RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Third Year - Semester I Examination – November/December 2016

PHY 3207 - ENERGY RESOURCES

Time: Two (2) hours

Answer **all four** questions
The use of a non-programmable electronic calculator is permitted.

1.

a. Write a short essay on world energy consumption and supply?

(40 marks)

b. Describe renewable energy and nonrenewable energy resources?

(20 marks)

c. A petrol car can run 10 km per one liter of petrol. The density of petrol is 0.74 kg l^{-1}. Assume, petrol contains octane (C_8H_{18}) only. How many kilograms of carbon dioxide are released the air when the car travels 100 km?

(The molar masses of carbon and hydrogen are 12 g mol^{-1} and 1 g mol^{-1} respectively).

(40 marks)

2.

a. What are the common conditions needed for the formation of fossil fuels?

(20 marks)

b. What are the major mining methods used in coal mining.

(20 marks)

c. Describe the petroleum (Oil) refining process using relevant diagrams.

(40 marks)

d. What do you mean by cracking and alkylation?

(20 marks)

3.

a. Prove that the discharge current of a battery is given by $\frac{V_{oc}}{R_{int} + R_{ext}}$, where V_{oc}, R_{int} and R_{ext} are the open circuit voltage, the apparent internal resistance of the battery and the load resistance of the external circuit.

(20 marks)

b. Prove that the power delivered by the battery during the discharge is $\frac{V_{oc}^{\ 2} R_{ext}}{(R_{int} + R_{ext})^2}$.

(20 marks)

c. A battery of open circuit voltage 6 V is connected to a load resistor with a resistance of 11 Ω. There is a 0.5 A current through the load resistor. Calculate the internal resistance of the battery.

(15 marks)

d. Calculate the power dissipated by the battery.

(15 marks)

e. Name three advantages of fuel cells over other types of energy conversion devices.

(15 marks)

f. Name five types of Fuel cells.

(15 marks)

4.

a. Briefly explain the general mechanism of a solar cell.

(40 marks)

b. Figure 1 shows a current density (J mA cm^{-2}) versus voltage (cell potential) curve for a solar cell under 1000 W m^{-2} light irradiation. The maximum power point is marked on the graph. Calculate following parameters of this solar cell.

i. The open circuit voltage of the cell.

ii. The short circuit current density of the cell.

iii. The maximum theoretical power density of the cell.

iv. The maximum power density of the cell.

v. The fill factor of the cell.

vi. The efficiency of the cell.

(60 marks)

c.

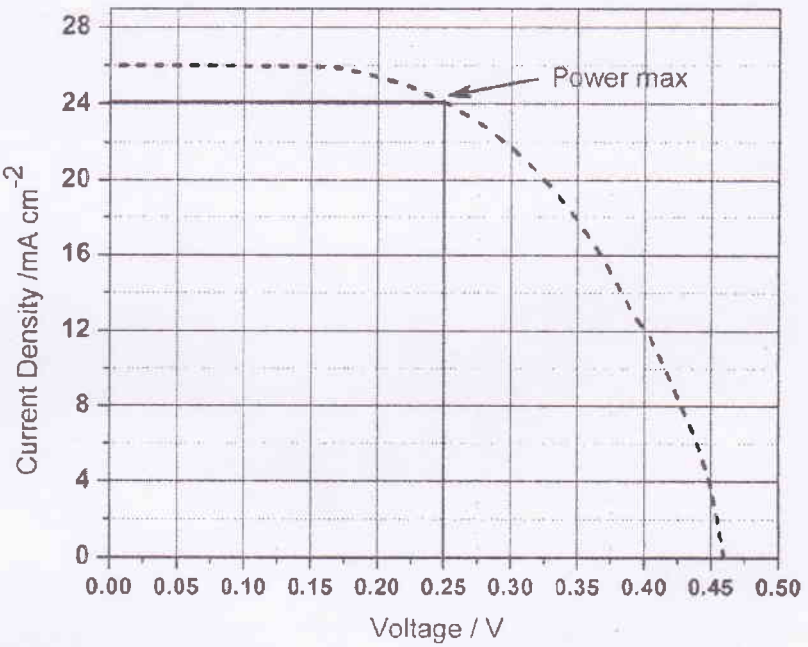

Figure 1

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