UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BME 3053
COURSE	: MAINTENANCE PLANNING & CONTROL
SEMESTER/SESSION	: 1-2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 4 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) **Discuss** how maintenance can increase the profitability of company. (3 Marks)

b) **Illustrate** how maintenance management principles are relevance in the service industry. (3 Marks)

c) Robot KUKA enters the waiting line at the rate four per day. The maintenance department services the equipment on a FIFO basis. The average repair time is one hour and half and nine-hour day working. **Calculate**:

i. Total number of units that are either being repaired or are waiting to be repaired. (2 Marks)
ii. Average total time in the repair shop. (2 Marks)
iii. Average number of units waiting to be serviced or repaired. (2 Marks)
iv. Average waiting time in the line. (2 Marks)
v. Probability that two units are in the system. (3 Marks)

d) A machine owner finds from his past records that the maintenance costs per year of a machine whose purchase price is RM8000 are as given in Table 1 below. **Determine** at which time it is profitable to replace the machine. (8 Marks)

Table 1: The maintenance cost and resale price of the machine

Year	1	2	3	4	5	6	7	8
Maintenance Cost	1000	1300	1700	2200	2900	3800	4800	6000
Resale Price	4000	2000	1200	600	500	400	400	400

QUESTION 2

a) **Discuss** how preventive maintenance effort level effect on corrective and preventive maintenance cost. (3 Marks)

b) Many consumer products need regular maintenance. **Choose** a product and discuss the maintenance (preventive/predictive/corrective) requirements for the items. (4 Marks)

c) **Explain** some of the applications of ultrasound predictive maintenance. (4 Marks)

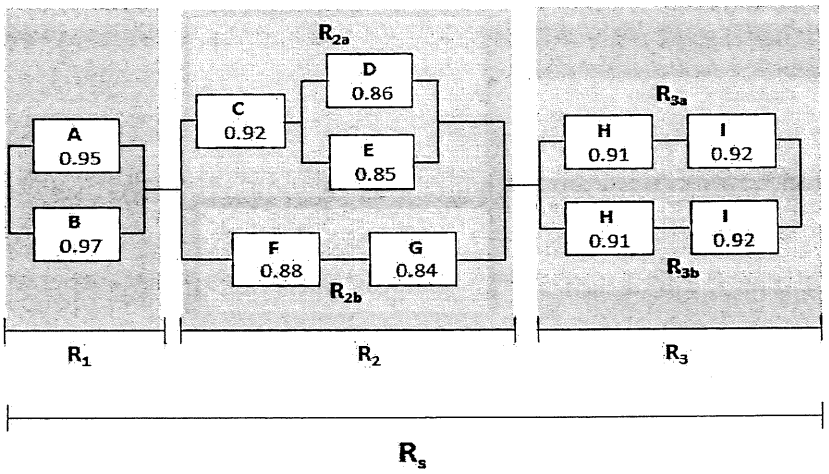
d) Assume that the equipment is operated 320 workdays for 8 hours per day and with a known MTBF of 180 hours. Failure costs are estimated at $4700 per occurrence. A PM maintenance option would cost $700 per scheduled routine. **Evaluate** the PM program if performing the PM routine every 100 hours reduces the probability of failure to 30%. (8 Marks)

e) **Illustrate** how the maintenance of products, plants, and infrastructures differs in terms of requirements and types of maintenance actions. (6 Marks)

QUESTION 3

a) **Discover** the methods for improving system reliability. (4 Marks)

b) A block diagram representation of a system is shown below. **Determine** the overall system reliability. (9 Marks)



c) **Prepare** a sample form for conducting FMECA. (7 Marks)

d) Assuming an exponential failure rate and a MTBF of 250 hours, **calculate**:

i. The failure rate (1 Mark)
ii. Reliability at 250, 350 hours of operation (4 Marks)

QUESTION 4

a) **Identify** the characteristics of maintenance projects. (3 Marks)

b) Following is the activity schedule as in Table 2 for a project to be planned and managed by PERT.

Table 2: Activity Table for project managed by PERT

Activity	Immediate predecessor	Times (days)		
		a	m	b
A	-	5	7	9
B	-	5	7	15
C	B, -	0.5	2	3.5
D	A, B, -	2	6.5	8
E	A, B	6	9	12
F	B	2	3	4
G	C, D	4.5	6	7.5
H	E	1	4	7
I	F	7	9	11

i. **Prepare** the network diagram. (6 Marks)

ii. **Determine** the project average time and critical path sequence from network analysis (forward and backward pass). (8 Marks)

iii. **Calculate** the project time standard deviation value to two decimal places. (2 Marks)

iv. The manager would be concerned if there were greater than 5% probability that the project completion will exceed 25 months. Should she be worried? Clearly **show** supporting probability computations. (3 Marks)

c) **Demonstrate** how CMMS help with maintenance management control function such as inventory management and tracking. (3 Marks)

----------End of question----------