



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018**

COURSE NAME : ELECTRIC POWER GENERATION
COURSE CODE : BEF 34303
PROGRAMME CODE : BEV
EXAMINATION DATE : JUNE/JULY 2018
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

- Q1** (a) Wind power is the conversion of wind energy into electrical energy using wind turbines.
- (i) Draw and label the turbine power output characteristics. (3 marks)
 - (ii) Differentiate **two (2)** advantages and disadvantages of horizontal and vertical turbine arrangement. (4 marks)
 - (iii) Determine the power generated by wind based on the following data:
 - Wind speed = 15 m/s
 - Blade length = 45 m
 - Air density = 1.20 kg/m³
 - Power coefficient = 0.4
 (3 marks)
- (b) The storage of electricity offers significant benefits for the generation, distribution and use of electrical power.
- (i) Describe **two (2)** advantages of energy storage in power system application. (4 marks)
 - (ii) Demonstrate the basic operation of pump storage hydro power system. (4 marks)
 - (iii) Justify the effectiveness of the method in **Q1(b)(ii)**. (2 marks)
- Q2** (a) Solar energy can be used to generate electricity by exploiting the heat contained in the sun's radiation.
- (i) Distinguish **two (2)** main features of photovoltaic and solar thermal generation. (4 marks)
 - (ii) By using a diagram, explain the working principle of the photovoltaic cell. (4 marks)
 - (iii) Draw the equivalent circuit of the solar cell. (2 marks)
 - (iv) Construct an electrical connection of standalone photovoltaic system. (4 marks)

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- (b) (i) List down **four (4)** main sources of biomass. (2 marks)
- (ii) Propose **two (2)** solutions in order to improve the efficiency of biomass system. (4 marks)

Q3 (a) Fuel cell is an electrochemical device, closely related to the battery, which harnesses a chemical reaction between two reagents to produce electricity.

- (i) Draw the principle of fuel cell system. (3 marks)
- (ii) Compare the chemical reaction happen in anode and cathode including the chemical formula. (4 marks)
- (iii) Choose a suitable fuel cell for lower temperature range (50°C to 100°C). (2 marks)

(b) Ocean energy is one of the renewable energy harnessed from the ocean.

- (i) List down **three (3)** types of technologies that can be used to extract oceans energy. (3 marks)
- (ii) Differentiate the harnessing strategies of the technologies in **Q3(b)(i)**. (6 marks)
- (iii) Select **two (2)** devices that can be used to extract wave energy at shore and offshore. (2 marks)

Q4 (a) There are several ways that can be utilized to convert the geothermal energy into electricity.

- (i) Describe the geothermal energy and its location. (2 marks)
- (ii) Distinguish the main features of the direct-steam power plant and flash-steam power plant. (6 marks)

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- (iii) Suggest a suitable geothermal power plant for low temperature range (85°C to 170°C).
(2 marks)
- (b) Municipal and industrial waste can be converted into electricity by using combustion power plant.
- (i) Justify the importance of converting waste into electricity.
(2 marks)
- (ii) Discuss the main process of traditional combustion plant in **Figure Q4(b)(ii)**.
(4 marks)
- (iii) Investigate main features of Refuse Derived Fuel (RDF) in order to ensure that it can be burnt easily in combustion boiler.
(4 marks)
- Q5** (a) (i) Illustrate the nuclear fission which occur during energy generation and write the related equations.
(3 marks)
- (ii) Draw and label the main components of nuclear reactor.
(3 marks)
- (iii) Evaluate the advantages and disadvantages of the nuclear power plant.
(4 marks)
- (b) A power reactor can deliver 500 MW. If the fission of each atom of U_{92}^{235} can release the energy of 300 MeV and Avogadro's constant is 6.023×10^{23} atoms per mole, calculate
- (i) the mass of uranium fissioned per hour.
(6 marks)
- (ii) the energy generated if 1 kg of uranium used in the fission process.
(4 marks)

- END OF QUESTIONS -

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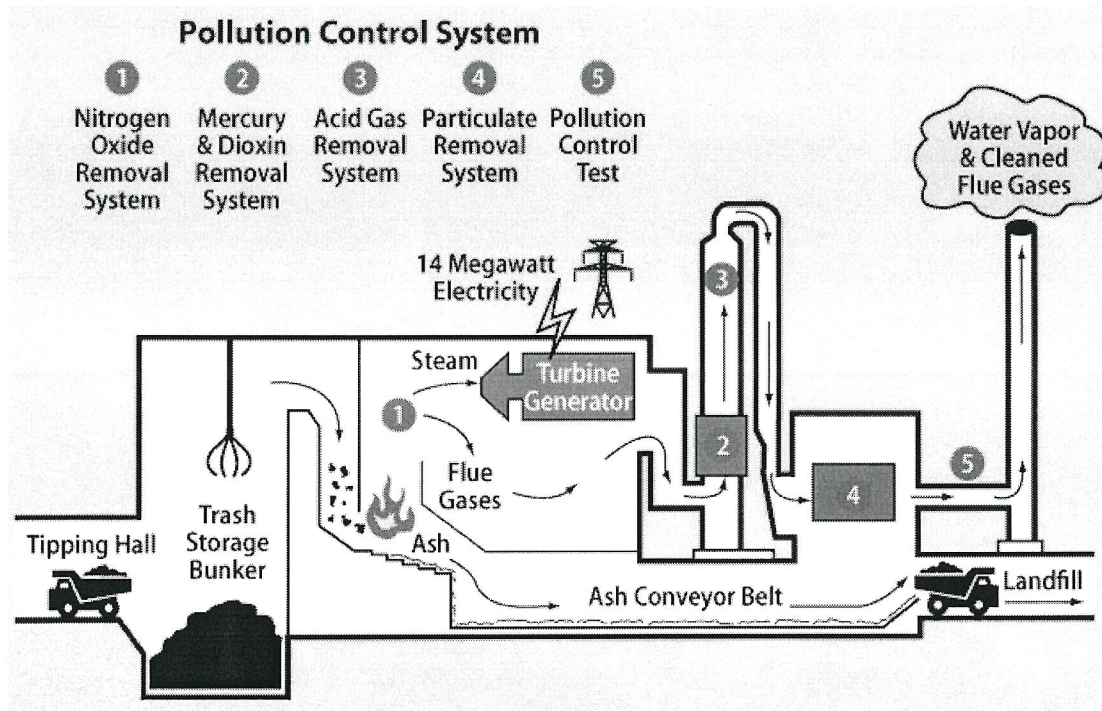


Figure Q4(b)(ii)

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