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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2014/2015**

COURSE NAME : PACKAGING WITH PAPER AND PAPERBOARD  
COURSE CODE : BNK 30303  
PROGRAM : BNK  
EXAMINATION DATE : DECEMBER 2014/JANUARY 2015  
DURATION : 2 HOURS 30 MINUTES  
INSTRUCTION : ANSWER **FOUR (4)** QUESTIONS ONLY.

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

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UNIVERSITI TUN HUSSEIN ONN MALAYSIA  
FACULTY OF ENGINEERING  
DEPARTMENT OF INDUSTRIAL ENGINEERING  
JALAN SEMBILAN, SEREMBAN, NEGERI SEMBILAN, MALAYSIA

- Q1** Historically, paper was used for packaging around 1550. A large proportion of paper and paperboard is used for packaging purposes. About 30% of the total output is used for corrugated and solid fiberboard, and the overall packaging usage is significant.
- (a) Give the definition of paper. (3 marks)
  - (b) Explain the differences between paper and paperboard. (8 marks)
  - (c) Discuss the applications of paper in packaging. Relate the applications with mechanical and optical properties for papers. (12 marks)
- Q2** Up to 40% of all packaging is based on paper and paperboard, making it the largest packaging material used, by weight.
- (a) Relate the advantages and disadvantages in utilizing paper and paperboard as a packaging material. (10 marks)
  - (b) Discuss the factors of paper and paperboard applications as packaging materials. (15 marks)
- Q3** Figure **Q3** shows a stack of corrugated box. The boxes are distorted after a week of storage.
- (a) Recognize **FOUR (4)** the cause of distortion. Sketch a diagram to support the answer. (10 marks)
  - (b) Discuss **TWO (2)** the prevention methods of distortion in corrugated box storage. Sketch a diagram to support the answer. (15 marks)

**Q4** A packaging mill wants to make corrugated board consist of face liner, medium liner and back liner. The mill bought 3 types of liner paper. Data of these liners are listed in a Table **Q4**.

- (a) Calculate the grammage ( $\text{g/m}^2$ ) of these papers. (3 marks)
- (b) Calculate the apparent density ( $\text{g/cm}^3$ ) of these papers. (3 marks)
- (c) Determine the tensile indexes ( $\text{Nm/g}$ ) of these papers. (3 marks)
- (d) Sketch and label 2-layer corrugated box liner to be used for face, medium and back. (6 marks)
- (e) State reasons for answer in **Q4 (d)**. (10 marks)

**Q5** Paper manufacturing industries were established in Malaysia since higher demand of paper usage. Paper is manufactured by mechanical and chemical process.

- (a) Sketch the diagram of paper manufacturing process. (5 marks)
- (b) Explain the importance functional aspects of printing and varnishing for food packaging. (8 marks)
- (c) The main food applications today are for food wrapping, frozen food and fresh food. Determine the suitable method of post-printing process to protect the packed food and sustain the performance of paper box. (12 marks)

**- END OF QUESTION -**

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**FIGURE Q3**

Kraft paper	Weight a sheet of 100 cm <sup>2</sup> (g)	Thickness of 5 sheets (µm)	Tensile strength of sheet (kN/m)
1	0.2631	530.2	19.084
2	0.2474	529.4	18.831
3	0.2339	532.5	17.062

**TABLE Q4**

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