UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	ELECTRIC POWER GENERATION
COURSE CODE	:	BEF 34303 / BEK 4243
PROGRAMME	:	BEF / BEE
EXAMINATION DATE	:	JUNE 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1   (a)   A modern complex interconnected power system can be subdivided into four (4) major parts. List down all those parts.

(2 marks)

(b)   The capital cost of a hydro-power station of 50 MW capacity is RM 1,000 per kW. The annual depreciation charges are 10% of the capital cost. A royalty of RM 1 per kW per year and RM per kWh generated is to be paid for using the river water for generation of power. The maximum demand on the power station is MW and annual load factor is 60%. Annual cost of salaries, maintenance charges etc. is RM 700, 000. If 20% of this expense is also chargeable as fixed charges, formulate the generation cost in two part form.

(12 marks)

(c)   List down two (2) types of advanced coal-burning power plant technologies. In your opinion, which type is more preferable and justify your choice.

(5 marks)

(d)   Engineers have explored many strategies that can be applied to traditional turbines in order to provide significant performance enhancements. Design and explain the reheating process for advanced gas turbine.

(4 marks)

(e)   Recommend two (2) methods that can be implemented in order to control sulphur emissions for piston engine power plant.

(2 marks)

Q2   (a)   The first stage in building a hydropower plant is to find a suitable site. This may appear obvious, but it is important to realise that hydropower is site specific. However, it does not only depend on suitable site being available but the nature of the project will also depend on the topography of the site.

(i)   As a project manager, decide the main points that should be taken into account while selecting the site for new hydropower plant project.

(8 marks)

(ii)   A hydropower plant is supplied from a reservoir of capacity 8×10^6 cubic meter at a head of 300 meter. Calculate the total energy available in kWh if the overall efficiency is 70%.

(3 marks)

(b) Pressures for land use and concerted campaigns to prevent the construction of wind farms are forcing wind farm developers in western Europe to consider building wind farms offshore. Evaluate the advantages and disadvantages of the offshore wind technology.

(6 marks)

(c) The solar cell exploits a completely different means of converting sunlight into electricity. This depends on the physical characteristics of materials called semiconductor. Point out three (3) steps on solar cell works to produce electricity.

(6 marks)

(d) Differentiate between biomass and coal in terms of environmental considerations.

(2 marks)

Q3 (a) Sketch a diagram and explain the principle of fuel cell including the simple chemical formula occurred at anode and cathode in order to produce electricity.

(10 marks)

(b) Cold seawater is an integral part of each of the three types of ocean thermal energy conversion (OTEC). Decide which type of OTEC systems that produces desalinized fresh water that suitable for drinking water and explain the process of generating electricity for the chosen system.

(9 marks)

(c) There are three principle ways of converting geothermal energy into electricity. Each is designed to exploit a specific type of geothermal resource.

(i) Define geothermal energy and where it can be found.
(ii) Decide which type of geothermal power plants that suitable for low temperature geothermal field and justify your answer.

(6 marks)

Q4 (a) The generation of power waste is a very specialised industry and its principal aim is not to produce electricity. Hence, describe the main purpose of power-from-waste plant.

(2 marks)

(b) Nuclear power is the most controversial of all the forms of power generation. To evaluate its significance involves weighing political, strategic, environmental, economic and emotional factors which attract partisan views far more strident that any other method of electricity generation.

(i) In terms of people and environment, predict the point of view from the opponent side regarding nuclear power.

(ii) An atomic power reactor can deliver 300 MW. If due to fission of each atom of $_{92}U^{235}$, the energy released is 200 MeV, calculate the mass of uranium fissioned per hour. Avogadro's number is 6.023×10^{23}.

(10 marks)

(c) The most widespread large-scale electricity storage technology is pumped storage hydropower. This is also the oldest storage technology in use, with the first plant built at the beginning of the twentieth century.

Draw the cross section diagram and explain in details on:
(i) The principle of pumped storage hydropower operation generating the electricity.
and evaluate:
(ii) The plant design which will provide the most efficient and cheapest operation.
(iii) Types of turbines that suited for the plant.

(13 marks)

- END OF QUESTIONS -