

**BACHELOR OF ELECTRICAL ENGINEERING FINAL EXAMINATION, 2019**(4<sup>th</sup> Year, 2<sup>nd</sup> Semester)**SUBJECT: - Principles of Software Engineering**

Time: -Three hours

Full Marks 100

(50 marks for each part)

**Answer any three questions from Part I and any two from Part II. 2 marks are reserved for neat & well organized answers.**

PART I		Marks																											
1.	a) Explain any software life cycle model other than Classical Waterfall, and mention one advantage and one disadvantage of using that model for software development.	7																											
	b) What is a SRS document? Why is it necessary to have this document during the process of software development?	2+2																											
	c) What are functional and non-functional requirements? Explain with the help of examples.	5																											
2.	a) Suppose a cyclic scheduler is used to schedule a task set consisting of real-time tasks $T_i (e_i, p_i, d_i)$ as follows: <b>T1(10, 50, 50), T2 (25,100,100), T3 (50, 200,100)</b> where $e_i \rightarrow$ event duration, $p_i \rightarrow$ period, $d_i \rightarrow$ deadline for the task $T_i$ in milli-seconds  What is the major cycle for the above task set? Suggest a suitable frame size and provide a feasible schedule for the task set. Show all the intermediate steps in your answer.	8																											
	b) Consider the following set of periodic real-time tasks $T_i (e_i, p_i,):$ <b>T1 (20 ms, 50 ms), T2 (25ms, 150ms), T3 (50 ms, 200 ms).</b>  Assuming that a context switching time of 2 msec for each task, determine whether the tasks would meet their deadlines using RMA Scheduling.	8																											
3.	a) The following table indicates the various tasks involved in completing a software project, the corresponding activities, and the estimated effort for each task.	3+5+3																											
<table border="1"> <thead> <tr> <th>Task</th> <th>Activity</th> <th>Effort ( days)</th> </tr> </thead> <tbody> <tr> <td>T1</td> <td>Requirement Specification</td> <td>25</td> </tr> <tr> <td>T2</td> <td>Design</td> <td>45</td> </tr> <tr> <td>T3</td> <td>Code actuator interface module</td> <td>40</td> </tr> <tr> <td>T4</td> <td>Code sensor interface module</td> <td>80</td> </tr> <tr> <td>T5</td> <td>Code user interface part</td> <td>60</td> </tr> <tr> <td>T6</td> <td>Code control processing part</td> <td>35</td> </tr> <tr> <td>T7</td> <td>Integrate and test</td> <td>120</td> </tr> <tr> <td>T8</td> <td>Write user manual</td> <td>65</td> </tr> </tbody> </table>		Task	Activity	Effort ( days)	T1	Requirement Specification	25	T2	Design	45	T3	Code actuator interface module	40	T4	Code sensor interface module	80	T5	Code user interface part	60	T6	Code control processing part	35	T7	Integrate and test	120	T8	Write user manual	65	
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The following precedence relationship is known among the different tasks: $T1 \leq T2 \leq \{ T3, T4, T5, T6\} \leq T7,$ Where, the precedence relation $T_i \leq \{ T_j, T_k\}$ implies that the task $T_i$ must																													

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	<p>complete before tasks <math>T_j</math> or <math>T_k</math> can start. Draw the <b>activity network</b> and use it to find the <b>critical path</b>. Also draw the <b>Gantt Chart</b> for the above project.</p>	
	<p>b) An Accounting System with the following characteristics: Number of <b>inputs=8</b>; Number of <b>outputs=10</b>; Number of <b>queries=12</b> Number of <b>files= 8</b>; Number of <b>external interfaces= 4</b></p> <p>i. Assuming a <b>Technical Complexity Factor=1.2</b>, what is the size of the system in Function Points? ii. Assuming an <b>average productivity of 12 FP</b> per person per month, what is the amount of <b>effort</b> required in person months?</p>	3+2
4.	<p>a) Design a <b>black-box test suite</b> for a function that accepts two pairs of integers, and two more integers as inputs i.e. Inputs are <math>(x_1, y_1)</math>, <math>(x_2, y_2)</math>, <math>r_1</math> and <math>r_2</math> where <math>(x_1, y_1)</math> and <math>(x_2, y_2)</math> represents the centres of two circles, while <math>r_1</math> and <math>r_2</math> represent the radius of the first and second circle respectively. The function prints whether the two circles are intersecting, disjoint, or one contained in another.</p>	6
	<p>b) Why is it necessary to test modules in isolation? Why are stub modules necessary for unit testing?</p>	2+2
	<p>c) What do you understand by Software Quality Assurance? Describe any two Software Quality Factors in brief</p>	2+4
5.	<p>Write short notes on any four of the following topics:</p> <p>i. CMM certification levels ii. Configuration Management iii. Branch Coverage &amp; Condition Coverage Strategies iv. Statistical Quality Assurance v. Classical Waterfall Model vi. Code Inspection vs. Code Walkthrough</p>	4*4
	<b>PART II</b>	<b>Marks</b>
6.	<p>a) Consider the requirements for billing software to be developed for a shop chain, which has both wholesale and retail outlets. The discount policy for its products are as follows:</p> <p>i. If the number of pieces/units of a product ordered are greater than or equal to 50, then for a wholesale outlet, the discount available is 6% for cash payment and 4% on all other modes of payment. However, for a retail shop, it is 4% for cash payment and 2% for non-cash payment modes.</p>	7

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7.	<p>ii. If the number of pieces/units of a product ordered are less than 50, then for a wholesale outlet, discount available is 4% for cash payment and 2% on other modes of payment. However, for a retail shop it is 2% for cash payment and no discount is available for all other modes of payment.</p> <p>Write the above requirements in the form of a <b>decision tree or table</b>.</p> <p>b) Draw an <b>ERD</b> for a hospital management system illustrating the relationship between the following entities: <b>hospital, bed, patient, doctor, treatment</b>. Make the following assumptions for the cardinal relationships between the entities:</p> <ul style="list-style-type: none"> <li>• A hospital may have many beds, but may not have any beds also (only outdoor)</li> <li>• A bed may be assigned to only one patient at any point of time</li> <li>• A patient may be referred to the hospital by 1 doctor</li> <li>• A doctor can treat zero to many patients, and a patient can be treated by 1 to many doctors</li> </ul> <p>Also assume a few attributes (at least two) for each of the entities.</p> <p>c) Explain about any two design principles, bringing out their importance in software design</p> <p>A washing machine comprises of several components, such as:</p> <ol style="list-style-type: none"> <li>i) A drum where the washing is carried out</li> <li>ii) A heater used to heat the water in the drum</li> <li>iii) Input and Output valves used to control the amount of water in the drum</li> </ol> <p>The wash cycle entered by the operator determines the temperature of wash and the sequence and speed of washing machine drum rotation.</p> <p>The events and associated actions for the machine are as follows:</p> <ul style="list-style-type: none"> <li>• When switched ON, the machine is in "idle state".</li> <li>• When an operator enters the wash cycle and starts the system, then the input valve is opened, the drum starts filling and the water level monitoring functionality is enabled.</li> <li>• Once the drum is full, the input valve closed and the heater is turned on.</li> <li>• When the required temperature is reached, the heater is turned off, and the drum rotation sequence (washing) starts.</li> <li>• Once this rotation sequence is over, the drum rotation is stopped and the output valve is opened to empty the drum.</li> <li>• When the water level indicator indicates that the drum is empty, the output valve is closed and end of cycle is indicated.</li> <li>• The operator then switches of the system to stop the washing machine controller and bring it back to the idle state</li> </ul> <p>a) Prepare an <b>event list</b> showing the events and the responses for the system</p> <p>b) Draw a <b>Context Diagram or Level 1 DFD/CFD</b> for the Washing Machine Control System described above.</p> <p>c) Draw <b>State Transition Diagram</b> for the Washing Machine</p>	<p>10</p> <p>2*4</p> <p>7</p> <p>10</p> <p>8</p>
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8.	<p>a) Perform <b>Structured Analysis</b> for a <b>Hospital Management System</b> with the following requirements:</p> <ul style="list-style-type: none"> <li>• The System Administrator shall maintain hospital information, staff information, list of doctors with their specialization, schedules and fee details and also provide role-wise user permissions</li> <li>• Any user can register with personal details (user id, name, contact number, address etc.). The user can search for a doctor based on either name or doctor's area of specialization and request for an appointment</li> <li>• A receptionist can schedule the appointments by checking the patient requests, search the doctor availability and fixing the date/time accordingly. (The receptionist can also do the patient registration for a patient visiting a hospital, or providing details over the phone, and then fix the appointment).</li> <li>• For OPD patients visiting the hospital, a card is issued on the first visit to keep note of the medical advice and line of treatment on every visit</li> <li>• For patients who are admitted to the hospital i.e. in-patients, the admission process includes registration (if not done already), bed/ward allotment, doctor assignment etc. A RFID tag is assigned to the patient to keep track of the patient details</li> <li>• The receptionist will also keep receive payments from the patient, record them in the system, provide receipts and file insurance claims through interfaces to other health care service provider systems</li> <li>• The doctor will check the patient from time to time, prescribe medicines and tests, and see the reports. Based on the reports, further medicines and tests are prescribed, or discharge from the hospital is advised</li> <li>• The system shall maintain the clinical details, medication orders, progress and discharge summary of patients</li> <li>• The system shall also be used to manage the different services provided by the hospital such as Operation Theatre management, Pathology Lab management, Pharmacy management etc.</li> <li>• The software should be able to print a number of reports as required by the hospital administration</li> </ul> <p>Analyze the different functionalities, entities and data flows involved. Following this analysis, create a <b>Context Diagram and Level 1 DFD</b> for the software to be developed. Also show the <b>Level 2 DFD</b> for the In-patient Admission process.</p>	6+8+6
9.	<p>b) Explain the advantages of Client-Server software development</p> <p>Refer to the problem statement of Q8. Use an object-oriented approach for the analysis and design for the development of the same software.</p> <p>a) Develop a <b>Use-Case Diagram</b> showing the requirements at a high level</p> <p>b) Draw an <b>UML Activity diagram</b> from patient admission to discharge</p> <p>c) Draw an <b>UML Class diagram</b> specifying at least four important classes with their attributes and relationships</p>	4 9 8 8