

ITMMEC – IIT DELHI
MINOR TEST II: ITL709 (MAINTENANCE PLANNING & CONTROL)

Max. Marks = 30

Date: 10-10-2015 (Saturday)

Time: 1 Hour

Note: Missing data, if any, may be assumed suitably

Q I (a) Discuss the following in context of maintenance personnel in plants.

- i) Differentiate between FMEA (Failure Mode and Effects Analysis) and FTA (Fault Tree Analysis).
- ii) Utility of the ABC Analysis.

(b) Find minimal cut sets for Boolean expression for a top event:

$$\overline{A}BCDF\overline{K}L + LMNQT + ABF + \overline{L}MNQR + ADEF + MR$$

(c) 'Lube Oil Equipment' 09 (LOE 09) is meant to lubricate equipments in a 'Production Line' 09 (PL 09). The LOE 09 is critical equipment; as its failure to supply lube oil leads to stoppage of the PL 09. The LOE 09 has three lube oil circuits (LOC 1, LOC 2 and LOC 3), each with two pumps in parallel (PM and PS). If the main pump (PM) fails; the standby pump (PS) will automatically come in operation. Only one lube oil circuit is needed to lubricate the equipments of the PL 09. A lube oil circuit fails to supply the lubricant if lubricant reservoir is empty, both the pump fails or pipe between the components of the lube circuit ruptures. Assume 24x7 power supply to operate the LOE 09 and switching from pump PM to pump PS as reliable.

Answer the following:

- (i) Develop a fault tree diagram for the event: "Stoppage of PL 09".
- (ii) Select an indenture level and a unit of it of your choice of the LOE 09. Identify any two pertinent failure modes of the chosen unit and carry out the FMEA procedure for these, and suggest your recommendation to lubricate the equipments of the PL 09.
- (iii) Choose a failure mode that is more critical of the two considered for the unit in (ii) above, and use the RCM decision logic to identify a preventive task for it.

(4, 2, 3, 6, 5, 3 = 23)

all ok

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Q II. a) A "Major Maintenance Work" (MMW) in a process plant consists of tasks 'A' to 'J'. The interrelationships among these tasks, their duration in days and manpower requirement are given in Table 1. There are five men in the plant that can be engaged to complete the MMW. **Answer the following:**

- i) Determine the critical path and the MMW.
- ii) Manpower required on 10th day of the MMW.

Table 1

Task	Interrelationships	Duration (Days)	Manpower Requirement
A	Independent of all other tasks	9	3
B	Depends on completion of A	9	2
C	Depends on completion of A	7	2
D	Depends on completion of B and C	5	4
E	Depends on completion of A	5	1
F	Depends on completion of B, C and E	3	3
G	Depends on completion of C, D and F	7	2
H	Depends on completion of A and C	8	2
I	Depends on completion of B	7	1
J	Depends on completion of A, C and H	1	4

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(7)

1 Dumb

(F)