CMR INSTITUTE OF TECHNOLOGY

USN	1	C	R			E	E			

Internal Assesment Test - II

Sub:	ELECTRICAL DISTRIBUTION SYSTEMS							Code:	10EE844
Date:	08/ 05/2017	Duration:	90 mins	Max Marks:	50	Sem:	VIII	Branch:	EEE

Note: **Answer any FIVE questions**. Sketch figures as necessary. Each Question is for 10 marks.(5x10=50M)

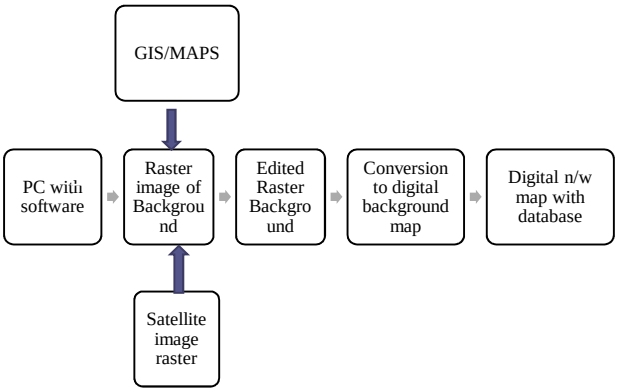
		Marks	OBE	
			CO	RBT
1 (a)	With block diagram ,explain the process of digital mapping	[04]	CO3	L2
(b)	Explain engineering design with flow diagram of design process	[06]	CO3	L4
2 (a)	Discuss in brief the planning criteria & standards of distribution system	[08]	CO3	L2
(b)	Write a note on GPS	[02]	CO2	L1
3 (a)	Explain different components of planning process	[05]	CO2	L4
(b)	Write a note on distributed generation	[05]	CO2	L1
4 (a)	Discuss the importance of voltage control on power utility system	[07]	CO2	L2
(b)	Write briefly about the operation criteria in distribution system	[03]	CO2	L1
5 (a)	Explain distribution substation with i) single bus sub station ii) Ring or mesh sub station	[10]	CO3	L4
6 (a)	Write short notes on harmonics and method to reduce them	[10]	CO3	L1
7 (a)	Explain the feeder system with circuit diagram in distribution system	[10]	CO2	L4
8 (a)	Discuss about demand side management and its benefits	[10]	CO2	L2

1a)

Digital Mapping

- Paper maps are **digitized and linked**
- Once digitization is completed – software numbers the node – draws **network diagram** – calculates the length
- Computer processing center issues prescribed format - data of **feeders, transformer capacity ,size ,type**

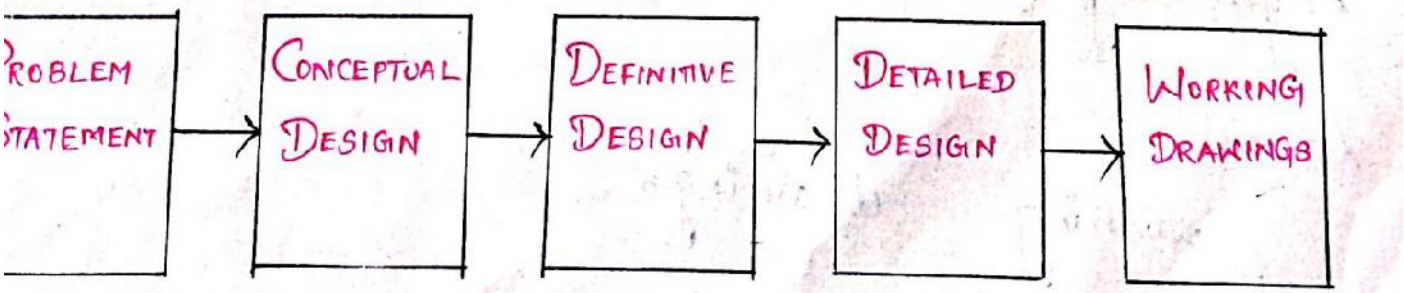
Process of Digitally Mapping a Network



1b)

Introduction - design,

Application of scientific & technical knowledge - planning, design, construction, operation and maintenance of various elect supply scheme.



Problem Statement :-

→ Definition of the problem - simple and clear

Conceptual design :-

→ principles, ideas and alternatives

Definitive design :-

→ evaluation of scheme from alternative design schemes.

→ each alternative design will have its own strength and weaknesses which has to be compared and evaluated to determine the best solution.

Detailed design :

determining equipment size, specifications, costs, quality and reliability (actual engineering process).

Layouts :-

working drawings.

2 a)

Planning criteria and standards :.

→ Criteria and standards - set of requirements - which planning process should evaluate.

→ Criteria and standards depend upon vision, mission and value of the utility.

→ Criteria - rules or procedures.

→ standards - specifications to ensure that the system is built with compatible equipment that will fit and function together when installed and maintained in an economical manner.

Typical criteria for planning :.

① → Perspective plan for next 15 yrs to meet load growth and forecast load centres - reviewed yearly on the basis of annual plans

② → Detailed project reports to be framed for long term and short term bases.

a) Feeders having poor performance - re-configuration of feeder / augmentation of line conductors and distribution transformers.

b) Use of new technology for system improvement

c) Loss minimization plan.

③ Demand - side management project reports.

④ Security

Areas.	Supply system.
(i) industrial areas.	sub-transmission open ring ckt 33/66/132/220KV.
(ii) major industrial consumers.	separate independent feeders.
(iii) urban estates	11KV open ring main system.
(iv) Rural areas.	separate feeders.
(v) Essential low voltage consumers	alternate supply arrangement.

⑤. The following voltage levels be used for consumers.

Connected load. (load demand)	Voltage supply.
i) 10KW	240V, 1ϕ two wire.
ii) 10KW - 50KW	415/240V, 3ϕ four wire.
iii) 50KW - 5MW	11 KV
iv) 5MW - 30MW	33 OR 66KV
v) 30MW - 50MW	132 KV
vi) >50MW	220KV

eg:- load demand of 10KW to be supplied by 240V, 1ϕ 2 wire.

⑥. Economic appraisal of alternate plans be done ⑥.
or least net present values.

⑦ Power utility would create and use load research facilities in order to identify consumer load profiles and forecast changes in the load.

⑧ Distribution system for historical buildings of national importance be under ground.

* The number of 11KV outgoing feeders at distribution sub-station should not be > 10.

* The length of 11KV from sub-station upto not to tail end should be > 12km.

- Loss minimization can be achieved by.
  a) LT line not exceeding 0.8km.
  b) improved metering eg:- electronic meters.

⑨ → 3ϕ fault level should not exceed 2000 MVA and 750 MVA res at 66 and 33KV level.
→ Fault level at 11KV not to be more than 350 and 250 MVA in urban and rural areas res.

⑩ THD - total harmonic distortion at any voltage level - within 5%.

Planning Standards :.

The utility system should comply with the rules of various IS (Indian Standards), REC (Rural Electrification Corporation), IEC, (International Electro technical commission), ISO (International Organization for Standardization) and the Electricity Act, 2003.

* Development of standard cost structure for material and labour rates
* Standards for system voltage - Indian Standards and voltage regulation.
* Load growth - atleast 10 yrs - to prepare new or system improvement schemes.
* Shunt capacitor fixed / switched type - installed in the distribution system - to improve PF - to reduce transmission and distribution losses.
* One mobile sub-stations / additional supply capacity is required in the distribution n/w to be kept as spare for every 100 sub-stations.

2 b) GPS - Global Positioning System

- Earth Orbiting satellites provide precise information on time and position
- To **locate** tap off points, transformers and other facilities of power distribution networks
- Can be used to capture network data for **11kV and greater than that**

Survey of India Sheets

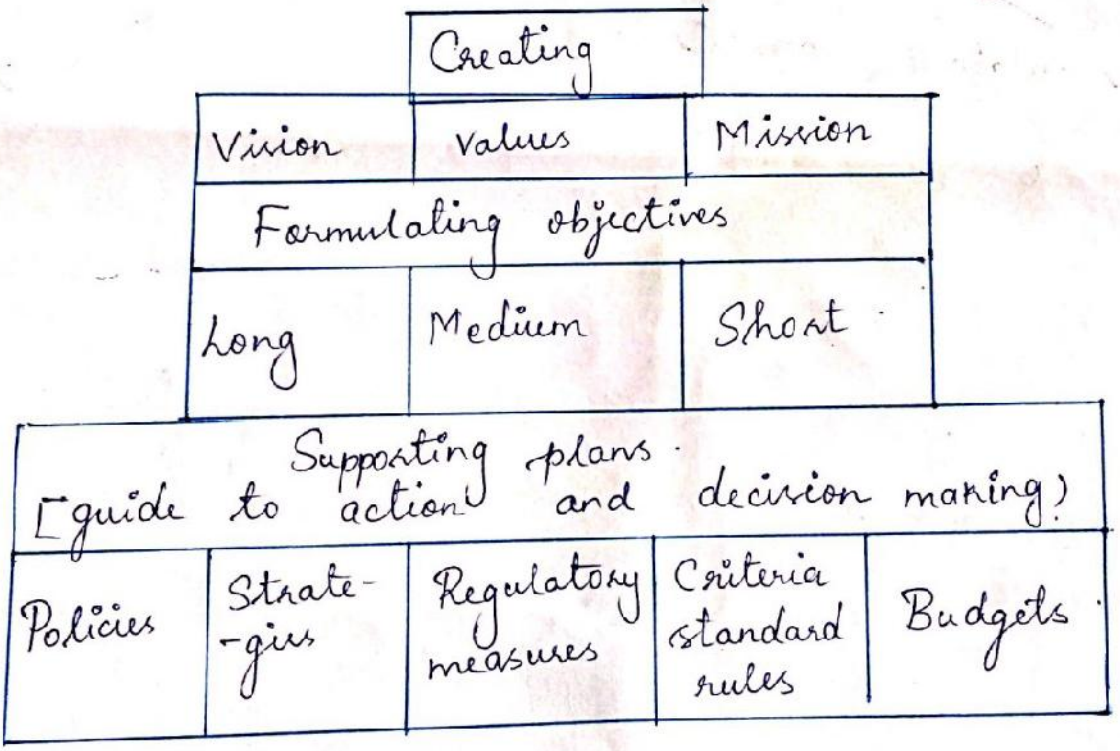
3 a)

Planning Process:

Planning - process of taking careful decision.

The objective of DS planning - provide satisfactory service at lowest possible cost

The components of planning process are shown in the figure below.



Planning process is driven by two i/ps - long-t
planning and short-term planning.

→ Vision – the art of seeing things which are invisible

→ Mission – for a particular task there can be a mission statement.

eg: Electricity for all in India by 2020.

→ Values : power utility should create values such as consumer satisfaction, environmental responsibility, service culture etc for the consumers.

→ Objectives – state the need to be achieved.

→ Strategy – Think – plan – deliver – review.

→ Regulatory measures are taken by central and state regulatory commissions.

The following steps are involved in the planning process:

i) Feasibility studies are carried out define the problem – find the alternative – evaluate the alternatives – select the best one.

ii) Detailed project report (for long, medium & short term plans) is prepared.

iii) Final approval is done after financial and economic appraisal.

iv) Once best plan is selected, the next proces of implementation begins.

3 b) Distributed generation (DG), also known as on-site generation, distributed resources (DR), distributedenergy resources (DER) or dispersed power (DP) is the use of small-scale power generation technologieslocated close to the load being served

- Energy Companies
- Equipment Suppliers,
- Regulators,
- Energy Users
- Financial and Supporting Companies
- Without any license
- Micro grids (wind,solar,DG,storage systems)

Distributed generation – radial network (preferred) – renewable energy sources

Promising Distribution Technologies

- Fuel cells
- Solar PV
- Wind power
- Tidal Power
- Bio mass
- Geothermal

Issues concerning connection to grid

- Voltage unbalance
- Voltage rise
- Increase in short circuit level
- PF

As per CEA regulations

4 a)

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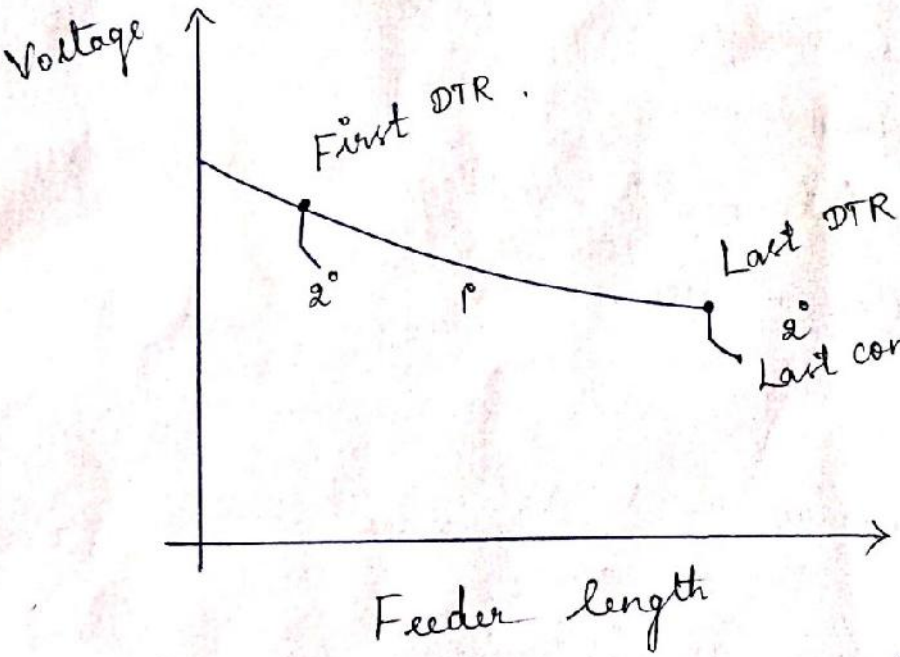
VOLTAGE CONTROL

All equipments designed to operate with certain voltage level. Voltage drop exists in each part of the system.

As a result, the last consumer on the DTR gets minimum value which is not desirable.



The maximum and min values for the consumer are specified in I.E Rules 1956.

→ Voltage drop and loss depend upon line impedance as well as loading.

→ ∴ Optimum conductor size is desirable.

For proper voltage control the following things need to be taken care of.

* Regulation
* KVA - Km conductor loading
* Voltage drop calculations
* Correction of system voltage problems
* Auto-matic voltage booster (AVB)
* Computation.

Voltage Regulation :

$$\%\ \text{Regulation} = \frac{V_S - V_R}{V_R} \times 100.$$

V_S - sending end voltage

V_R - receiving end voltage

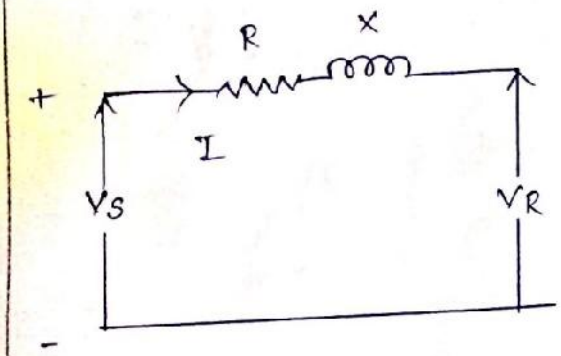
$$\%R = \left[\frac{IR\cos\phi + IX\sin\phi}{V_R}\right] \times 100.$$

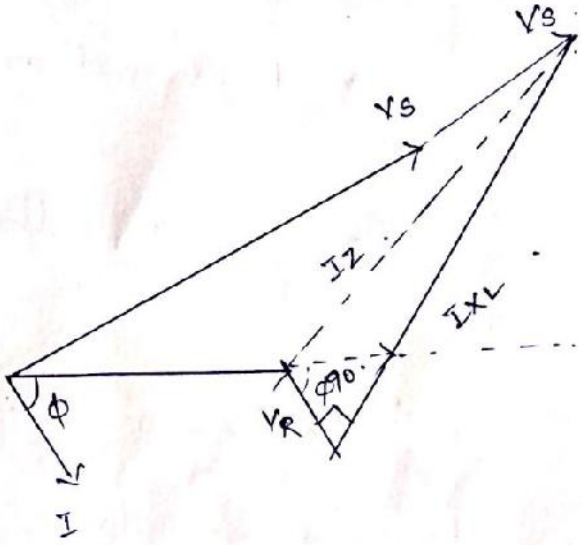
where I = line current

R = line resistance

ϕ = PF angle

X = line reactance.





$$V_S = V_R + IR\cos\phi + IX_L\sin\phi$$

$$V_S - V_R = IR\cos\phi + IX_L\sin\phi$$

4 b)

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OPERATION CRITERIA AND STANDARDS.

Procedure and practices for safe and efficient operation of DS.

Power utility should prepare operational code.

CRITERIA ——→ principles of operation.

* Outage programme - notification (in advance) to consumers
* Contingency planning - if system failure happens steps to restore and maintain power supply
  Eg: mobile diesel generating set - mobile distribution transformers.
* Peak load restrictions to be notified in advance.
* Metering arrangement for energy audit - to prepare feeder wise energy balance sheet and for whole sub-station.
* Electronic meters should be adapted.