Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	BIOMATERIALS
COURSE CODE	:	BEU 41103
PROGRAMME	:	BEJ
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 (a) Draw the structure of a bone and label the microstructures of the cartilage.
(2 marks)

(b) Suggest and explain **FOUR (4)** techniques that can be used to examine the neoplastic diseases of the soft tissues.
(6 marks)

(c) You are evaluating a synthetic bone graft. Following the implantation of the bone graft in a mice, the scanning electron microscopy (SEM) indicated detachment of tissue from the bone graft. Deduce the **FOUR (4)** reasons that the failure of tissue adhered to the bone graft.
(8 marks)

(d) Most tissues in the human body are relatively soft. Explain the characteristic and function of cartilage. State the considerations in designing a synthetic scaffold material to replace cartilage via tissue engineering approach.
(4 marks)

Q2 (a) Draw and explain the post-translation process for the synthesis of collagen fibers.
(8 marks)

(b) Suggest and explain a method to fabricate a skin graft of nanofibres based on Polylactic Acid (PLA).
(4 marks)

(c) Suggest suitable methods that can be used to characterise the biocompatiblity properties of the skin graft of PLA.
(8 marks)

Q3 (a) In a research team, titanium dioxide (TiO_2) was suggested to be the coating for the femoral of an artificial bone. But, this material was found to be bio-inert. Recommend strategies and molecules that can reduce the bio-inertness of TiO_2 for cell adhesion and in-growth of cells.

(4 marks)

(b) When the bioinertness problem is solved and you would like to examine the surface properties of the TiO_2 coating, suggest **FOUR (4)** suitable methods that can be used to study the surface properties of the coating. Explain the expected outcomes for each of the suggested methods of measurement.

(16 marks)

Q4 **Figure Q4(a) and (b)** show the photomicrographs of immuno-fluorescence imaging of cytoskeleton and vinculin expressions of keratinocytes cultured on the glass substrate and a soft liquid crystals substrate, respectively.

(a) Deduce the organisation of the cytoskeleton in the keratinocytes and draw the structural organisation of the cytoskeleton to the vinculins for the keratinocytes shown in **Figure Q4 (a) and (b)**.

(6 marks)

(b) Explain the reason the cell expressed such characteristics.

(4 marks)

(c) If these cells were to be cultured in microspheres of hydrogel, estimate the responses of the cytoskeletons in the microspheres. Distinguish the differences of the cytoskeleton expressions when the cells are cultured on the glass substrate and in the hydrogel. Draw the cytoskeleton responses of cells to the two different materials.

(10 marks)

Q5 In your research lab, you are required to design an artificial skin graft that can be used for replacement of burn skin. Chitosan is an extract from the shrimp and other crustacean shells, and it has been incorporated into many new hydrogels design.

(a) Suggest the **TWO (2)** advantages and disadvantages of Chitosan in the design of the biomaterial.

(4 marks)

(b) The mechanical properties are important to ensure that the cells are adaptable to the stiffness of the material and restructure themselves accordingly. Suggest and explain **TWO (2)** techniques that could be used to assess the **TWO (2)** physical properties of a chitosan doped PEG.

(6 marks)

(c) Deduce the expected Young's modulus and stress strain reponse of the chitosan hydrogel.

(4 marks)

(d) Paraffin and polycarbonate were prepared for thermal analysis. It was found that paraffin after polymerisation could be remelted to polymerise into another shape. However, the cured polycarbonte under cooling is not reversibe after heat application. Suggest the reason for the observations.

(6 marks)

- END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER/SESSION : SEM II/2015/2016 PROGRAMME : 4 BEJ
COURSE NAME : BIOMATERIALS COURSE CODE: BEU41103

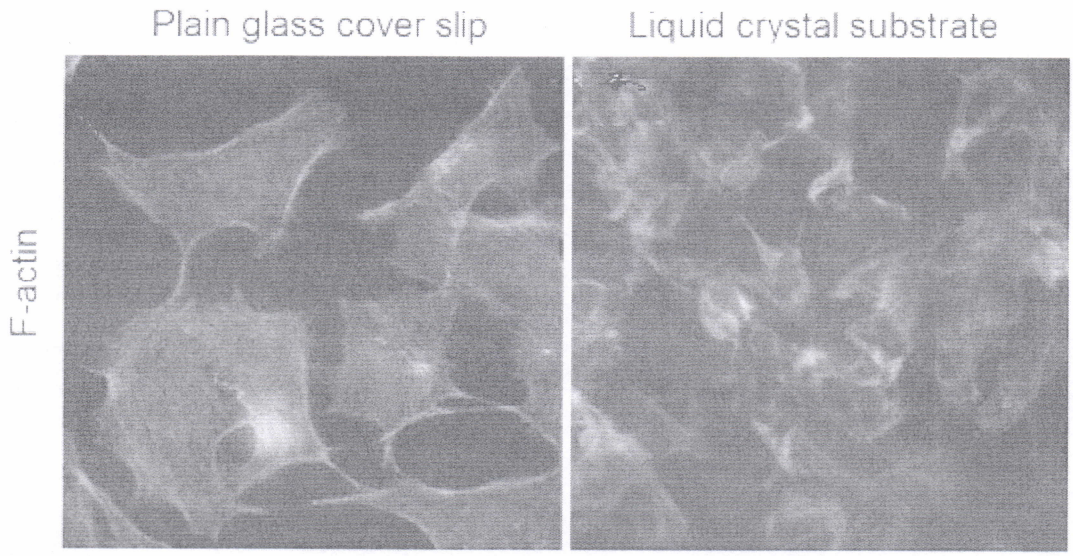

Figure Q4 (a)

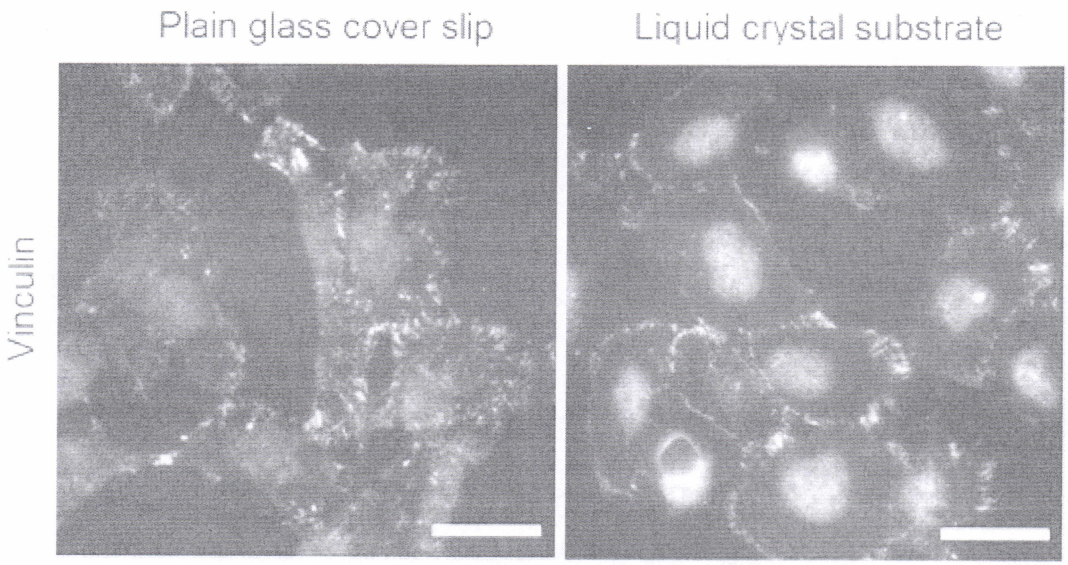

Figure Q4 (b)