

A project schedule is a timetable that organizes tasks, resources and due dates in an ideal sequence so that a project can be completed on time. A project schedule is created during the planning phase and includes the following: A project timeline with start dates, end dates and milestones.

There are seven principles of software project scheduling :

COMPARTMENTALIZATION :

A given software project is compartmentalized into a number of manageable activities. The project is divided into a number of small tasks.

INTERDEPENDENCY :

Interdependent tasks are accomplished first. Certain tasks occur in sequence whereas other tasks occur in parallel. Therefore tasks which occur in sequence has to be performed in a sequential order since the output of one task will be the input of the next task. Other tasks can occur independently.

TIME ALLOCATION :

Each and every task has to be assigned a specific time period i.e a start date and a completion date based on whether the work will be performed in a full time or part time basis.

EFFORT VALIDATION :

Every project is assigned to a software team. The project manager has to make sure that the effort allocated should not be more than the number of people available to do the work.

DEFINED RESPONSIBILITIES :

Each of the scheduled task is assigned to a specific member of the software team.

DEFINED OUTCOMES :

Each task has a defined outcome. Work product is the outcome of a software project.

DEFINED MILESTONES :

Every task is associated with a milestone. A milestone is an action or event marking a significant change in development process.

3.7 Risk Analysis and Management

GTU : Winter-2011, Summer-2013, 2016, 2018, 2019, Marks 1

✓ **Definition of risk :** The risk denotes the uncertainty that may occur in the choices due to past actions and risk is something which causes heavy losses.

✓ **Definition of risk management :** Risk management refers to the process of making decisions based on an evaluation of the factors that threaten to the business.

Various activities that are carried out for risk management are -

- ✓ 1. Risk identification
- ✓ 2. Risk projection
- ✓ 3. Risk refinement
- ✓ 4. Risk mitigation, monitoring and management.

3.7.1 Software Risks

There are two characteristics of the risks

1. The risk may or may not happen. It shows the uncertainty of the risks.
2. When risks occur, unwanted consequences or losses will occur.

Different types of risk

1. Project risk

Project risks arise in the software development process then they basically affect budget, schedule, staffing, resources, and requirements. When project risks become severe then the total cost of project gets increased.

2. Technical risk

These risks affect quality and timeliness of the project. If technical risks become reality then potential design implementation, interface, verification and maintenance problems get created. Technical risks occur when problem becomes harder to solve.

3. Business risk

When feasibility of software product is in suspect then business risks occur. Business risks can be further categorized as

- i) **Market risk** - When a quality software product is built but if there is no customer for this product then it is called market risk (i.e. no market for the product).
- ii) **Strategic risk** - When a product is built and if it is not following the company's business policies then such a product brings strategic risks.

- iii) Sales risk - When a product is built but how to sell is not clear then such a situation brings sales risk.
- iv) Management risk - When senior management or the responsible staff leaves the organization then management risk occurs.
- v) Budget risk - Losing the overall budget of the project is called budget risk.

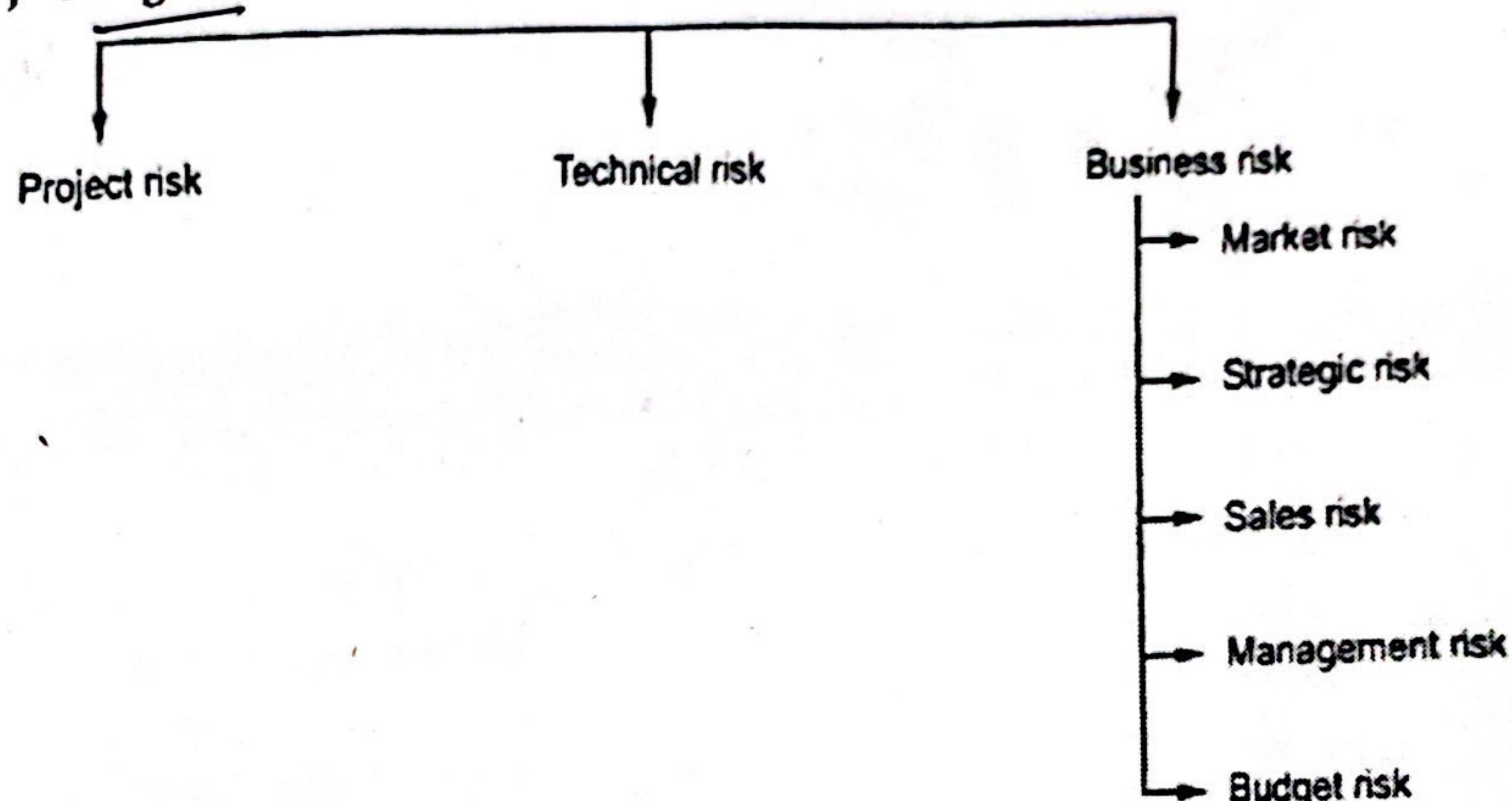


Fig. 3.7.1 Categorization of risk

Another categorization of risk proposed by Charette is -

Known risks are those risk that are identified after evaluating the project plan. These risks can also be identified from other sources such as environment in which the product gets developed, unrealistic dead lines, poor requirement specification and software scope. There are two types of known risks - predictable and unpredictable risks.

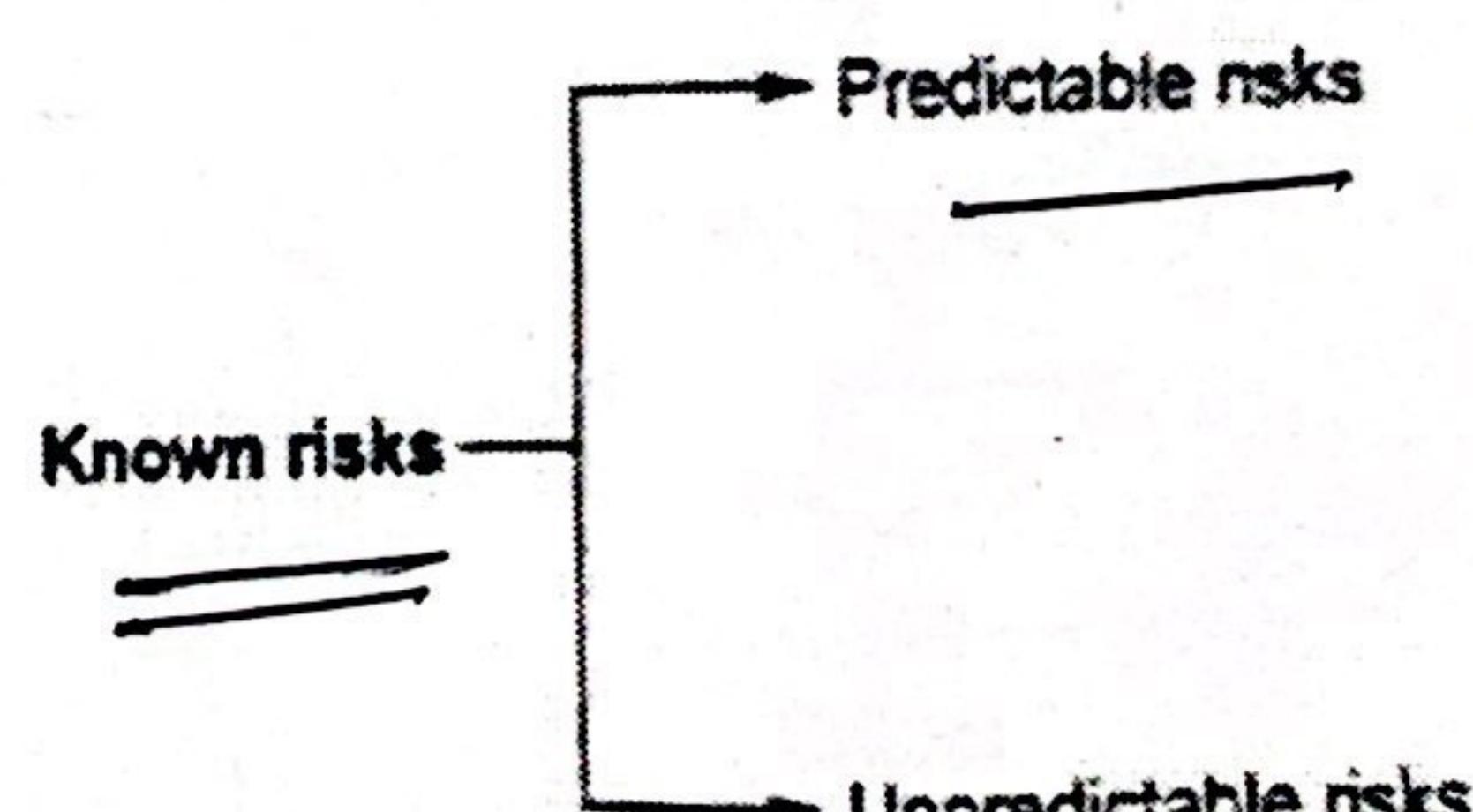


Fig. 3.7.2

Predictable risks are those risks that can be identified in advance based on past project experience. For example : Experienced and skilled staff leaving in between or improper communication with customer resulting in poor requirement specification.

Unpredictable risks are those risks that can not be guessed earlier.

For example certain changes in Government policies may affect the business project.

3.7.2 Reactive Vs. Proactive Risk Strategies

Reactive and proactive risk strategies are the approaches used for managing the risks.

Reactive risk strategy

- Reactive risk management is a risk management strategy in which when project gets into trouble then only corrective action is taken. But when such risks can not

- ✓ 1. **Performance risk** - It is the degree of uncertainty that the product will satisfy the requirements
- ✓ 2. **Cost risk** - It is the degree of uncertainty that the project will maintain the budget.
- ✓ 3. **Support risk** - It is the degree of uncertainty that the software project being developed will be easy to correct, modify or adapt.
- ✓ 4. **Schedule risk** - It is the degree of uncertainty that the software project will maintain the schedule and the project will be delivered in time.

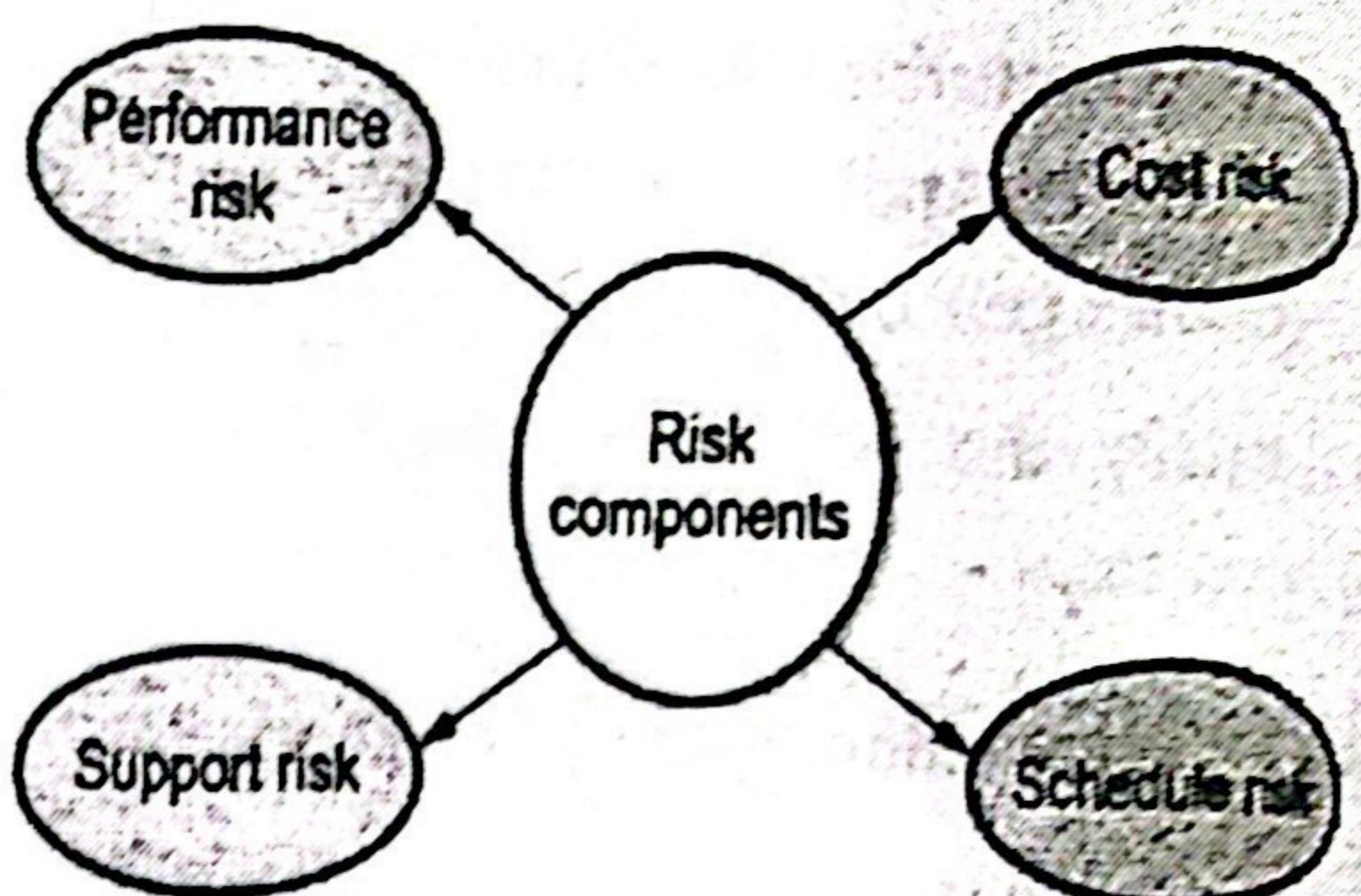


Fig. 3.8.1 Components of risk

Associated with these components are the risk drivers that are used to analyse the impact of risk. These four risk drivers are listed below

For the risk impact assessment a table is built in which impact of each risk driver on each software component can be specified.

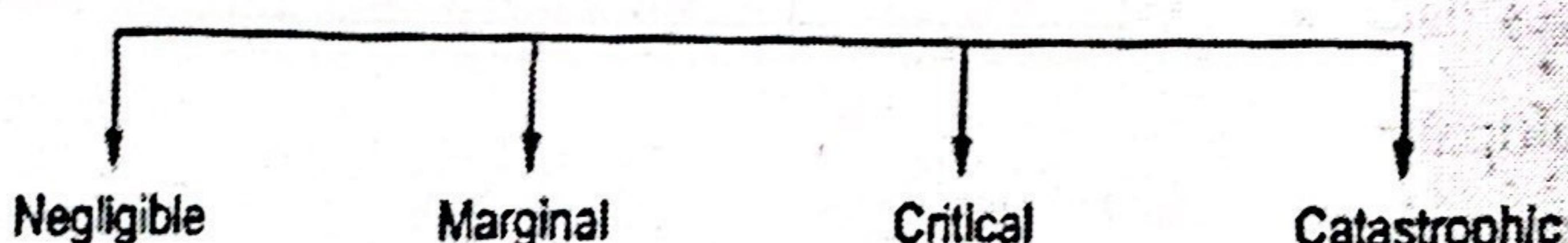


Fig. 3.8.2

Review Question

1. Describe difference between risk components and risk drivers.

GTU : Summer-2011, Marks 7

3.9 Risk Projection

The risk projection is also called risk estimation.

There are two ways by which risk can be rated

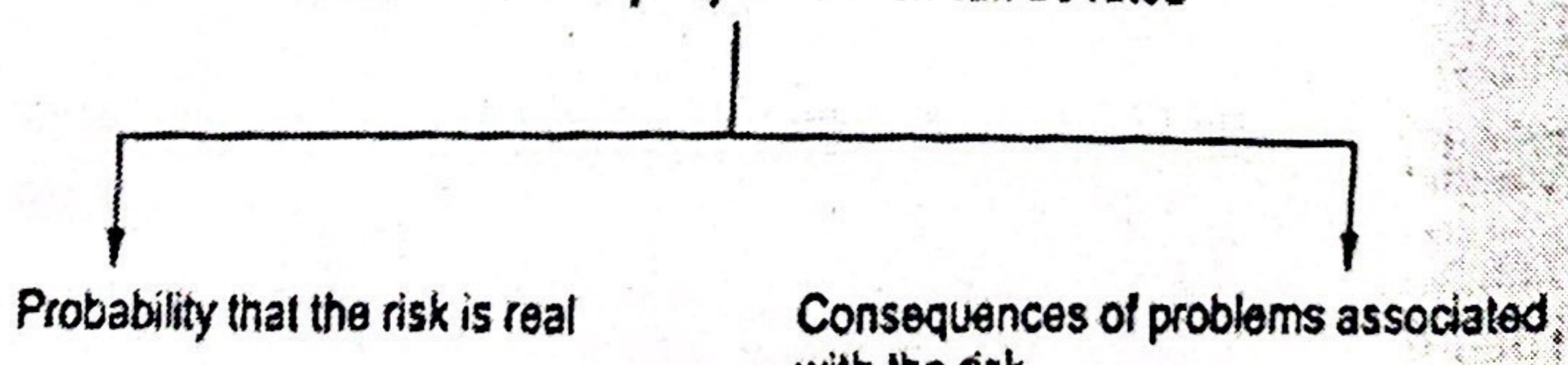


Fig. 3.9.1

The project planner, technical staff, project manager performs following steps to perform following steps for risk projection -

- Establish a scale that indicates the probability of risk being real.
- Enlist the consequences of the risk.
- Estimate the impact of the risk on the project and product.

- Maintain the overall accuracy of the risk projection in order to have clear understanding of the software that is to be built.

These steps help to prioritize the risks. Once the risks are prioritized then it becomes easy to allocate the resources for handling them.

3.9.1 Building Risk Table

- Building the risk table is the simplest and most commonly used technique adopted by project managers in order to project the risks. The sample risk table is as given below -

Risk table				
Risk	Category	Probability	Impact	RMM
Is the skilled staff available	Staff	50 %	Catastrophic	
Is that the team size sufficient	Staff	62 %	Critical	
Have the staff received sufficient training	Staff	25 %	Marginal	
Will technology meet the expectations	Technology	30 %	Critical	
Is the software management tool available	Environment	40 %	Negligible	
How much amount of reused software is required ?	Project size	60 %	Marginal	
Will customer change the requirement ?	Customer	20 %	Critical	

While building the risk table

- The project team first of all enlists all probable risks with the help of risk item checklist.
- Each risk is then categorized. As we know various categories of risk can be
a) Project size b) Technology c) Customer d) Staff e) Business f) Developing environment.
- Probability of occurrence of each risk is then estimated by each team member individually.
- Then impact of each risk is assessed. While calculating the impact of each risk, each using the cost drivers each component of risk (performance, cost, support, and schedule) is assessed and it then averaged to quote the overall impact of particular risk.

After building this table it is then sorted by probability and impact. The high probability and high impact risks will be at the top of the table. And low probability and low impact risk will be at the bottom of the table. This arrangement of the table is called first-order prioritization.

3. Then the project manager goes through this first-order prioritized risk table and draws a horizontal line at some point in the table. This line is called cut off line. The risks table above the cut off line is now considered for further risk analysis.
4. The risk table below the cut off line is again sorted and a second-order prioritization is applied on this table.
5. The risk table above the cut-off line is having the risks with high probability and high impact and such risks should occupy the significant amount of management time.
6. All the risks that lie above the cut off line should be managed. Using Risk mitigation, monitoring and management plan the last column of the risk table is filled up.

3.9.2 Assessing Risk Impact

While assessing the risks impact three factors are considered

- Nature of risk
- Scope of the risk
- Timing at which risk occurs.

Nature of risk denotes the type or kind of risk. For example if software requirement is poorly understood, the software processes gets poorly designed and ultimately it will create a problem in unit testing. Scope of the risk means severity of the risk. And timing of risk means determining at which phase of software development life cycle the risk will occur and how long it will persist.

U.S. Air Force has suggested following steps in order to determine the impact of risk -

1. The probability of all the components of risk (performance, cost, support and schedule) is calculated and averaged.
2. Using risk drivers (catastrophic, critical, marginal, negligible) the impact of risk on each components is determined.
3. Build the risk table and analyse the high impact, high probability risks.

Risk exposure

The risk exposure can be calculated by following formula

Risk Exposure = Probability of occurrence of risk × Cost

For example : Consider a software project with 77 percent of risk probability in which 15 components were developed from the scratch. Each component have on an average 500 LOC and each LOC have an average cost of \$10. Then the risk exposure can be calculated as ,

First of all we will compute

$$\begin{aligned} \text{cost} &= \text{Number of components} * \text{LOC} * \text{cost of each LOC} \\ &= 15 * 500 * 10 = \$75000 \end{aligned}$$

$$\begin{aligned} \text{Then Risk Exposure} &= \text{Probability of occurrence of risk} \times \text{Cost} \\ &= 77 / 100 * 75000 \\ &= \$57750 \end{aligned}$$

Thus risk exposure for each risk from risk table is calculated. The total risk exposure of all risks helps in determining the final cost of the project.

Review Question

1. How risk projection is carried out risk table ?

3.10 Risk Refinement

Risk refinement is a process of specifying the risk in more detail. The risk refinement can be represented using CTC format suggested by D.P.Gluch.

The CTC stands for *condition-transition-consequence*. The condition is first stated and then based on this condition sub conditions can be derived. Then determine the effects of these sub conditions in order to refine the risk. This refinement helps in exposing the underlying risks. This approach makes it easier for the project manager to analyze the risk in greater detail.

3.11 Risk Mitigation

GTU : Summer-2015, Winter-2018, Marks 7

RMM stands for risk mitigation, monitoring and management. There are three issues in strategy for handling the risk is

1. Risk avoidance 2. Risk monitoring 3. Risk management.

Risk mitigation

Risk mitigation means preventing the risks to occur(risk avoidance). Following are the steps to be taken for mitigating the risks.

1. Communicate with the concerned staff to find of probable risk.
2. Find out and eliminate all those causes that can create risk before the project starts.

3. Develop a policy in an organization which will help to continue the project even though some staff leaves the organization.
4. Everybody in the project team should be acquainted with the current development activity.
5. Maintain the corresponding documents in timely manner. This documentation should be strictly as per the standards set by the organization.
6. Conduct timely reviews in order to speed up the work.
7. For conducting every critical activity during software development, provide additional staff if required.

Risk monitoring

In risk monitoring process following things must be monitored by the project manager,

1. The approach or the behaviour of the team members as pressure of project varies.
2. The degree in which the team performs with the spirit of "team-work".
3. The type of co-operation among the team members.
4. The types of problems that are occurring.
5. Availability of jobs within and outside the organization.

The project manager should monitor certain mitigation steps. For example:

If the current development activity is monitored continuously then everybody in the team will get acquainted with current development activity.

The objective of risk monitoring is

1. To check whether the predicted risks really occur or not.
2. To ensure the steps defined to avoid the risk are applied properly or not.
3. To gather the information which can be useful for analyzing the risk.

Risk management

Project manager performs this task when risk becomes a reality. If project manager is successful in applying the project mitigation effectively then it becomes very much easier to manage the risks.

For example, consider a scenario that many people are leaving the organization then if sufficient additional staff is available, if current development activity is known to everybody in the team, if latest and systematic documentation is available then any 'newcomer' can easily understand current development activity. This will ultimately help in continuing the work without any interval.

Review Questions

1. Explain Risk Management, Monitoring and Mitigation.
2. Discuss RMMM.

GTU : Summer-2015, Marks 7

GTU : Winter-2018, Marks 4

3.12 Risk Plan

GTU : Winter-2017, 2019, Marks 7

The RMMM plan is a document in which all the risk analysis activities are described. Sometimes project manager includes this document as a part of overall project plan. Sometimes specific RMMM plan is not created, however each risk can be described individually using risk information sheet. Typical template for RMMM plan or Risk information sheet can be,

Risk information sheet			
Project name <enter name of the project for which risks can be identified>			
Risk id <#>	Date <date at which risk is identified>	Probability <risk probability>	Impact <low/medium/high>
Origin <the person who has identified the risk>	Assigned to <who is responsible for mitigating the risk>		
Description <Description of risk identified>			
Refinement/Context <associated information for risk refinement>			
Mitigation/Monitoring <enter the mitigation/monitoring steps taken>			
Trigger/Contingency plan <if risk mitigation fails then the plan for handling the risk>			
Status <Running status that provides a history of what is being done for the risk and changes in the risk. Include the date the status entry was made>			
Approval <name and signature of person approving closure>	Closing date <date>		

The risk information sheet can be maintained by database systems. After documenting the risks using either RMMM plan or Risk information sheet the risk mitigation, monitoring and analysis activities are stopped.

Review Questions

1. What is risk management ? Explain RMMM plan.
2. Explain RMMM.

GTU : Winter-2017, Marks 7

GTU : Winter-2019, Marks 4

