpul solar yang akan anda pilih berdasarkan jawapan di atas.*
[2 markah]
- [d] *Terangkan bagaimana loji tenaga suria berskala besar dapat beroperasi berjam-jam selepas matahari terbenam. Beri satu contoh bagaimana ia mampu untuk berbuat demikian.*
[4 markah]
2. [a] *Apakah impak-impak sel fotovoltik terhadap alam sekitar?*
[4 markah]
- [b] *Berikan 3 sebab yang menyumbang kepada kecekapan lebih rendah terhadap prestasi sel fotovoltik*
[3 markah]
- [c] *Bincangkan kelebihan dan keburukan sel bahan api?*
[4 markah]
- [d] *Apakah yang perlu diberi perhatian terhadap teknologi sel bahan api hidrogen pada masa ini?*
[4 markah]

- [e] Ethanol had been used to refuel a Direct Methanol Fuel Cell (DMFC).
- [i] What is your opinion on ethanol as an alternative fuel in the fuel cell?
[3 marks]
 - [ii] What are the reactions at the anode and cathode and the overall reaction when ethanol was used as fuel?
[3 marks]
 - [iii] What are your opinions on the fuel cross over phenomena when ethanol is used and how will it affect the efficiency of the fuel cell?
[4 marks]
3. [a] Briefly discuss what biomass is and the major six categories of biomass resources.
[7 marks]
- [b] [i] Sketch and describe an updraft fixed bed gasifier used in biomass conversion process.
[10 marks]
- [ii] What are the advantages and disadvantages for this type of gasifier compare to a downdraft fixed bed gasifier?
[4 marks]
- [c] Briefly discuss the following biomass properties :
- [i] Intrinsic moisture
[1 mark]
 - [ii] Extrinsic moisture
[1 mark]
 - [iii] Fixed carbon content
[1 mark]
 - [iv] Alkali metal content
[1 mark]

- [e] *Etanol telah digunakan untuk mengisi minyak sel bahan api metanol langsung (DMFC).*
- [i] *Apakah pendapat anda mengenai etanol sebagai bahan api alternatif dalam sel bahan api?* [3 markah]
- [ii] *Apakah tindak balas di anod dan katod serta tindak balas keseluruhan apabila etanol digunakan sebagai bahan api?* [3 markah]
- [iii] *Apakah pandangan anda mengenai fenomena “fuel cross over” apabila etanol digunakan dan bagaimana ia akan memberi kesan kepada kecekapan sel bahan api?* [4 markah]
3. [a] *Bincangkan secara ringkas apakah biojisim dan enam kategori utama sumber biojisim.* [7 markah]
- [b] [i] *Lakar dan terangkan suatu penggegas lapisan tetap arus menaik yang digunakan dalam proses penukaran biojisim.* [10 markah]
- [ii] *Apakah kelebihan dan kelemahan jenis penggegas ini berbanding dengan penggegas lapisan tetap arus menurun?* [4 markah]
- [c] *Bincangkan secara ringkas sifat-sifat biojisim berikut :*
- [i] *Kelembapan intrinsik* [1 markah]
- [ii] *Kelembapan ekstrinsik* [1 markah]
- [iii] *Kandungan karbon tetap* [1 markah]
- [iv] *Kandungan logam alkali* [1 markah]

4. One of the main motivation for the development of biofuels is the escalating price of Brent Crude Oil (*BCO*). However, the price of *BCO* has decreased from peak, sometime in Year 2008 when it was above US\$ 130 per barrel until about US\$ 30 per barrel in early-2016. In the beginning of 2017, the price of *BCO* has slightly recovered to about US\$ 50 per barrel. Based on statements above, answer the following questions :

[a] Define biofuel and give two examples of liquid biofuel that are currently being commercially used.

[4 marks]

[b] Biofuels have evolved from first to second and third generation.

[i] Define first, second and third generations of biofuel.

[2 marks]

[ii] Briefly discuss the advantages and disadvantages of the various generations of biofuels.

[6 marks]

[c] How do you think the drop in the price of *BCO* will affect the development of biofuels?

[4 marks]

[d] From environmental point of view, do you think the use of biofuels has superiority as compared to *BCO* as a source of energy?

[4 marks]

[e] What can you comment on the development of liquid biofuels in Malaysia?

[5 marks]

4. *Salah satu faktor utama yang menggalakkan perkembangan tenaga-bio adalah peningkatan harga Minyak Mentah Brent (MMB). Walau bagaimanapun, harga MMB telah jatuh daripada paras tertinggi dalam tahun 2008 apabila didagang pada harga melebihi US\$ 130 per-tong ke US\$ 30 per-tong pada awal tahun 2016. Pada awal tahun 2017, harga MMB telah pulih kembali ke sekitar US\$ 50 per-tong. Berdasarkan kenyataan di atas, jawab soalan-soalan berikut :*

[a] Berikan takrifan tenaga-bio dan nyatakan dua contoh tenaga-bio cecair yang kini digunakan secara komersil.

[4 markah]

[b] Tenaga-bio telah berkembang daripada generasi pertama ke kedua dan seterusnya ketiga.

[i] Takrifkan tenaga-bio generasi pertama, kedua dan ketiga.

[2 markah]

[ii] Bincangkan secara ringkas kelebihan dan kekurangan tenaga-bio bagi setiap generasi

[6 markah]

[c] Pada pandangan anda, bagaimanakah penurunan harga MMB akan memberi kesan terhadap perkembangan tenaga-bio?

[4 markah]

[d] Daripada perspektif alam sekitar, adakah anda setuju dengan pandangan bahawa penggunaan tenaga-bio adalah lebih baik daripada MMB sebagai sumber tenaga?

[4 markah]

[e] Apakah komen anda terhadap perkembangan tenaga-bio cecair di Malaysia?

[5 markah]