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**Code : 20PM01T****II Semester Diploma Examination, February/March-2023****PROJECT MANAGEMENT SKILLS****Time : 3 Hours ]****[ Max. Marks : 100**

- Instruction :** (i) Answer any one full questions from each Section – I, II, III, IV and V.  
(ii) Each full question carries 20 marks.

**SECTION – I**

1. (a) Define a Project. Mention any three examples for projects you seen. 5
- (b) List any five characteristics of a project. 5
- (c) Explain the different types of projects. 5
- (d) Give an outline about different sectors where project opportunities are available as a Project Manager / Project Consultant. 5
  
2. (a) List the benefits of project design stage in execution of projects. 5
- (b) Explain generalized Work Breakdown Structure (WBS) with a neat sketch. 6
- (c) Mention any four advantages of effective project team. 4
- (d) Prepare a list of project resources needed for construction of residential building. 5

**SECTION – II**

3. (a) Collect the prerequisites for any successful project implementation. 5
- (b) Explain Project Execution Plan (PEP). 5
- (c) Prepare a detailed Work Breakdown Structure for conducting college annual day program of your institution. 10

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4. (a) Explain with neat sketch product life cycle curve. 4
- (b) List the various stages in project management life cycle. 4
- (c) Explain different types of project risks associated with any project. 6
- (d) A state highway project was planned to implement with an estimated budget of 50 crores. However, after the completion of project, it was found that the total project cost was 55 crores. Analyze the possible reasons for the cost overrun (i.e. increase in cost of project). 6

**SECTION – III**

5. (a) State the need of project planning in project management. 5
- (b) Why project evaluation needed in project management cycle ? 5
- (c) Draw a typical time overrun analysis sheet. 4
- (d) A shopping mall construction project was planned with an estimated time duration of 18 months. However, the project took 24 months for its completion. Evaluate the possible reasons for the delay in the project. 6
6. (a) Write the steps required in any project control. 6
- (b) Explain Gantt chart & Bar chart with suitable example. 8
- (c) Mention the various steps involved in any project review. 6

**SECTION – IV**

7. (a) List the various tools available for project planning. 4
- (b) Explain network techniques with an illustration. 5
- (c) What is project audit program in Project Management ? 3
- (d) Explain the following time estimates : 8
- (i) Optimistic Time
  - (ii) Pessimistic Time
  - (iii) Most likely Time
  - (iv) Expected Time

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8. (a) List the various tools available for project control, review and audit. 4
- (b) Write differences between PERT and CPM (Project Evaluation and Review Technique) & Critical Path (method). 6
- (c) The three time estimates ( $t_o$ ), ( $t_m$ ), ( $t_p$ ) for each activity in a project are given below. Determine the expected time for each activity and also calculate the Standard Deviation of the project. 10

Activity	Time Estimates		
	$t_o$	$t_m$	$t_p$
1 – 2	9	12	21
1 – 3	6	12	18
2 – 4	1	1.5	5
3 – 4	4	8.5	10
2 – 5	10	14	24

Note :  $t_o$  – Optimistic Time

$t_m$  – Most likely Time

$t_p$  – Pessimistic Time

$t_e$  – Expected Time

## SECTION – V

9. (a) Define critical path, total float and free float. 6
- (b) Explain crashing project duration through network technique. 4
- (c) The following activities constitute a project (i) construct the network to represent the project and also identify the critical path (ii) write all project paths possible. 10

Activity	Duration (Days)
1 – 2	8
1 – 3	8
1 – 4	10
2 – 4	10
2 – 6	16
3 – 5	18
3 – 6	14
4 – 5	17
5 – 6	9

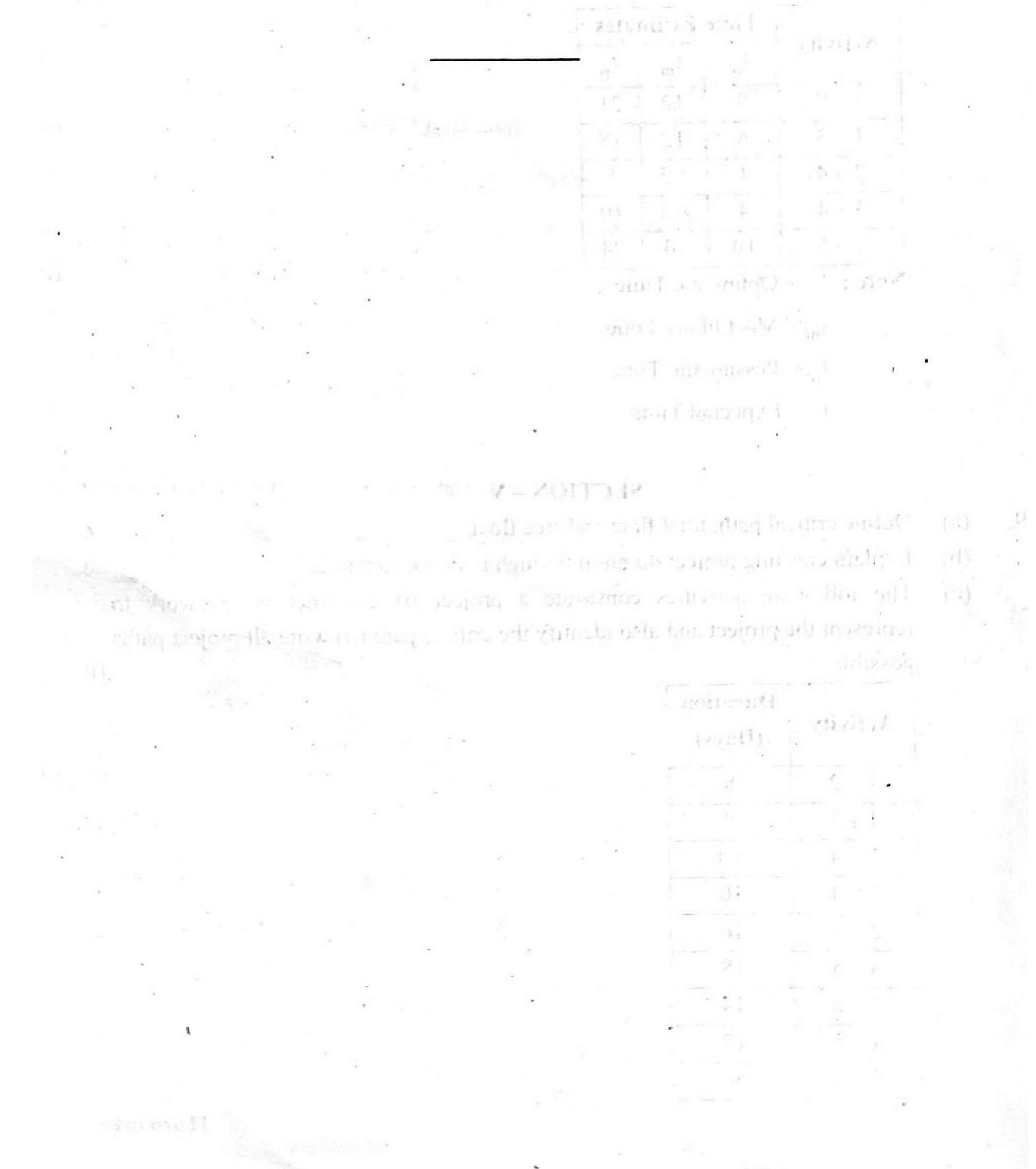
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10. (a) What are Digital Projects ? Give any three examples of Digital Projects. 5
- (b) Identify the Digital Trends in Project Management. 5
- (c) Discuss the use of IoT Application in Digital Project Management. 5
- (d) Discuss cloud computing technology application in digital project management. 5



II Semester Diploma Examination, February / March - 2023

**PROJECT MANAGEMENT SKILLS****[Max. marks: 100]****Instructions:** (i) Answer any **ONE** full question from each **Section -I,II,III,IV,V** and **marks**.(ii) Each Full question carries **20 marks**.**NOTE:** Similar / Relevant answers are also to be evaluated as per the Scheme of Valuation

<b>Q. Nos</b>	<b>Questions Description</b>	<b>Marks</b>
<b>SECTION- I</b>		
1	1(a) Definition of Project- 2 Marks ; Any 3 Examples – 3 Marks	$2 + 3 = 5$
	1(b) Any 5 Characteristics-Each 1 Mark	$1 \times 5 = 5$
	1(c) Listing -3 Marks ; Explanation of any one project – 2 Marks	$3 + 2 = 5$
	1(d) Any 5 sectors each one 1 Mark	$1 \times 5 = 5$
2	2(a) Any 5 benefits of product design- each 1 Mark	$1 \times 5 = 5$
	2(b) Sketch – 3 Marks ; Explanation – 3 Marks	$3 + 3 = 6$
	2(c) Any 4 advantages – each 1 Mark	$1 \times 4 = 4$
	2(d) List the project resources- each 1 Mark	$1 \times 5 = 5$
<b>SECTION- II</b>		
3	3(a) Any 5 prerequisites- each 1 Mark	$1 \times 5 = 5$
	3(b) Explanation	5
	3(c) WBS Level 2 – 4 Marks; WBS Level 3 – 6 Marks <b>Note :</b> Any general college day event breakdown structure can be considered	$4 + 6 = 10$
4	4(a) Project Life cycle curve – 2 Marks ; Explanation – 2 Marks	$2 + 2 = 4$
	4(b) Listing of phases / stages – each 1 Mark	$1 \times 4 = 4$
	4(c) Any four Project risks – 2 Marks ; Explanation of any 2 risk – $2 \times 2 = 4$ Marks	$2 + 4 = 6$
	4(d) Any 6 possible reasons for increase in cost of project – each 1 Mark	$1 \times 6 = 6$
<b>SECTION- III</b>		
5	5(a) Any 5 reasons for need of project planning- each 1 Mark	$1 \times 5 = 5$
	5(b) Any 5 reasons for need of project evaluation- each 1 Mark	$1 \times 5 = 5$
	5(c) Time overrun sheet <b>Note :</b> Any other time overrun sheet can be considered	4
	5(d) Any 6 possible reasons for delay in the project – each 1 Mark	$1 \times 6 = 6$
6	6(a) Each step in project control -1 mark	$1 \times 6 = 6$
	6(b) Gantt Chart Sketch – 2 Marks; Explanation – 2 Marks Bar Chart Sketch – 2 Marks ; Explanation – 2 Marks	$4 + 4 = 8$
	6(c) Any 6 Steps in project review	$1 \times 6 = 6$

SECTION- IV			
7	7(a)	Any 4 tools of project planning – 1 Mark each	$1 \times 4 = 4$
	7(b)	PERT – 2.5 Marks ; CPM – 2.5 Marks	$2.5 + 2.5 = 5$
	7(c)	Project audit explanation	3
	7(d)	Explanation of Optimistic time – 2 Marks; Most likely time – 2 Marks Pessimistic time – 2 Marks ; expected time – 2 Marks	$2 \times 4 = 8$
8	8(a)	Any 4 tools for project control, review , audit	$1 \times 4 = 4$
	8(b)	Any 6 differences b/w PERT & CPM	$1 \times 6 = 6$
	8(c)	Expected time for each activity – $1.5 \times 5 = 7.5$ Marks; Standard deviation – 2.5 Marks	$7.5 + 2.5 = 10$
SECTION- V			
9	9(a)	Definition of Critical path – 2 Marks; Total float – 2 Marks; Free float – 2 Marks	$2 + 2 + 2 = 6$
	9(b)	Explanation of crashing network	4
	9(c)	Network Construction – 5 Marks; Writing all possible paths – 3 Marks; Identifying critical path – 2 Marks	$5 + 3 + 2 = 10$
10	10(a)	Definition of Digital projects – 2 Marks ; Any 3 Example's each 1 Mark	$2 + 3 = 5$
	10(b)	Any 5 present Digital trends in project management- each 1 Mark	$1 \times 5 = 5$
	10(c)	Brief Explanation of IoT Applications	5
	10(d)	Brief Explanation of Cloud Technology Applications	5

II Semester Diploma Examination, February / March - 2023

## PROJECT MANAGEMENT SKILLS

[Max. marks: 100]

**Instructions:** (i) Answer any ONE full question from each Section –I,II,III,IV,V and marks.

(ii) Each Full question carries 20 marks.

**NOTE:** Similar / Relevant answers are also to be evaluated as per the Scheme of Valuation

### SECTION - I

**Q1. 1 (a). Define a project. Mention any three examples for projects you seen. – 5 Marks**

**Definition:**

A project is a temporary, unique and progressive sequence of tasks that must be completed on time to attain a certain outcome.

**OR**

Project is a temporary endeavor undertaken to create a unique product or service.

**OR**

A project is a one-shot, time limited goal directed, major undertaking, requiring commitment of varied skills and requirements.

**OR**

Project is a work plan which is scientifically devised with the right man for the right work at the right time to achieve a specific objective within a certain set time frame.

**OR**

Project is a unique process, consist of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective confirming to specific requirements, including the constraints of time cost and resource. (ISO10006).

**Examples for projects:**

- |  |  |
|--|--|
| 1. High way road construction projects | 7. Information technology projects           |
| 2. Metro rail project                  | 8. Educational projects                      |
| 3. Oil refinery projects               | 9. Construction of apartments                |
| 4. Power projects                      | 10. Conducting national elections            |
| 5. Health projects                     | 11. War execution                            |
| 6. Automotive Manufacturing projects   | 12. Launching new weapon defense system etc. |

**1 (b). List any five characteristics of a project.****- 5 Marks**

Following are some important features of a project:

- Unique in nature. (No two projects are exactly similar)
- Have definite goals (objectives) to achieve
- Require set of resources.
- Have a specific time frame for completion with a definite start and finish.
- Project has a life cycle reflected by start, growth, maturity and decline
- Involves risk and uncertainty
- Require cross-functional teams and interdisciplinary approach.
- Change is an inherent feature in any project throughout its life.

**1 (c). Explain different types of projects****- 5 Marks**

Projects are often categorized in terms of their need speed of implementation as follows:

- a. Normal Projects
- b. Crash Projects
- c. Disaster Projects

**a. Normal Projects**

Adequate time is allowed for implementation. All the phases in a project are allowed to take their normal time, as measured previously Minimum requirement of capital. No sacrifice in terms of quality.

**b. Crash Projects**

Requires additional costs to gain time. Maximum overlapping of phases is encouraged. Simultaneous work, by subcontracting is the way out

**c. Disaster Projects**

These are projects, undertaken, due to unexpected nature's calamities or fury like floods results in rehabilitation of dwelling houses for affected people. Anything needed to gain time is allowed in these projects. Round the clock work is done at the construction site. Capital cost will go up very high. Project time will get drastically reduced.

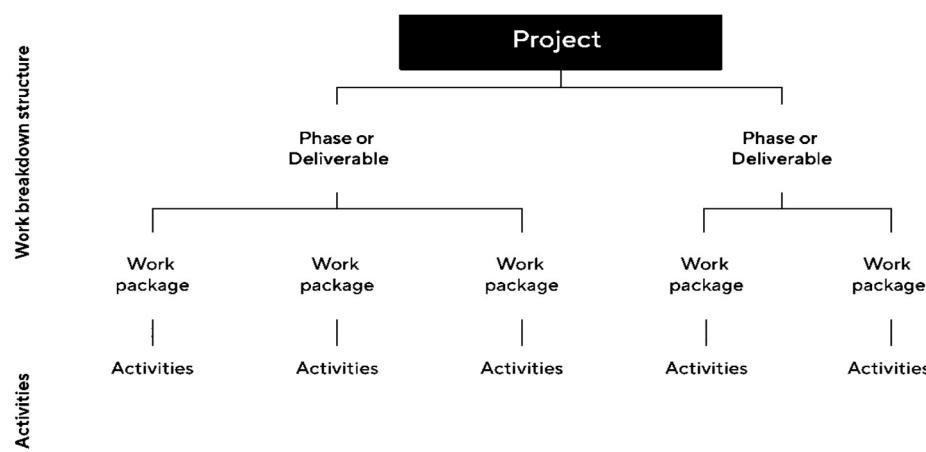
**1 (d). Give an outline about different sectors where project opportunities are available as a project manager / project consultant.****- 5 Marks**

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>➤ Construction Sector</li> <li>➤ Manufacturing Sectors</li> <li>➤ Production fields</li> <li>➤ Health care</li> <li>➤ Power Generation</li> <li>➤ Automotive / aerospace</li> </ul> | <ul style="list-style-type: none"> <li>➤ Marketing and sales</li> <li>➤ Supply chain management</li> <li>➤ IT Sectors – cyber security etc.</li> <li>➤ Education sectors</li> <li>➤ Defense</li> <li>➤ Refinery Sector</li> </ul> |
|--|---|

**Q2. 2 (a). List the benefits of project design stage in execution of projects. - 5 Marks**

Project design is useful to the entrepreneurs in the following ways:

1. It gives a comprehensive idea about the entire project- described in every phase along with the time schedule within which it has to be completed.
2. It is a diagrammatic representation of the work plan designed to execute the project, after adjusting the usual delays that may arise in the implementation of the project
3. The various constituent activities of the project are narrated in sequence to highlight the various phases of the project.
4. It enables to identify the knowhow of events which must take place for the successful completion of the project.
5. It helps entrepreneurs in coordinating project activities.
6. It serves as an effective tool of planning and implementation of a project.
7. It helps managers to plan the project economically

**2 (b). Explain Generalized work breakdown structure (WBS) with a neat sketch. – 6 Marks**

**Fig. Work Breakdown Structure**

- A Project is a combination of interrelated activities which must be performed in a certain order for its completion. The process of dividing the project into these activities is called Work Breakdown Structure (W.B.S.). The connection between each activities is established and implemented in a project. The number of activities or the size of each activity will depend upon the level of detail desired
- The work breakdown structure represents a systematic and logical breakdown of the project into its component parts such as activities. It is constructed by dividing the project into its major parts, with each of these being further divided into sub-parts. This is continued till a breakdown is done in terms of manageable units of work for which responsibility can be defined.

Thus the work breakdown structure helps in:

- Effective planning by dividing the work into manageable elements which can be planned, budgeted, and controlled
- Assignment of responsibility for work elements to project personnel and outside agencies.
- Development of control and information system

**2 (c). Mention any four advantages of effective project team.**

- 4 Marks

1. Clear objective of the project from the initiation to 'completion.
2. Good decision making process, which speeds up the activities.
3. Clear roles, responsibilities and leadership.
4. Ensures smooth progress of the project without overlapping.
5. Leadership roles are shared by the team head.
6. Trust, co-operation, support and constructive conflict or feedback.
7. Individual and mutual accountability for performance results.

**2 (d). Prepare a list of project resources needed for construction of residential building.**

- 5 Marks

1. Different categories of Workforce – supervisor, construction worker, engineer
2. Construction equipment's such as bulldozers etc.
3. Building materials for construction such as Wood, cement, metals, bricks, concrete, clay etc.
4. Money (Finance)
5. Land for construction

## SECTION - II

**Q3. 3 (a). Collect the perquisites for any successful project implementation**

- 5 Marks

Some of the important prerequisites are

1. Adequate formulation,
2. Sound project organization,
3. Proper implementation planning,
4. Advance action,
5. Timely availability of funds,
6. Judicious equipment tendering and procurement,
7. Better contract management,
8. Effective monitoring.

**3 (b). Explain project execution plan (PEP)****- 5 Marks**

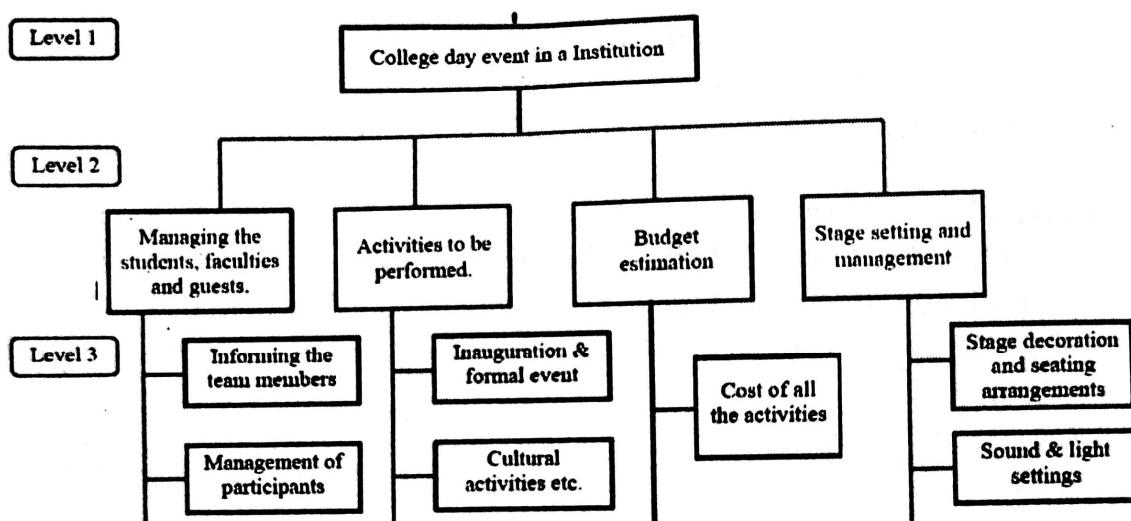
The Project Execution Plan is the governing document that establishes the means to execute, monitor, and control projects. It is a document that describes the objectives we want to achieve in a company with the time and resources needed along with the costs, quality, benefits, etc.

PEP includes four sub-plans. These are:

1. Contracting Plan
2. Work packing Plan
3. Organization Plan
4. Systems and Procedure Plan

**3 (c). Prepare a detailed work breakdown structure for conducting college annual day**

**program of your institution.**

**- 10 Marks**

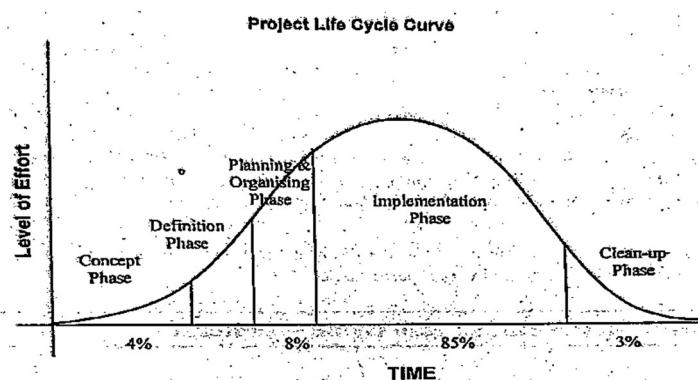
**Fig. Work breakdown structure for College Annual Day Event**

**Note:** Any general college day event breakdown structure can be considered

**Q4. 4 (a). Explain with a neat sketch project life cycle curve.****- 4 Marks**

Product life cycle curve is a parabolic pattern of indicative of growth, maturity and decline.

This curve helps a project manager to ascertain the state of health of any project at any point of time.



**Fig. Project Life cycle curve**

**4 (b). List the various stages in project management life cycle -**

**4 Marks**

The four phases of project life cycle are,

1. Initiation
2. Planning
3. Execution
4. Closure or Termination



*Fig. Various phases of project life cycle*

**4 (c). Explain the different types of project risks associated with any project. - 6 Marks**

Risk is defined as the possibility of an outcome being different from the expected outcome. It refers to the possibility of adverse results flowing from the uncertainty involved in carrying out the activities. The element of risk is inherent in every activity of a project. All projects are exposed to various types of risks.

1. *Technical Risks:* Technical risks refer to changes in technical specifications of the product resulting in loss.
2. *Social Risks:* Social risks refer to risks arising from changes in the needs and preferences of customers. Lack of necessary natural resources, labour unrest, agitations and social movements against the project also constitute social risks.
3. *Economic Risks:* Economic risks refer to an increase in the rate of inflation, changes in the economic policies of governments.
4. *Political Risks:* Nationalisation or privatisation of a particular industry, political instability, and trade restriction are some examples of political risks. The project manager should ensure that the project does not go against the political interests of the country.
5. *Production Risks:* Production risks refer to the shortage of necessary raw materials, sudden breakdown of key machinery and huge rise in installation and maintenance costs.
6. *Marketing Risks:* Marketing risks refer to failure of the developed product or service in the market due to changes in market demand, errors in forecasting of demand, or difficulties in distribution.
7. *Financial Risks:* Financial risks refer to bad debts, change in the interest rate, wrong choice of investments and mistakes in the accounting procedures.
8. *Human Risks:* Human risks refer to the sudden demise of key employee, limited availability of skilled employees, inter-group politics, etc.

**4 (d). A state highway project was planned to implement with an estimated budget of 50 crores. However, after the completion of the project, it was found that the project total cost was 55 crores. Analyze the possible reasons for the increase in cost of the project.**

**- 6 Marks**

The possible reasons for the given project cost overruns

1. Unplanned expansion of the project scope.
2. Inaccurate initial cost estimation.
3. Failures in project performance.
4. Errors in project design.
5. Improper risk management.
6. Improper project team building.
7. Wrong choice of equipment
8. Incompetent material suppliers.
9. Time overrun.

### SECTION - III

**Q5. 5 (a). State the need of project planning in project management. - 5 Marks**

Project Planning is all about designing effective policies and methodologies in order to attain or fulfil project deliverables or project scope or project objectives. Project planning is thinking before doing. Reasons for need of project planning are:

1. To completely define all work requested so that it will be readily identifiable to each project participant
2. To eliminate or reduce uncertainty
3. To improve efficiency of the operation
4. To obtain a better understanding of the objectives
5. To provide a basis for monitoring and controlling work

**5 (b). Why project evaluation needed in project management cycle. - 5 Marks**

Project Evaluation is a step-by-step process of collecting, recording and organizing information about project results, including short-term and longer-term project outcomes

**Reasons for need of project evaluation are:**

Project evaluation provides answers to several aspects such as:

- Progress made.
- Effective and efficient use of resources.
- Desired output achieved.
- Improvements to be made for better outcome.
- Success factors
- Whether the results justify the input etc.

**5 (c). Draw a typical time overrun analysis sheet****- 4 Marks**

<b>Sl. No.</b>	<b>Project Description</b>	<b>Estimated time</b>	<b>Project actual time</b>	<b>Time Overrun</b>	<b>% of time Overrun</b>	<b>Reasons for time overrun</b>
1.	Shopping mall	12 Months	15 Months	3 Months	✓	✓
2.	Showroom & office	10 Months	16 Months	6 Months	✓	✓
3.	IT Park	18 Months	22 Months	4 Months	✓	✓
4.	House	2 Months	12 Months	10 Months	✓	✓
5.	Office Complex	8 Months	12 Months	4 Months	✓	✓

**Note:** Any other time overrun sheet can be considered

**5 (d). A shopping mall construction project was planned with an estimated time duration of 18 months. However, the project took 24 months for its completion. Evaluate the possible reasons for the delay project in the project.**

**- 6 Marks**

The possible reasons for the given project time overruns

1. A change in the scope of the project.
2. Ineffective project time management.
3. Delays in starting and executing some of the project activities.
4. A delay in one project, results in delays in subsequent projects.
5. Use of outdated technology.
6. Political interference.
7. Poor administration.
8. Poor planning.

**Q6. 6 (a). Write the steps required in any project control.****- 6 Marks**

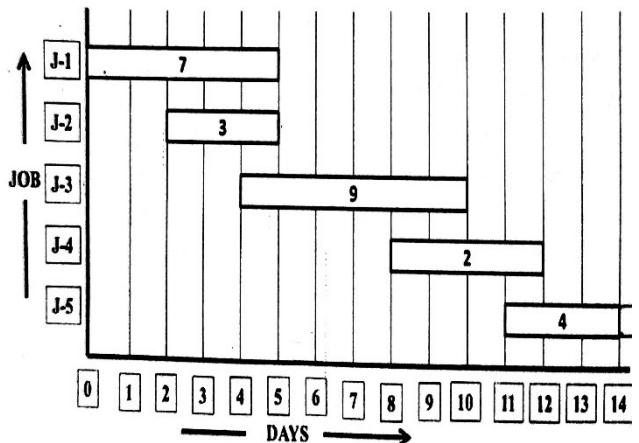
There are two important steps in the project control viz;

1. Establishment of controls.
2. On-going controlling activities using above controls. - It is nothing but controlling a project when it enters the production period using the controls established during the initiation period. Control during the production period involves four steps. They are

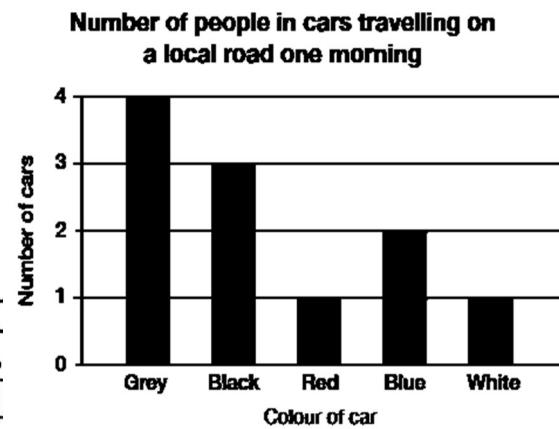
3. Setting targets for what should be achieved.
4. Measurement of what is happening including anticipation of what may happen.
5. Comparison between what should happen and what is happening or likely to happen.
6. Taking corrective actions to make things happen, as they should. These four steps should follow each other till the work is completed.

**6 (b). Explain Gantt chart and Bar chart with suitable example.**

- 8 Marks



**Fig. Gantt Chart**



**Fig. Bar Chart.**

**Gantt Chart:**

- Gantt Chart is the oldest formal planning tool designed by Henry Gantt in 1913. Under this, the activities of project are broken down into a series of well-defined jobs of short duration whose cost and time can be estimated. It is a picture in which the activities / jobs are represented by horizontal bars in the time axis. The length of the bar indicates the estimated time for the job/ activity. The left hand end of the bar shows the beginning time, the right hand the ending time. The manpower required for the activity is shown by a number on the bar.

**Bar charts:**

- Bar charts are the two-dimensional pictorial representation of a project. In a bar chart, the activities of the project are shown on one axis and their durations are represented on the other axis. The bars can be plotted vertically or horizontally. A vertical bar chart is sometimes called a column chart.
- A bar chart helps to review the project progress, allows for rescheduling the project and highlights the critical activities and other bottlenecks in the completion of the project. A bar chart, however, is normally suited to small projects. It cannot take into account the uncertainties in activity duration nor represent the interrelationships between the various activities of the project.

**6 (c). Mention the various steps involved in any project review**

**- 6 Marks**

The various steps involved in any project review are

1. Initial review
2. Performance evaluation
3. Abandonment analysis
4. Behavioral issues in project management
5. Administrative aspects of capital budgeting
6. Evaluating the capital budgeting system of organization

**SECTION - IV**

**Q7. 7 (a). List the various tools available for project planning.**

**- 4 Marks**

The various tools available for project planning are,

1. Gantt Charts
2. Bar Charts
3. Flow Charts
4. Time estimates
5. Product design print
6. Network Diagrams
7. CPM – Critical Path Method
8. PERT – Project Evaluation & Review technique.
9. WBS- Work Breakdown Structure
10. Velocity Diagrams

**7 (b). Explain network techniques with an illustration.****- 5 Marks**

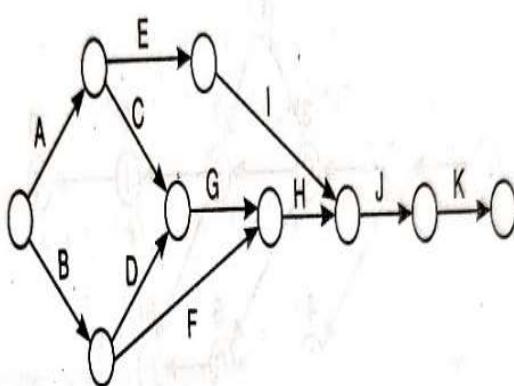
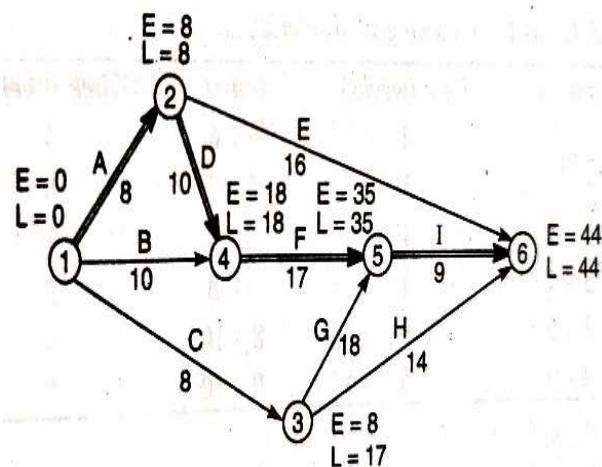
A network (also called network diagram or network technique) is a symbolic representation of the essential characteristics of a project. PERT and CPM are the two most widely applied techniques.

**(i). Programme Evaluation and Review Technique (PERT)**

It uses event oriented network in which successive events are joined by arrows. It is preferred for projects that are non-repetitive and in which time for various activities cannot be precisely predetermined. There is no significant past experience to guide; they are once-through projects. Launching a new product in the market by a company, research and development of a new war weapon, launching of a satellite, sending space craft to Mars are PERT projects. Three time estimates — the optimistic time estimate, the pessimistic time estimate and the most likely time estimate are associated with each and every activity to take into account the uncertainty in their times.

**(ii). Critical Path Method (CPM)**

It uses activity oriented network which consists of a number of well recognised jobs, tasks or activities. Each activity is represented by arrow and the activities are joined together by events. CPM is generally used for simple, repetitive types of projects for which the activity times and costs are certainly and precisely known. Projects like construction of a building, road, bridge, physical verification of store, yearly closing of accounts by a company can be handled by CPM. Thus it is deterministic rather than probabilistic model

**Fig. PERT****Fig. CPM**

**7 (c). What is project audit program in project management? - 3 Marks**

The Project audit programme is preliminary examination of the project's Organization, administration, record keeping- costs, planning and control, working methods, quality aspects and techniques performed in order to establish project current and future status from time to time.

**7 (d). Explain the following time estimates - 8 Marks**

- i. **Optimistic time (to):** The optimistic time is the time required to complete the activity if no hurdles or complications arise.
- ii. **Most likely time (tm):** The most likely time is the time in which the activity is most likely to be completed. This estimates takes into consideration normal circumstances, making allowances for some unforeseen delays.
- iii. **Pessimistic time (tp):** The pessimistic time is the time required if unusual complications or unforeseen difficulties arise.
- iv. **Expected Time (te):** Expected time is the mean time that the activity is expected to consume while executed.

$$t_e = \frac{tp+4tm+to}{6}$$

**Q8. 8 (a). List the various tools available for project control, Review and audit - 4 Marks**

The various tools available for project control, Review and audit are,

1. Gantt Charts
2. Bar Charts
3. Flow Charts
4. Milestone Charts
5. Network Diagrams
6. CPM – Critical Path Method
7. PERT – Project Evaluation & Review technique.
8. WBS- Work Breakdown Structure
9. Project Documentation

## 8 (b). Write the differences between PERT &amp; CPM.

- 6 Marks

Sl. No.	PERT	CPM
1	It is appropriate where the time estimates are uncertain in the duration of activities.	It is appropriate when the time estimates are found with certainty in the duration of activities.
2	It uses three time estimates for the performance of an event.	It uses only one-time estimate for the Activity and which is constant
3	It is concealed with the events.	It is concealed with the activity.
4	It is suitable for non-repetitive projects.	It is suitable for repetitive projects.
5	It can be analyzed statistically.	It cannot be analyzed statistically.
6	Time is the direct controlling factor.	Cost is the direct controlling factor.
7	The circle stands for an event and the line connecting the circles represents an activity.	The circle stands for an activity and the line joining the circles represents an events
8	It is applied to research development industries.	It is applied to the construction.

8 (c). The three time estimates ( $t_o$ ), ( $t_m$ ), ( $t_p$ ) for each activity in a project are given below.

Determine the expected time for each activity and also calculate the standard deviation of the project.

- 10 Marks

Activity	Time Estimates		
	$t_o$	$t_m$	$t_p$
1-2	9	12	21
1-3	6	12	18
2-4	1	1.5	5
3-4	4	8.5	10
2-5	10	14	24

**Note:** $t_o$  - Optimistic Time $t_m$  - Most Likely Time $t_p$  - Pessimistic Time $t_e$  - Expected Time

Activity	Time Estimates			Expected Time for each activity $t_e = \frac{t_p + 4t_m + t_o}{6}$	Variance for each activity $V = \sigma^2 = \left( \frac{t_p - t_o}{6} \right)^2$
	$t_o$	$t_m$	$t_p$		
1-2	9	12	21	13	4
1-3	6	12	18	12	4
2-4	1	1.5	5	2	0.4444
3-4	4	8.5	10	8	1
2-5	10	14	24	15	5.4444

**Standard Deviation of project ( $\sigma$ ):**

$$V = \sigma^2 = \left( \frac{t_p - t_o}{6} \right)^2$$

$$\sigma = \sqrt{4 + 4 + 0.4444 + 1 + 5.4444}$$

$$\sigma = 3.8586$$

## SECTION - V

**Q9. 9 (a). Define critical path, total float and free float.**

– 6 Marks

✓ **Critical path:**

Critical path is the longest sequence of connected activities through the network. Critical path has zero slack time. The activities in the critical path are called critical activities. They are critical in the sense that delay in any of the activities results in the delay of completion of project.

✓ **Total Float:**

It is the difference between maximum time available to perform the activity and activity duration. The maximum time available for any activity is from the earliest start time to latest completion time.

✓ **Free Float:**

Free float is the time by which completion of an activity can be delayed without delaying its immediate successor activities.

**9 (b). Explain crashing project duration through network techniques.**

– 4 Marks

Each activity of the project consumes some resources and hence has cost associated with it. In most of the cases cost of an activity will vary to some extent with the amount of time consumed by the activity. The cost of total project, which is the aggregate of the activity costs will also depend upon the project duration. Thus by increasing the costs, the project duration can be cut down to some extent. The aim is always to strike a balance between the costs and time and to obtain an optimum project schedule. An optimum project schedule implies lowest possible cost and the associated time for the project. The total cost of any project consists of the direct and indirect costs involved in its execution.

Often there may be compelling reasons to complete the project earlier than would be the case

with the duration of the critical path computed on the basis of normal expected activity times. Examples are war situations or market introduction of a new product. The motive in hastening the project might be to ensure that the competitors do not steal a march. Also the managements often want to reduce the target time so that the saved time can be used for some extra work in such situations, our concern is to find the project cost if some or all the activities are crashed from the knowledge of the normal direct cost and crashed direct cost, the cost slope for each Activity can be determined. If the indirect cost per unit time is known, the total cost of the project can be found by adding the direct and indirect costs.

**The normal time ( $T_n$ )** for the completion of the project will be the sum of the normal time durations of the critical activities and the normal direct cost ( $C_n$ ) of the project will be the sum of the normal cost of all the activities since each and every activity has to be executed to complete the project.

**The minimum time ( $T_c$ )** that the project will take for its completion will be sum of the crashed time durations of the activities along the critical path. If all the activities (critical as well as non-critical) are crashed, the cost will be very high without any additional advantage over and above the one obtained by crashing only the critical activities. Therefore, the non-critical activities need not be expedited since their crashing is not going to decrease the project duration further.

However, in the process of crashing the critical activities, it may so happen that some of the non-critical activities become critical. It is, therefore, essential to proceed step by step, crashing one activity at a time and examine whether any other non-critical activity has also become critical. Obviously, first the critical activity with minimum cost slope should be selected for crashing and then the critical activity with next higher cost slope and so on till all the critical activities are fully crashed or no further crashing is possible.

The time-cost trade-off method consists of systematic analysis of the project time and cost. At each step of crashing, the direct cost is calculated; it would naturally be higher than the normal direct cost as it includes the additional cost of crashing too. However, the indirect cost will reduce as the project duration has been reduced. The total cost is then found at each step. A table or a curve may be constructed between the total cost and time. It is found that as the project duration is decreased, the total cost may also decrease, reaching the minimum value, beyond which it may increase. This minimum cost is called the *optimum project cost* and the corresponding time, *optimum project time*. In emergencies and during sudden rush of orders from the customers, the crashing may be further continued to get the *minimum* or *crash project time* and the corresponding *crash cost*.

9 (c). The following activities constitute a project. Construct the network to represent the project and also identify the critical path. Also Write all the project paths possible

Activity	Duration ( Days )
1-2	8
1-3	8
1-4	10
2-4	10
2-6	16
3-5	18
3-6	14
4-5	17
5-6	9

- 10 Marks

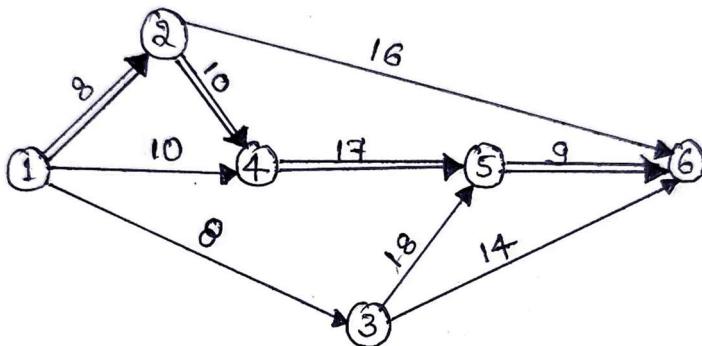


Fig. Network Diagram of a project

The various paths of the network and their duration are;

Path	Duration ( Days )
1-2-6	$8+16=24$
1-2-4-5-6	$8+10+17+9=44$
1-4-5-6	$10+17+9=36$
1-3-5-6	$8+18+9=35$
1-3-6	$8+14=22$

**The Path:** 1-2-4-5-6, the longest in time takes **44 days**, Therefore, is the **Critical path**. It is represented by **Double lines** in **Network Diagram**.

**Note:** Any other network method to find critical path other than this also can be considered.

**Q10. 10 (a). What are Digital Projects? Give any three examples of Digital projects - 5 Marks**

Digital projects are modern day software projects that predominantly use digital technologies such as *Big Data technologies, Augmented reality and virtual reality (AR & VR), Artificial intelligence (AI) technologies, cloud computing technologies, experience platforms, enterprise portals, content management systems (CMS), commerce platforms, user experience technologies, mobile technologies, search, analytics, and collaboration* etc. to achieve high-quality deliverables.

These digital projects are mainly executed through an Agile methodology or in iterations to attain faster time to market.

**Examples of Digital projects are**

1. *Karnataka LMS Portal by Govt. of Karnataka* Which uses content management systems (CMS)
2. Unified University college management system (UUCMS) by Govt. of Karnataka
3. Digitization of existing banking processes, Development of next generation online banking platform, digital bank office, virtual branch, digital wallets, etc.
4. Media and entertainment sector service providers such as Netflix, Amazon do analysis on data collected on their users
5. Online Educational Service providers, Vedanta, Byzus, Coursera etc.
6. Digitization of Identity – Aadhaar Card Project
7. Automatic Driving car by Audi Volvo, cruise control in cars
8. Smart Traffic system
9. Robotics Digital project in hospitals, healthcare
10. Tracking customer spending habit shopping behavior in retail stores like amazon, flip kart, reliance, big bazaar etc.
11. Ola, Uber, Zomoto, Swiggy, Movie tickets using Book my Show, Rapido etc.
12. Smart Pollution Control, Smart traffic control, autonomous cars.
13. Smart Home Automation
14. *Government of Karnataka Digital Initiatives* such as, e-Office, e-PAR, e-Procurement, HRMS, Bhoomi, Nondani, State Scholarship Portal (SSP), Khajane-II, e- Udyami, Seva Sindhu
15. *Government of India Digital initiatives* such as, Digi locker, Direct Benefit transfer, National Academic Depository, ICT Learning missions – NPTEL, Swayam, National Digital Library(NDL)

**Note:** If any other relevant examples can be considered

**10 (b). Identify the digital trends in project management****- 5 Marks**

As the digital technology ecosystem is continuously evolving, organizations need to constantly look out for modern digital technologies to realize their digital vision.

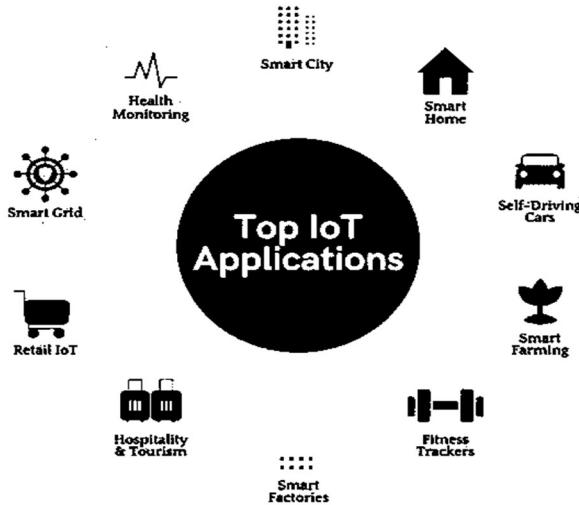
The main current trends in the digital space are given here:

1. ***Location-based analytics:*** Using location-based services, organizations want to push personalized, relevant, and effective campaigns and services.
2. ***Social channel utilization and touch point optimization:*** Organizations want to engage their customers at all touch points (web, offline, kiosk, mobile, social media, IVR, etc.). Due to increased popularity of social media platforms, organizations use them for the voice of customer channels, brand marketing, campaigns, etc.
3. ***Mobile-first and cloud-first strategies:*** Digital platforms are built with mobile devices as their primary delivery platforms. The applications are deployed increasingly on the cloud to realize the “software-as service” model.
4. ***Intuitive user experiences:*** Seamless and integrated cross-channel enabled content with dashboard views, unified views, 360-degree activity views, and rich, real-time visualizations are becoming the norm in the user experience space. Good customer experiences bring trust and loyalty.
5. ***Digital marketing:*** Organizations are leveraging social media platforms to market their products such as Insurance etc. and brands. Peer recommendations and peer approval play a major role in influencing customers.
6. ***Analytics:*** Real-time analytics of user actions and analysis of historical data will be used for contextual recommendation and for personalizing the experience.
7. ***Banking:*** Digital banking, omni-channel experience, personalization, dashboard experience, virtual branch, self-service tools, social media engagement, analytics, mobile apps, digital payments, and digital wallets.
8. ***Retail:*** Virtual assistant, AI-based smart recommendations, chat bot, augmented reality, mobile apps, Big Data, IoT, wearables, cloud delivery (SaaS), social media marketing, social listening, user enablement, targeted marketing, loyalty management, digital marketing, customer segmentation, and voice of customers.
9. ***Utilities:*** Dashboard experience, self-service, process automation, real-time monitoring, dashboard view, and analytics.
10. ***Life sciences:*** Business intelligence, mobile apps, CRM, ERP applications, wearables, IoT, and reporting.
11. ***Automobile:*** IoT and telematics.
12. ***Other digital technologies:*** Organizations are increasingly investing in Big Data, IoT, and

wearables for applicable use cases

**10 (c). Discuss the use of IoT application in Digital project management.**

- 5 Marks



**Fig. IoT Applications**

**The Internet of Things (IoT)** is a network of physical objects/devices such as appliances, vehicles etc. that are fitted with sensors, software and other technologies Connected to the Internet, these ‘things’ are able to exchange real time data with other connected devices and systems over networks. These connected devices combine with automated systems to gather IoT data that can be analyzed to assist with tasks.

**Over 9 billion ‘Things’ (physical objects) are currently connected to the Internet, as of now.**

**In the near future, this number is expected to rise to a whopping 20 billion.**

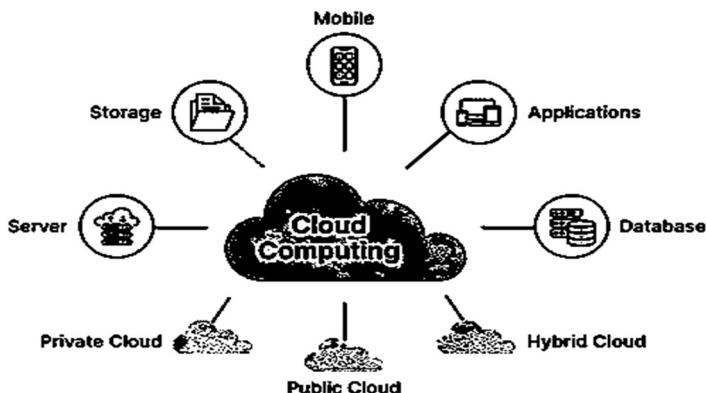
**Applications of Internet of Things (IoT):**

1. Connected vehicles such as Autonomous driving cars
2. Connected Health – monitoring BP and Heart rate, Wearables in fitness control
3. Smart Grids with Energy management capability
4. Smart cities - to assist the infrastructure planning of an entire smart city, air quality monitoring, Earthquake detection, Radiation detection/hazardous gas detection
5. Smart Building – Reducing Energy consumption
6. Smart homes / Home automation such as, auto lighting and electricity monitoring, Home security systems, Smart Air conditioning systems, Smart Washing machine.
7. Industrial IoT used in manufacturing, healthcare, retail, automotive
8. Agriculture for weather monitoring, soil content monitoring

9. Transport – Smart Traffic control, Smart parking control, smart roadside assistance
10. Military applications for data collection of battle field
11. Voice assisted devices such as Alexa, Google, Siri etc.

**10 (d). Discuss cloud computing technology application in digital project management.**

- 5 Marks



**Fig. Cloud Computing**

**Cloud computing** is the on-demand delivery of IT resources over the Internet with pay-as-you-go pricing. Instead of buying, owning, and maintaining physical data centers and servers, (IT infrastructure) you can access technology services, such as computing power, storage, and databases, on an as-needed basis from a cloud provider such as Google Cloud, Amazon Web Services (AWS).

It eliminates the need for enterprises to procure, configure, or manage resources themselves, and they only pay for what they use.

**Benefits of cloud computing:**

1. *Agility* - The freedom to experiment, test new ideas to differentiate customer experiences, and transform your business.
2. *Elasticity*- scale the resources up or down to instantly grow and shrink capacity as your business needs change.
3. *Lower IT costs (Cost savings)*- The cloud allows you to trade fixed expenses (such as data centers and physical servers) for variable expenses, and only pay for IT as you consume it. Plus, the variable expenses are much lower than what you would pay to do it yourself because of the economies of scale.
4. *Deploy globally in minutes*-With the cloud, can expand to new geographic regions and deploy globally in minutes. For example, AWS has infrastructure all over the world, so can deploy your application in multiple physical locations with just a few clicks.

***Applications of cloud computing:***

1. Healthcare companies are using the cloud to develop more personalized treatments for patients.
2. Financial services companies are using the cloud to power real-time fraud detection and prevention.
3. Video game makers are using the cloud to deliver online games to millions of players around the world.
4. IT companies use data backup, Disaster recovery- Rather than building more data centers to ensure continuity during disasters, businesses use cloud computing to safely back up their digital assets.