



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2009/2010**

SUBJECT NAME : STRUCTURE REPAIR AND
REHABILITATION

SUBJECT CODE : BFP 4043

COURSE : 4 BFF

EXAMINATION DATE : NOVEMBER 2009

DURATION : 3 HOURS

INSTRUCTION : ANSWER QUESTION 1 AND
THREE (3) OTHER QUESTIONS

THIS PAPER CONSISTS OF SEVEN (7) PAGES

- Q1** (a) Owner of a building has decided to renovate his retail building to a heavy machinery workshop. The building is situated next to a big tree. He has come to you to seek for advice about this matter.
- (i) Explain clearly **three (3)** defects that might occur to the building structure if the renovation is carried out. (9 marks)
- (ii) Propose with sketches **two (2)** steps to be taken to avoid the defects. (8 marks)
- (b) Table 1 shows data taken from monitoring of a crack movement on a concrete floor for 7 days. From observation, it was found that the crack is long and runs parallel on the surface. The average width is 4.5 mm. There was also a brown stain on the crack surface.

Table 1: Crack readings

Point / Date	17-Jan	18-Jan	19-Jan	20-Jan	21-Jan	22-Jan	23-Jan
	Reading on location 1						
S1	0.003	0.005	0.004	0.002	0.006	0.003	0.003
S2	0.001	0.002	0.005	0	0.006	0	0.002
S3	0.002	-0.001	0.002	0.001	0.004	0	-0.001

- (i) From the data obtained, give your opinion about this crack. (4 marks)
- (ii) Give **two (2)** suggestions on how to repair this crack. (4 marks)
- Q2** Owner of a house has appointed you to investigate about the defects that have occurred on the floor of his house.
- (a) Discuss clearly the procedures to be followed before inspection, during inspection and reporting. (9 marks)
- (b) In the investigation you will have to do a verbal enquiry. Explain **four (4)** sources of information in the verbal enquiry. (6 marks)
- (c) The investigation must be verified for validity. Explain clearly **four (4)** modes of verification. (10 marks)

Q3 A large historic building, which was built on abandon mining land, suffers from the beam and foundation defects due to subsidence. You are requested by your manager to carry out maintenance and rehabilitation works.

- (a) (i) Explain **three (3)** reasons why underpinning is implemented in the rehabilitation process. (3 marks)
- (ii) Discuss **three (3)** information that can be obtained during the investigation of the ground below the structure before the rehabilitation work begins. (6 marks)
- (b) With aid of sketches, explain in detail the most suitable method of underpinning for this building. (10 marks)
- (c) The causes of structural defects include movement of structure, load and environment. Discuss **three (3)** structural defects due to the environment. (6 marks)

Q4 (a) Sketch and discuss clearly any **three (3)** faulty workmanship during the construction process as follows:

- (i) Improper reinforcing steel placement
 (ii) Premature removal forms
 (iii) Improper grades of slab surfaces
 (iv) Plastic settlement cracking
 (v) Honey combing

(9 marks)

(b) Based on Table 2 calculate the cost of 3m^3 of concrete needed for the repair work due to the crack that appears on the building surface.

Table 2 : Reinforced concrete work (1:3:6)

Item	Rate
Cement (1280 kg/m^3)	RM 250/tonne
Sand (1500 kg/m^3)	RM 40/tonne
Aggregate (1600 kg/m^3)	RM 45/tonne
Labour salary (8 hours/day)	RM 40/day
Labour for concrete batching	3 labours
Labour constant concrete batching	2 hours/ m^3
Wastage	15%
Profit	5%

(16 marks)

- Q5**
- (a) Explain the general procedure for cleaning, repair and protection of reinforcing steel before any repair material could be applied. (4 marks)
- (b) Define and give an example of any **three (3)** remedial actions as follows :-
- (i) Refurbishment
 - (ii) Renovation
 - (iii) Adaptive-use
 - (iv) Alteration
 - (v) Dismantle
- (9 marks)
- (c) Discuss with sketches the surface repair placement using the following methods:
- (i) Grouted preplaced aggregate
 - (ii) Full depth repair
 - (iii) Form and pump
- (12 marks)

- S1 (a) Pemilik bangunan ingin mengubahsuaikan bangunannya kedainya kepada ruang bengkel jentera berat. Bangunan tersebut terletak berhampiran dengan pokok besar. Beliau telah menemui anda untuk meminta nasihat mengenai perkara tersebut.
- (i) Terangkan dengan jelas **tiga (3)** kerosakan yang akan berlaku pada struktur bangunan jika pengubahsuaian dilakukan. (9 markah)
- (ii) Cadangkan berserta lakaran **dua (2)** langkah yang boleh di ambil untuk mengelakkan kerosakan pada struktur bangunan dari berlaku akibat dari kerja pengubahsuaian. (8 markah)
- (b) Jadual 1 menunjukkan data bacaan pergerakan satu retak pada lantai konkrit yang diperolehi daripada kerja pemantuan selama 7 hari. Dari pemerhatian didapati bentuk retak tersebut memanjang dan selari di permukaan. Purata lebar ialah 4.5 mm Terdapat juga warna coklat pada permukaan retak tersebut.

Jadual 1 : Beza bacaan retak

Titik / Tarikh	17-Jan	18-Jan	19-Jan	20-Jan	21-Jan	22-Jan	23-Jan
	Beza bacaan di lokasi 1						
S1	0.003	0.005	0.004	0.002	0.006	0.003	0.003
S2	0.001	0.002	0.005	0	0.006	0	0.002
S3	0.002	-0.001	0.002	0.001	0.004	0	-0.001

- (i) Dari data yang diperolehi nyatakan pendapat anda mengenai retak tersebut. (4 markah)
- (ii) Cadangkan **dua (2)** kaedah bagaimana hendak membaiki retak tersebut. (4 markah)
- S2 Pemilik sebuah rumah telah melantik anda untuk memeriksa mengenai kerosakan lantai yang telah terjadi di rumahnya.
- (a) Bincangkan dengan jelas prosedur yang perlu diikuti sebelum pemeriksaan, semasa pemeriksaan dan penyediaan laporan. (9 markah)
- (b) Di dalam penyiasatan anda akan menyiasat secara lisan. Terangkan dengan jelas **empat (4)** punca maklumat yang boleh dapati semasa penyiasatan secara lisan dilakukan. (6 markah)
- (c) Siasatan perlu dibuat verifikasi untuk memastikan kesahihannya. Nyatakan dengan jelas **empat (4)** mod verifikasi tersebut. (10 markah)

- S3 Sebuah bangunan bersejarah yang dibina di atas bekas tanah lombong, telah mengalami kerosakan pada rasuk dan asas disebabkan oleh pemendapan. Anda telah ditugaskan untuk membuat kerja pembaikan dan baikpulih pada bangunan tersebut.
- (a) (i) Nyatakan **tiga (3)** sebab mengapa *underpinning* dilakukan dalam kerja baikpulih asas. (3 markah)
- (ii) Bincangkan **tiga (3)** maklumat yang akan didapati semasa pemeriksaan tanah di bawah struktur, sebelum kerja baikpulih dijalankan. (6 markah)
- (b) Dengan bantuan lakaran, terangkan dengan jelas kaedah *underpinning* yang paling sesuai untuk bangunan tersebut. (10 markah)
- (c) Kecacatan struktur boleh disebabkan oleh pergerakan struktur, pembebanan dan alam sekitar. Bincangkan **tiga (3)** kecacatan struktur disebabkan oleh alam sekitar. (6 markah)
- S4 (a) Bincangkan berserta lakaran mana-mana **tiga (3)** kesilapan kerja konkrit di bawah semasa pembinaan dilaksanakan.
- (i) *Improper reinforcing steel placement*
(ii) *Premature removal forms*
(iii) *Improper grades of slab surfaces*
(iv) *Plastic settlement cracking*
(v) *Honey combing* (9 markah)
- (b) Berdasarkan Jadual 2, kirakan kadar harga untuk 3m^3 konkrit, yang akan digunakan untuk kerja-kerja baikpulih keretakan di permukaan sebuah bangunan.

Jadual 2 : Kerja konkrit bertetulang (1:3:6)

Item	Kadar
Simen (1280 kg/m^3)	RM 250/tan
Pasir (1500 kg/m^3)	RM 40/tan
Batu baur (1600 kg/m^3)	RM 45/tan
Gaji buruh (8 jam bekerja/hari)	RM 40/hari
Buruh untuk bancuh konkrit	3 pekerja
Angkatap buruh bancuh konkrit	2 jam/ m^3
Pembaziran	15%
Keuntungan	5%

(16 markah)

- S5 (a) Terangkan prosedur pembersihan, membaiki dan melindungi tetulang keluli sebelum bahan baikpulih diletak padanya. (4 markah)
- (b) Berikan definisi berserta contoh mana-mana **tiga (3)** tindakan pembaikan di bawah:
- (i) Pembaharuan
 - (ii) Pengubahsuaian
 - (iii) Suaiguna
 - (iv) Pemindaan
 - (v) Merombak
- (9 markah)
- (c) Bincangkan berserta lakaran kaedah pengantian baikpulih permukaan di bawah:
- (i) *Grouted preplaced aggregate*
 - (ii) *Full depth repair*
 - (iii) *Form and pump*
- (12 markah)