Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (INFORMATION TECHNOLOGY/COMPUTER AND COMMUNICATION ENGINEERING)

END SEMESTER EXAMINATIONS, NOVEMBER 2017

SUBJECT: PROGRAM ELECTIVE – IV: SOFTWARE RELIABILITY

[ICT 4023]

REVISED CREDIT SYSTEM
(23 /11/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL the questions.
- Missing data, if any, may be suitably assumed.

1A. Differentiate between reliability and availability. Calculate availability measures for the following: 5

i) A system has an mean time between failure (MTBF) of 2050 hours and a mean time to repair (MTTR) of 10 Hours. What is the inherent availability of the system A_I?

ii) A system has a mean time between maintenance action (MTBMA) of 100 hours, a F_c of ½, a F_p of 1 and M_{CT} of 2 hours and M_{PT} of 1 hour (F_c = no. of corrective actions/1000 hrs, F_p = no. of preventive actions/1000 hrs, M_{CT} and M_{PT} are mean active time for corrective and preventive maintenance respectively). What is achieved availability A_A?

iii) A system has a MTBMA of 165 hours and a mean down time (MDT) of 5 hours. What is operational availability A_O?

1B. What is the significance of software reliability engineering (SRE)? Explain the steps used in SRE process with a neat block diagram. 3

1C. Explain how McCabe's cyclomatic number can be used as a software metric with a suitable example. Which software entity and attribute it really measures? 2

2A. Discuss the various ways of improving predictive accuracy in software reliability. 5

2B. What is goal question metric (GQM) paradigm used in software measurement? Construct a simple Goal Question Metric(GQM) tree corresponding to the producer's goal of improving the quality of the software. 3

2C. The failure time of a certain component has a Weibull distribution with $\beta=4$, $\theta=2000$ and $\gamma=1000$. Find the reliability of the component and the hazard rate for an operating time 1500 hrs. 2

3A. Compare Musa's basic exponential model and logarithmic model. A program will experience 100 failures in infinite time. It has now experienced 50 failures. The initial failure intensity was 10 failures/cpu hour, $\theta = 0.02$/failure. Calculate current failure intensity, and no.of failures after 10 cpu hrs and 100 cpu hrs for both the models. 5

3B. Differentiate between black box, white box and grey testing methods 3

3C. Specify any two impacts of risk in software engineering. If the risk factor is 0.25 and software has 70% complexity, calculate severity index. 2

4A. Discuss various scales and measures (direct & indirect) used in software measurement with an example that impact quality of the software. 5

4B. A system has a constant failure rate of $\lambda = 8.167/10^9$ hr. 3

i) What is the probability that it will fail during the first year of operation?
ii) What is the probability that it will not fail till 5 years of operation?
iii) What is the Mean Time To Failure (MTTF)?

4C. Compare between coupling and cohesion property of modules. Discuss their significance on the design. 2

5A. What are the drawbacks of function point count metric? Consider the following scenario and compute both the unadjusted (Assign complexity scale for components: simple-3, average-4 and complex-10) and adjusted function-point count (assign scale irrelevant – 0, essential-5) for this system. State any assumptions made. 5

The course-mark system enables lecturers to enter student marks for a predefined set of courses and students opting those courses. The marks can be updated but cannot the change the course information, as course lists are responsibility of the system administrator. A lecturer selects choice of course and then operations from menu driven system. The information displayed is always a list of students together with all the known marks, grades and averages. The operations include:

i) Enter course marks
ii) Enter exam marks
iii) Compute averages
iv) Produce letter grades
v) Display information

5B. Classify every software failure as either syntactic, semantic or system crash. Every system crash failure is more critical than every semantic failure, which in turn is more critical than every syntactic failure. Use this information to define two different measures of attribute of criticality of software failures. How are these measures related? Which is the scale of each? 3

5C. A system's defect probability is 10%. A lot is accepted if not more than 2 defectives are found in 6. Calculate the probability of having exactly 2 defects. 2