CBCS SCHEME

USN | | | | | | | | | | 15EC654

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Digital Switching System

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain the different network structures (topologies) used in communication with neat diagram. **(08 Marks)**

b. Explain the principle of operation of four wire circuits with the help of a neat diagram. **(08 Marks)**

OR

2 a. Explain principle of frequency division multiplexing with suitable block diagram. **(08 Marks)**

b. Explain in brief power levels encountered in telecommunication transmission systems **(08 Marks)**

Module-2

3 a. Explain in brief different functions of a switching system. **(08 Marks)**

b. Explain in brief what do you mean by message switching and circuit switching. **(08 Marks)**

OR

4 a. With a neat diagram, explain basic call processing of incoming and outgoing calls through digital switching systems. **(10 Marks)**

b. Explain the significance of distribution frames with the help of a neat diagram. **(06 Marks)**

Module-3

5 a. Define and explain the following terms :
i) Traffic intensity
ii) Grade of service
iii) Busy hour
iv) Occupancy. **(06 Marks)**

b. Derive the expression for second Erlange distribution starting from the basic principles. **(10 Marks)**

OR

6 a. Starting from the Markov chain model show that the call arrivals follow a Poisson distribution. **(08 Marks)**

b. A group of 20 trunks provides a GOS of 0.01 when offered 12E as traffic :
i) How much GOS is improved if one extra trunk is added to the group
ii) How much does the GOS deteriorate if one trunk is out of service? **(08 Marks)**

Module-4

7 a. With a neat sketch, explain the operation of a space switch. **(08 Marks)**

b. Describe the frame alignment and synchronization networks. **(08 Marks)**

Scheme & Solution prepared by

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OR

8 a. Explain in brief basic software architecture used in digital switching systems. (10 Marks)
b. Explain in brief call models and connect sequence. (06 Marks)

Module-5

9 a. Explain in brief generic switch hardware architecture. (08 Marks)
b. Explain in brief common characteristics of a digital switching system. (08 Marks)

OR

10 a. Explain the organizational interfaces of a typical digital switching system central office. (10 Marks)

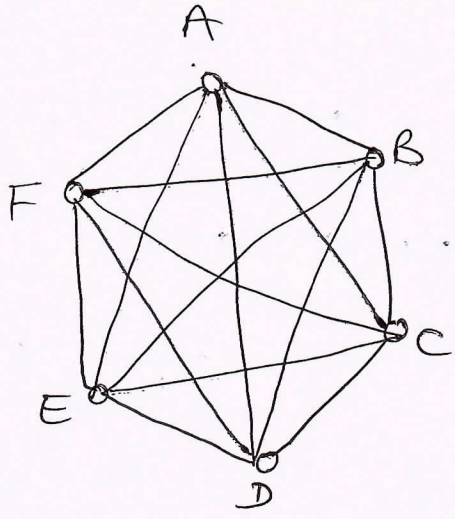
b. Write short notes on :
i) Reliability analysis of network control processing
ii) Recovery strategy. (06 Marks)

* * * * *

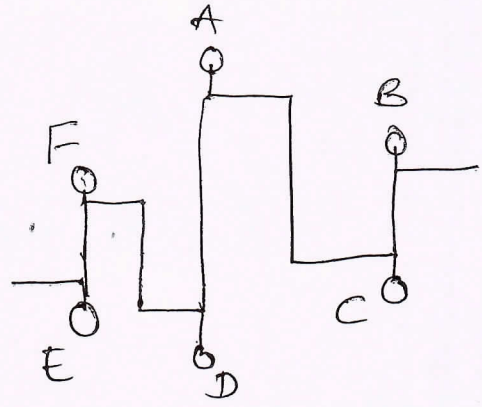
Q. 1a. Network Structures (Topologies) used in Communication System

8 Marks

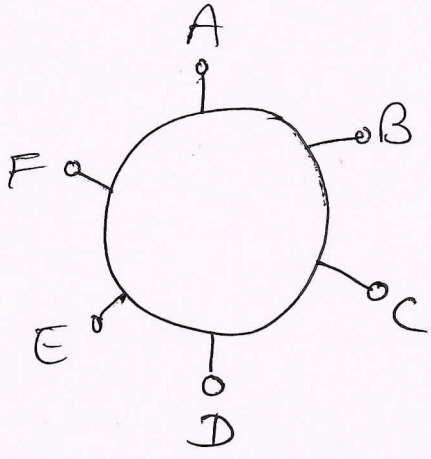
1.) Mesh



2.) Bus



3.) Ring



4.) Star

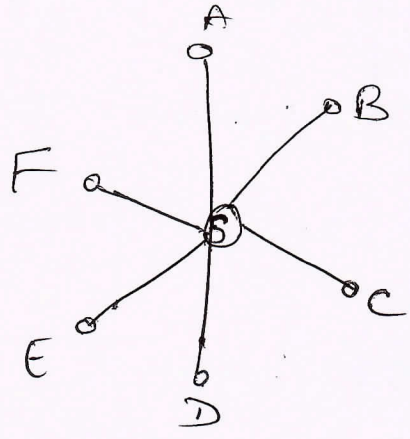
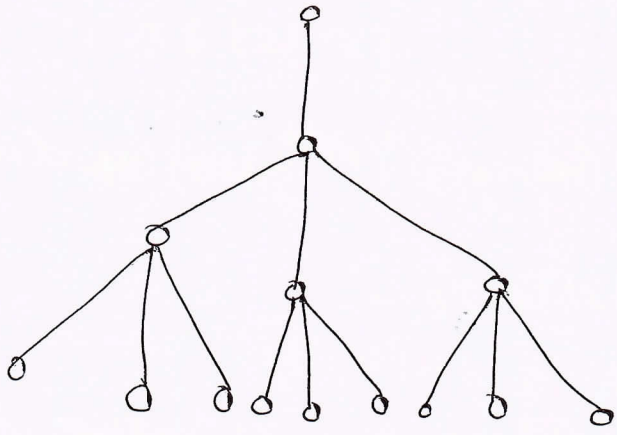


Diagram ⇒ 4M

(5) Tree



(1) Mesh –

Explanation ⇒ 4M

(1) Each station needs lines to n-1 others.

(2) Total number of lines required is $N = \frac{1}{2} n(n-1)$

Ex- System serving 10000 users station would need 50 million lines

(2) Bus –

(1) Usually not used for telephony.

(2) Reason for the same is only one conversation happen at a time.

(3) Ring

(1) Both Bus & Ring topologies can be used for data communication

(2) A terminal that needs to send a message stores it until the circuit becomes free. Used in LANs.

(4) Star

(1) No. of lines required is $N = n$

(2) Low cost system as no. of lines are less.

(5) Tree

(1) Trafic is high & transmission costs are lower comparatively.

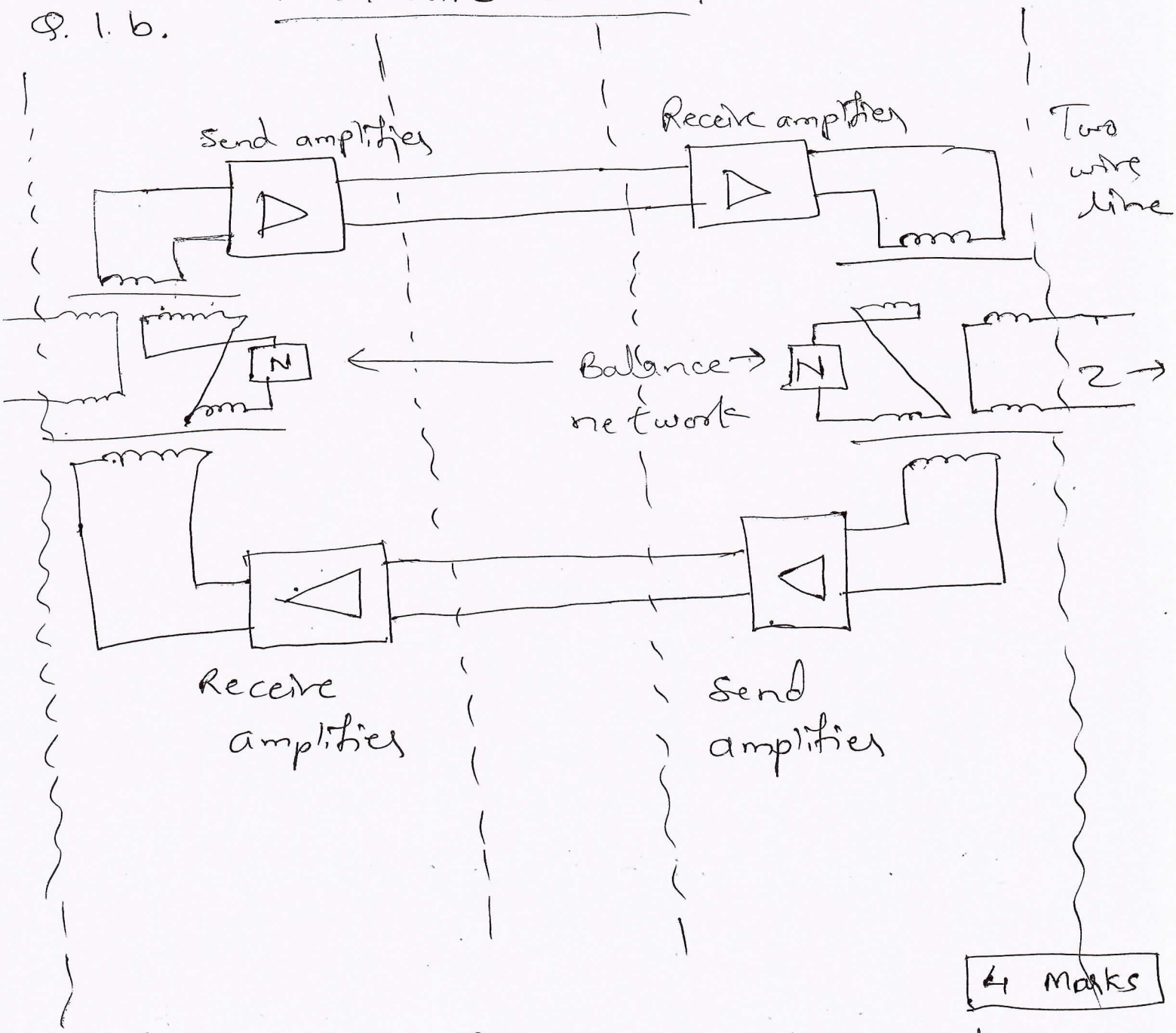
(2) Backbone tree is complemented by lateral routes between some exchanges at the same level.

14

8 Marks

Q. 1. b.

Four wire circuit.



4 Marks

(1) The term four wire circuit is used as the go & return paths may be provided by channels in a multiplex transmission system instead of on physical cable pairs

(2.) At each end, the four wire circuit must be connected to a two wire line leading to a telephone.

(3.) To avoid continuous oscillation (singing), two wire line at each end is connected to the four wire circuit by a four wire / two wire terminating set.
This contains hybrid transformer.

(4.) O/p from receive amplifier causes equal voltages to be induced in secondary winding of T_1.

(5.) No EMF induced in secondary of T_2 & no signal applied to i/p of send amplifier.

(6.) Power divides equally b/w i/p of send amplr & o/p of receive amplifier.

(7.) Price for avoiding singing is thus 3 dB loss in each direction of transmission.

4 Marks

16

8 Marks

Q. 2 a. Frequency division multiplexing

(1) Here transmission of a number of baseband channels are sent over a common wideband transmission path by using each channel to modulate a different carrier frequency.

1-2 Marks

Brief features of FDM.

→ 12 telephone channels

→ $0 < f_m < F_m$ is applied with f_c.

→ o/p is $f_c \pm f_m$

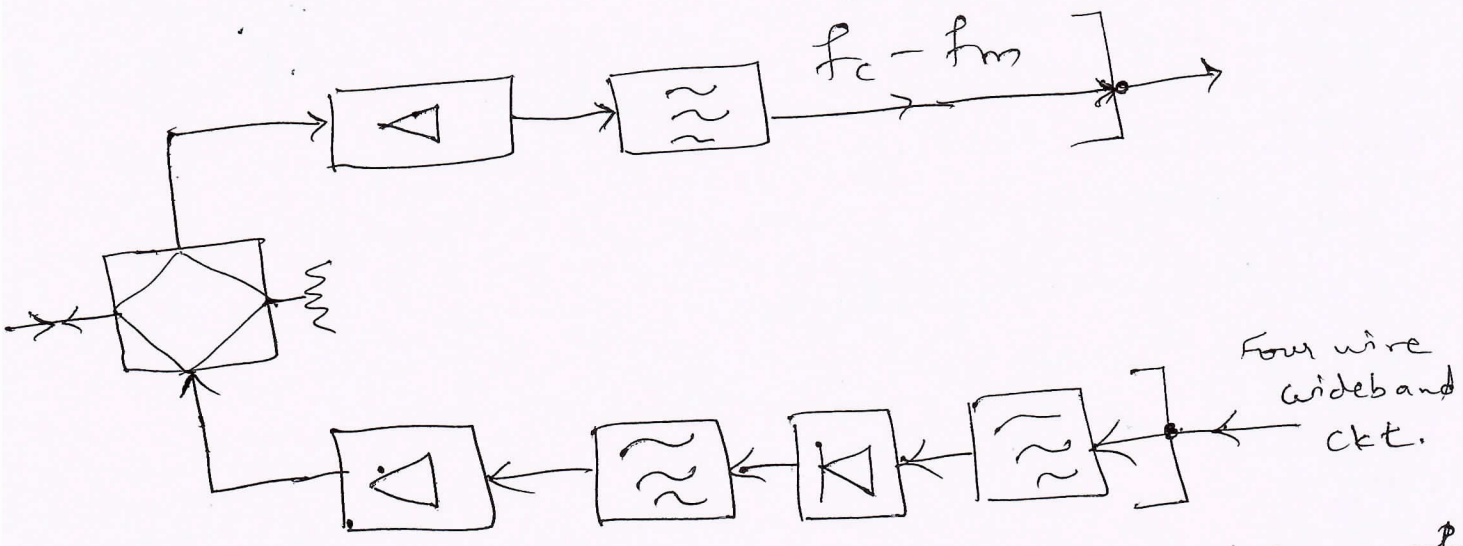
→ Suppressed carrier modulation used to minimize total power - amplifiers.

→ Carrier spacing 4 kHz

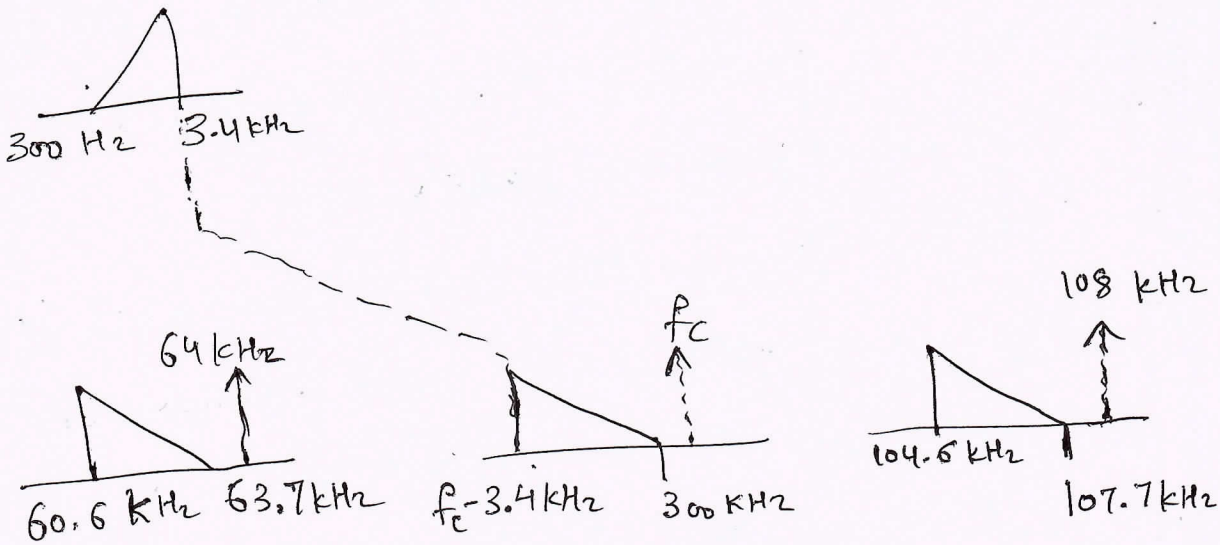
→ Baseband 300 Hz to 3.4 kHz

→ 12 channel group - carrier 120 kHz

2-3 marks



2 marks



2 mark

8 marks

Q. 2.b. Transmission Systems

→ Categories

1. 'Customers' lines
2. Junction circuits
3. Trunk circuits.

2 marks

→ Brief points about power levels.

1. Low resistance
2. Use of analog carrier systems.
3. FDM - served by four wire circuit.
4. Systems provide pair gain
5. ISDN - basic rate access - 144 kbit/sec
6. For primary rate access - 24 channel or 30 channel PCM system used.
7. Optical fibres used for many circuits.
8. FDM carrier system - trunk networks - 4 + 12 + 24 channel systems used on open wire & balanced pairs cables.
9. Digital transmission used in optical fibres.
10. Powerful satellites having regenerative transponde

6 marks

Q. 3 a. Functions of Switching system [8 marks

. Briefly explain 8 functions — 1 mark each.

1.) Attending → detect call requests.

2.) Information ~~processing~~ receiving

3.) Information processing

4.) Busy testing — make busy test — to check it is free or engaged

5.) Interconnecting —

- connection to calling terminal
- connection to called terminal
- connection b/w two terminal

6.) Alerting — alert the customer.

7.) Supervision — monitor connections.

8.) Information Sending — sending info. to customers.

— [8 marks]

20

8 marks

Q. 3 b. Message Switching

5 marks

→ Briefly Explain the meaning & highlight points.

→ Sending message by telegraphy from one place to other.

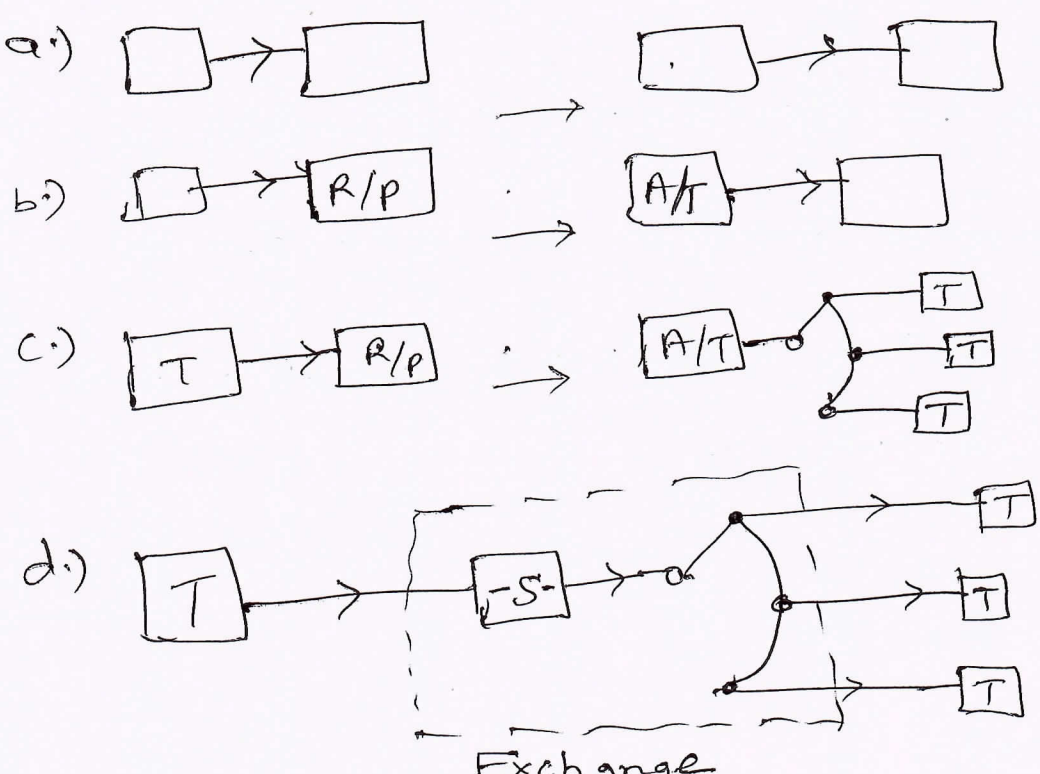
→ Improvements needed in message switching.

→ Tom tape Relay System — automatical function.

→ It is delay system or queing system.

→ Packet switching — widely used.

— Ex — VDU (visual Display Unit)



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Circuit Switching - Brief Explanation [3 marks]

→ Simultaneous both way communication

→ Needed in real time

→ Requirements not met in message switching

→ Telephone on demand.

→ Maintain connection for duration of call.

→ New call can be connected,

→ Ex. of lost call system

10 m

Q. 4 a. Digital Switching System

Call Processing.

→ Intra-LM calls → Inter-LM calls
→ Incoming calls →Outgoing calls, 1 m

→ Incoming Calls 3 m

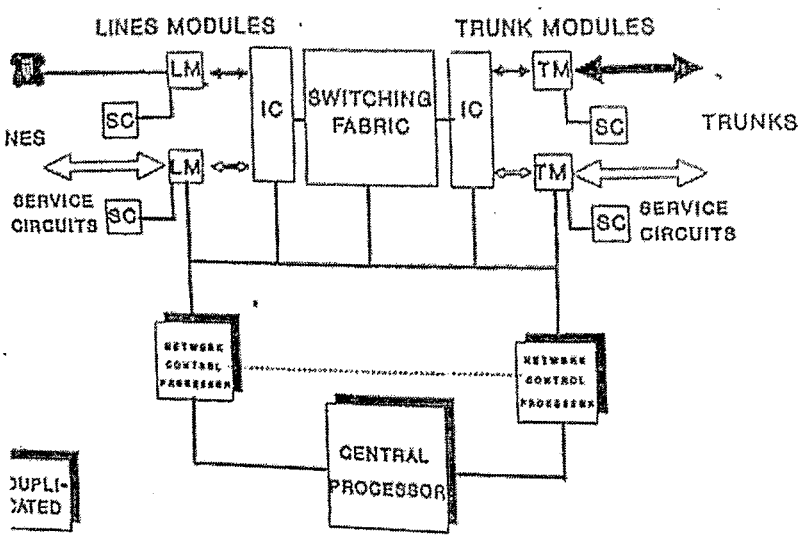
→ Requests a path through switching fabric from interface controller of n/w control processor.

→ Functions – audible ringing to calling line,

→ Outgoing calls 3 m

→ LM requests a path thro' switching fabric to a trunk module via interface controllers.

→ Outgoing Trunk



3m

23

Q.4b. Distribution Frames — 6 marks.

Imp. points

→ PBXs increase no. of exchange lines.

→ Growth of traffic - flexibility required

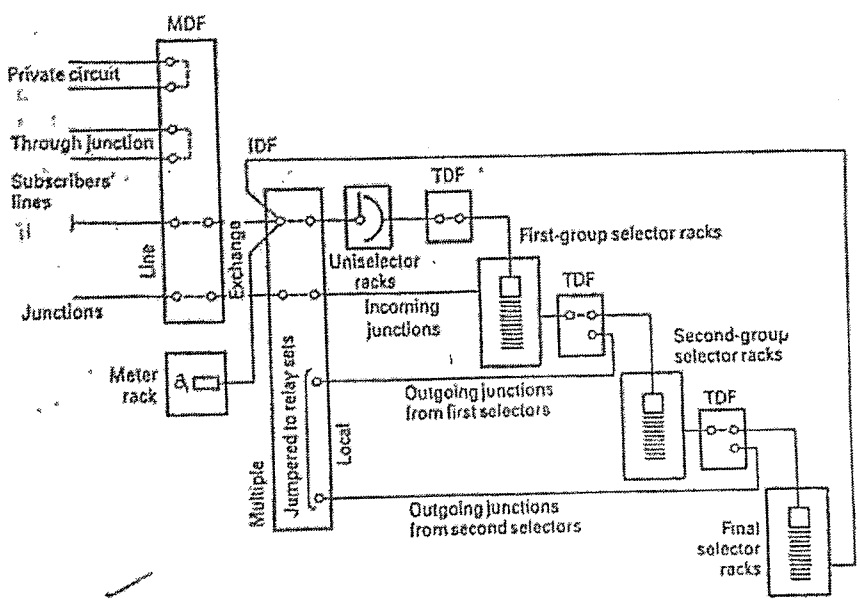
→ Distribution frames help by use of jumpers.

→ It distributes traffic evenly

→ EN - to - DN translation is provided.

→ Digital Distribution Frame used.

3 marks

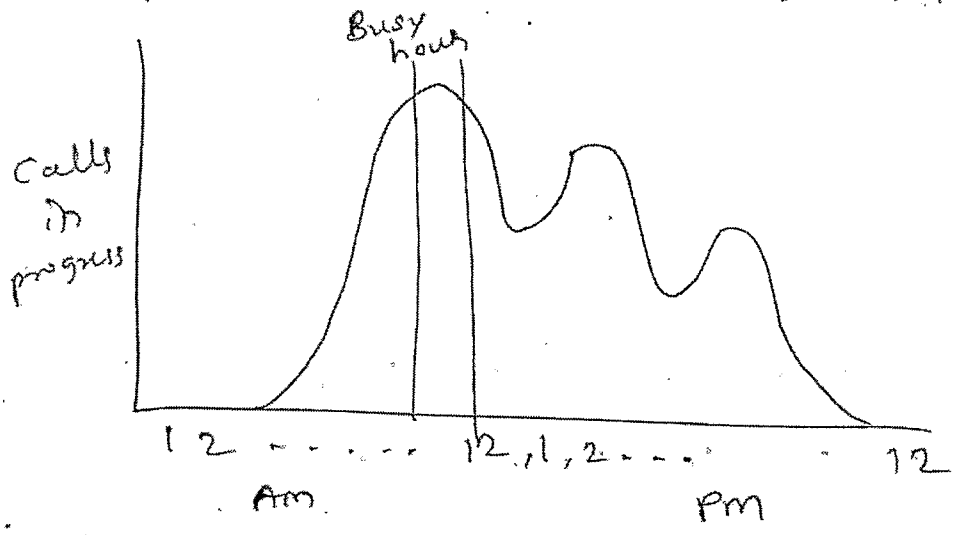


3 marks

24

Q. 5. a. Define & Explain briefly — 6 Marks

i) Traffic Intensity – Definition — 2 mark



1 mark

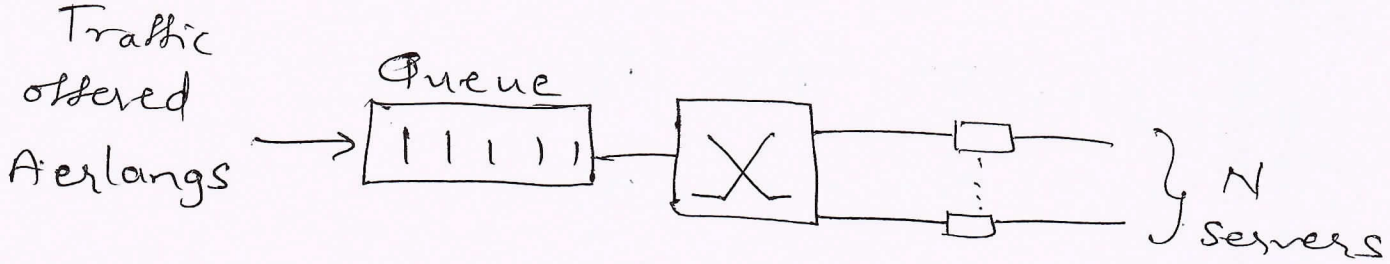
ii) Grade of Service – Probability of a call being blocked or queued for some period of time due to limited system resources during the busy hour of the day — 1 mark

iii) Busy Hour – Peak traffic load time — 1 mark

iv) Occupancy – Ratio of arrival rate to avg. service rate — 1 mark

Q. 5 b. Second Erlange Distribution

10 marks
25



Derivation

⇒2 mark

Start with $P(x) = \frac{A^x}{x!} P(0)$ for $0 \leq x \leq N$

$P(a) = A\delta t/h$

$P(e) = N\delta t/h$

Substitute and get

$$P(N) = \frac{A^N}{N!} \cdot P(0) \quad , P(N+1) \, , P(N+2)$$

⇒ 3 m

If x is b/w 0 & ∞,

$$\sum_{x=0}^{\infty} P(x) = 1$$

Substitute to get

$$P(0) = \left[\frac{NA^N}{N!(N-A)} + \sum_{x=0}^{N-1} \frac{A^x}{x!} \right]^{-1}$$

⇒ 5 m

Q.6.a. Markov Chain Model [8 M]

Define probabilities $P(a)$, $P(e)$

$$P_{j,k} = P(a) = A\,\delta t/h.$$

$$P_{k,j} = P(e) = k\,\delta t/h$$

$$P(j \to k) = P(j)\,P(a) = P(j) A\,\delta t/h$$

$$P(k \to j) = P(k)\,P(e) = P(k) k\,\delta t/h$$

Find $P(k) = \frac{A}{k} \cdot P(j)$

$$P(1) = \frac{A}{1} \cdot P(0)$$

$P(2)$

$$P(2) = \frac{A}{2} \cdot P(1) = \frac{A^2}{2 \cdot 1} P(0)$$

$$P(3) = \frac{A}{3} P(2) = \frac{A^3}{3 \times 2 \times 1} P(0)$$

$$P(x) = \frac{A^x}{x!} P(0)$$

$$1 = \sum_{x=0}^{\infty} P(x) = \sum_{x=0}^{\infty} \frac{A^x}{x!} P(0) = e^A P(0)$$

$$P(0) = e^{-A} \quad \& \quad P(x) = \frac{A^x}{x!} e^{-A}$$

Call arival has Poisons Distribution

Q.6.b.

8M 27

(1) $E_{1,21}(12) = \dfrac{12\,E_{1,20}(12)}{21 + 12\,E_{1,20}(12)}$

$= \dfrac{12 \times 0.01}{21 + 12 \times 0.01}$

$= 0.0057$

4M

(2)

$E_{1,20}(12) = 0.01 = \dfrac{12\,E_{1,19}(12)}{20 + 12E_{1,19}(12)}$

$0.2 + 0.12\,E_{1,19}(12) = 12\,E_{1,19}(12)$

$\therefore E_{1,19}(12) = 0.017$

4M

Q.7 a. Space Switch 8M

Brief Explanation — 5M

→ Connections made b/w incoming & outgoing PCM highways by means of a crosspoint matrix.

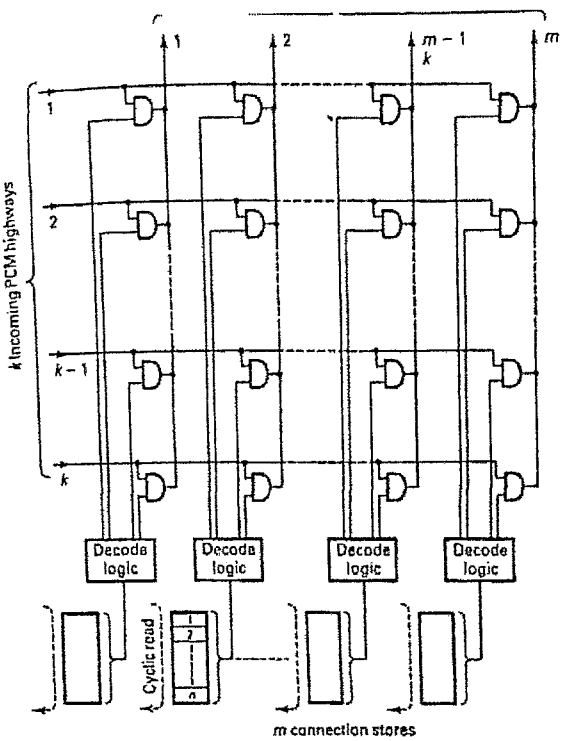
→ 2 i/p AND gate is used.

→ k incoming, m outgoing PCM highways.

→ n time slots

→ k x m switches in a space division switching network.

Diagram — 3M

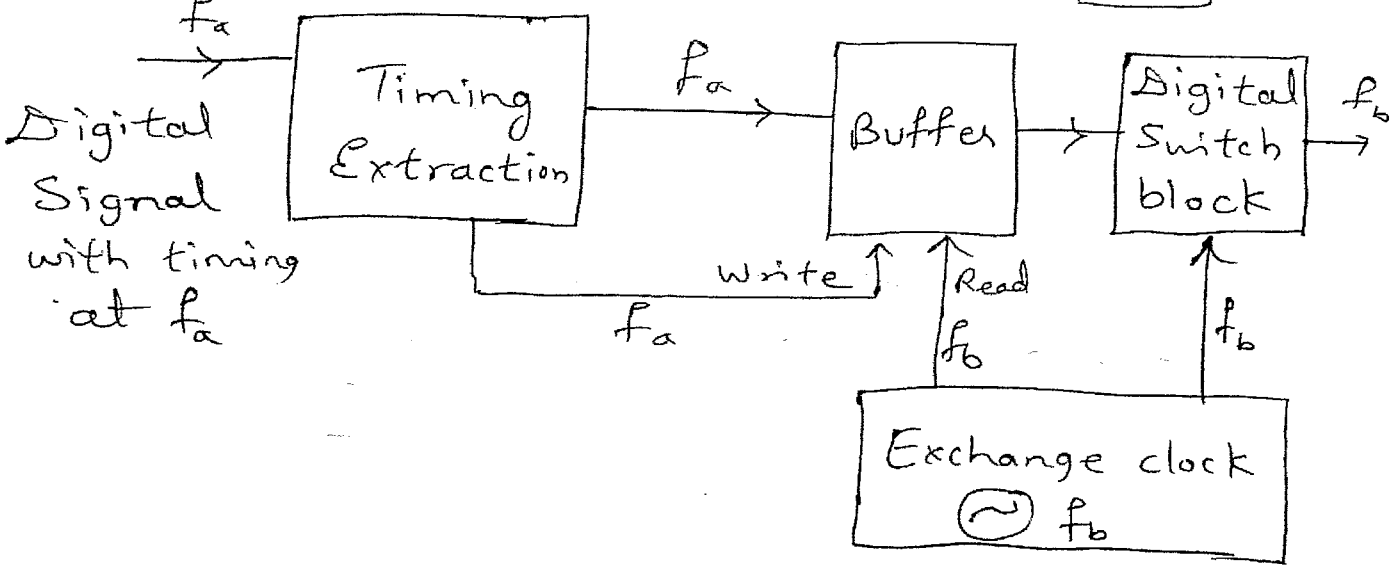


Q. 7. b.

Frame Alignment. 8M

29

Diagram 2M



Imp points 2M

→ PCM Junction stores incoming digits in Frame Alignment Buffer.

→ out rate is f_b. of exchange clock

→ Frame slip – error.

→ Uncontrolled & controlled slip.

→ Plesiochronous – independent clock.

(20)

Synchronization Networks

2m

→ Despotic control.

→ PSTN – link exchange clocks to national reference standards.

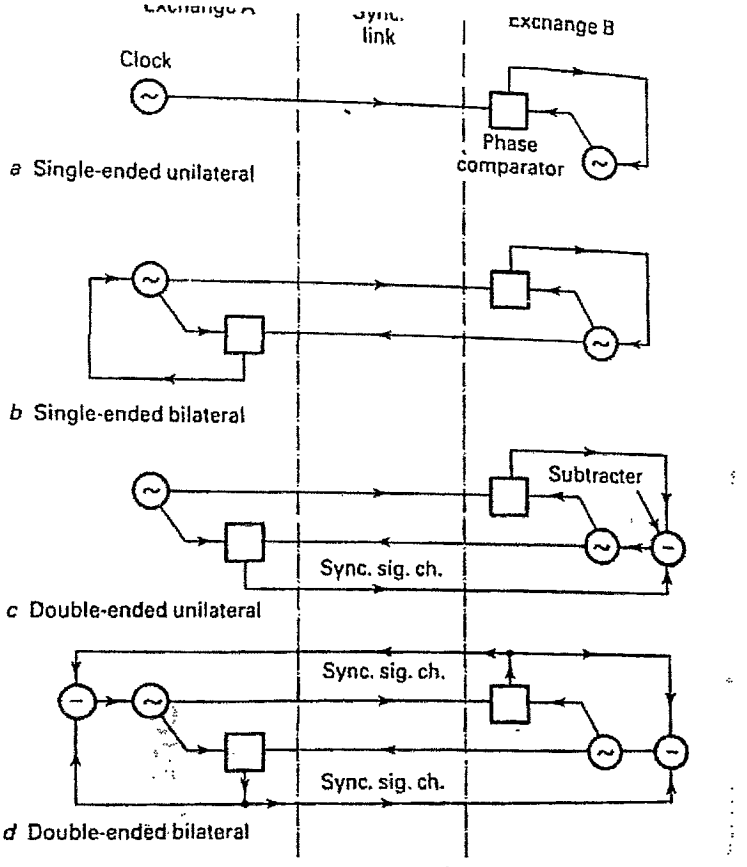
→ Plesiochronous network – have some slips.

→ Mesochronous working.

→ Unilateral sync. system.

→ Master slave configuration

Diagram



Q. 8 a.

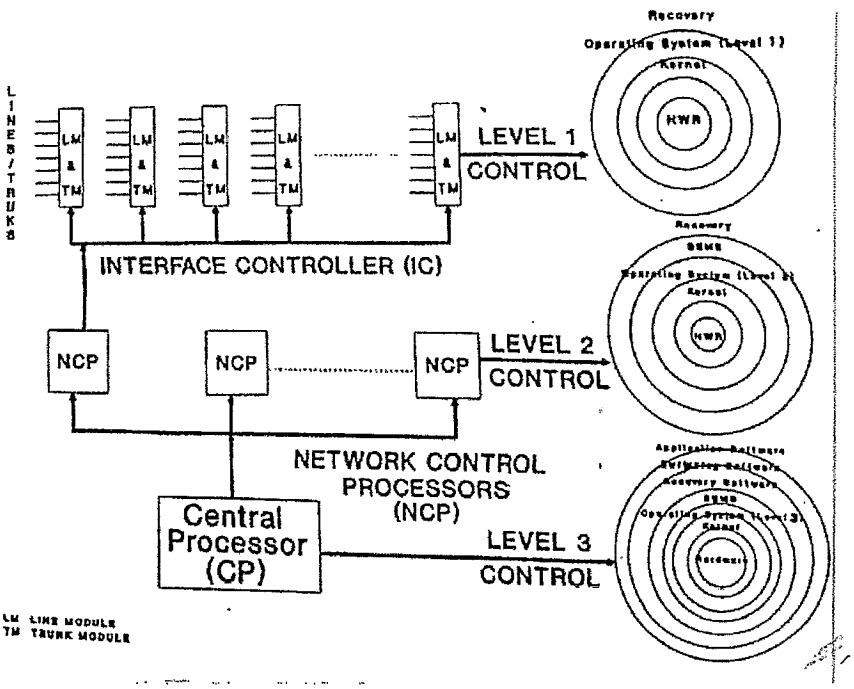
10 Marks
31

Basic Software Architecture

In brief write all imp. components. 8M

1. Operating Systems
   - Kernel & its functions
2. Database management System
3. Concept of Generic Program
4. Software Architecture for Level 1 control
5. Software Architecture for Level 2 control
6. Software Architecture for Level 3 control
7. DSS software classification

Diagram - 2M



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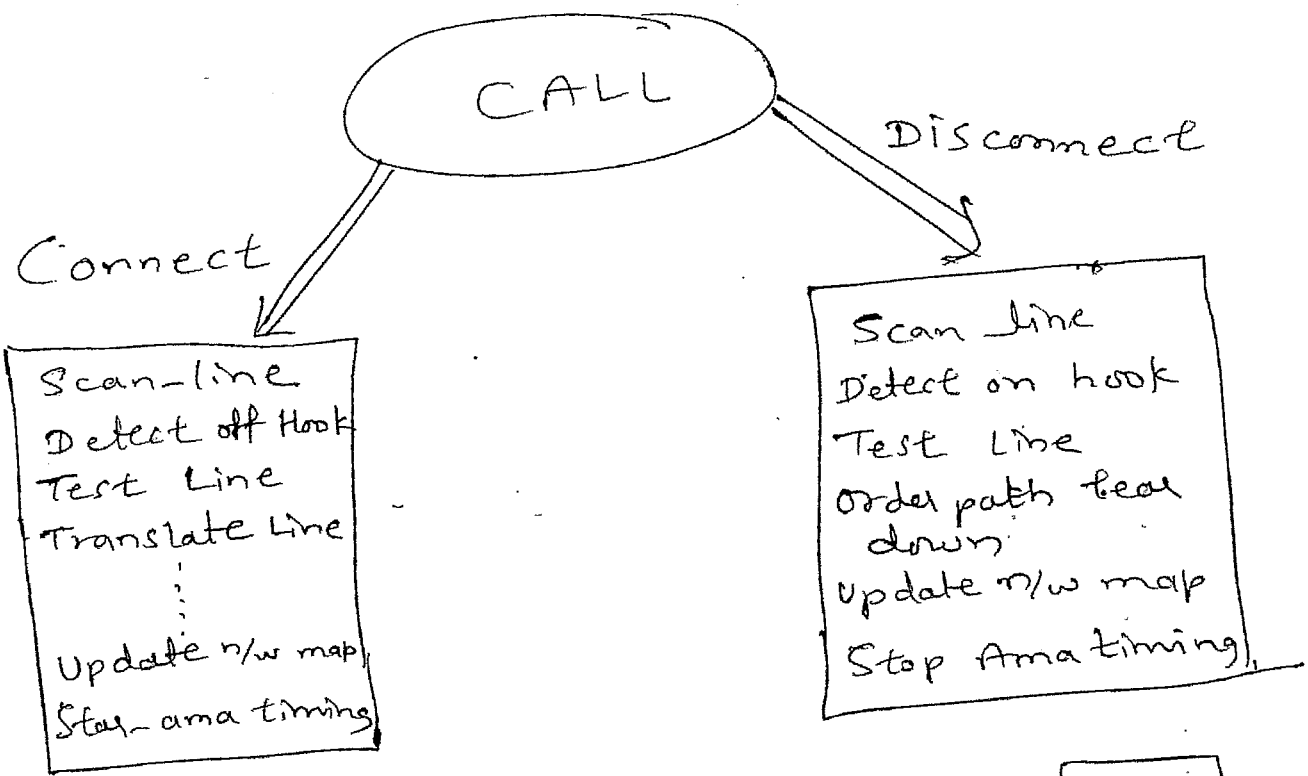
Q.8b.) Call Models — 6 M

→ Imp Points — 2 M

→ Used in design of Telephony Systems.

→ Describes H/w & S/w actions needed for connecting & disconnecting a call.

→ Call Sequence — 2 M



Briefly explain Imp points — 2 m

→ Scanning program - off hook - dial tone

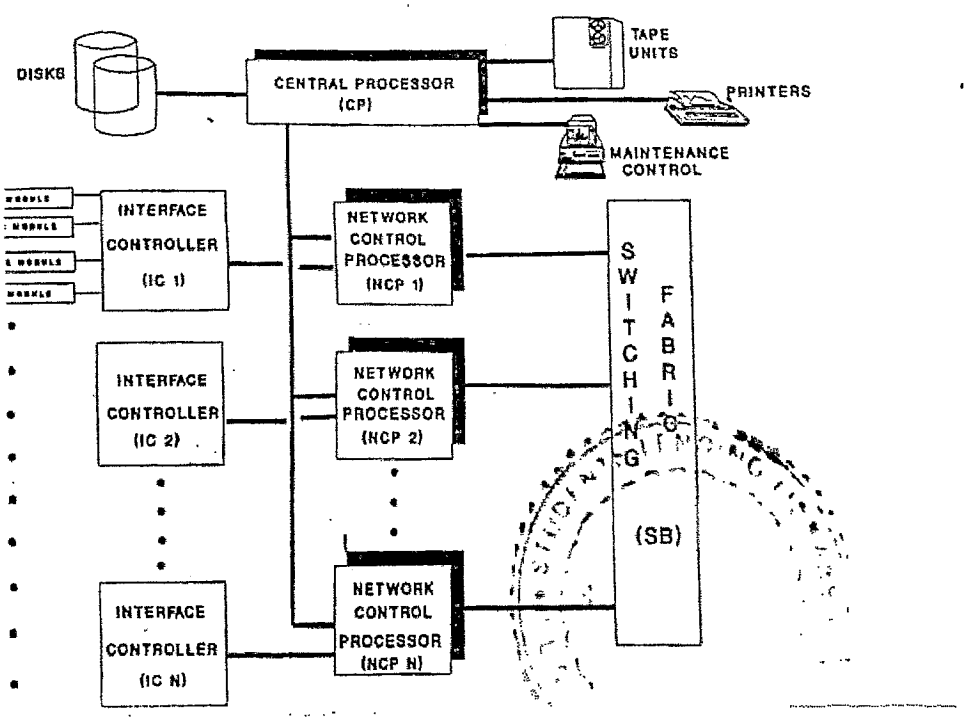
→ Test - presence of false ground, high rtg, line cross.

Q. 9.a. Generic Switch Hardware Architecture — 8 m

Briefly Explain architecture — 6 m

→ Central Processor
→ Network Control Processors
→ Interface Controllers
→ Interface modules
→ Switching Fabric

Diagram — 2 m



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Q. 9b. Common Characteristics of DSS [8M]

Imp Points –

→ Dual Capability

→ Termination Capability – 60000 trunks
– 100000 lines

→ Traffic Capacity – 2000000 BHCA's

→ Architecture – quasi distributed Hadware

→ Architecture Software – modular Software design.

→ Switching Fabric – TST mode

→ Remote Operation – RSM's to Support switching functions.

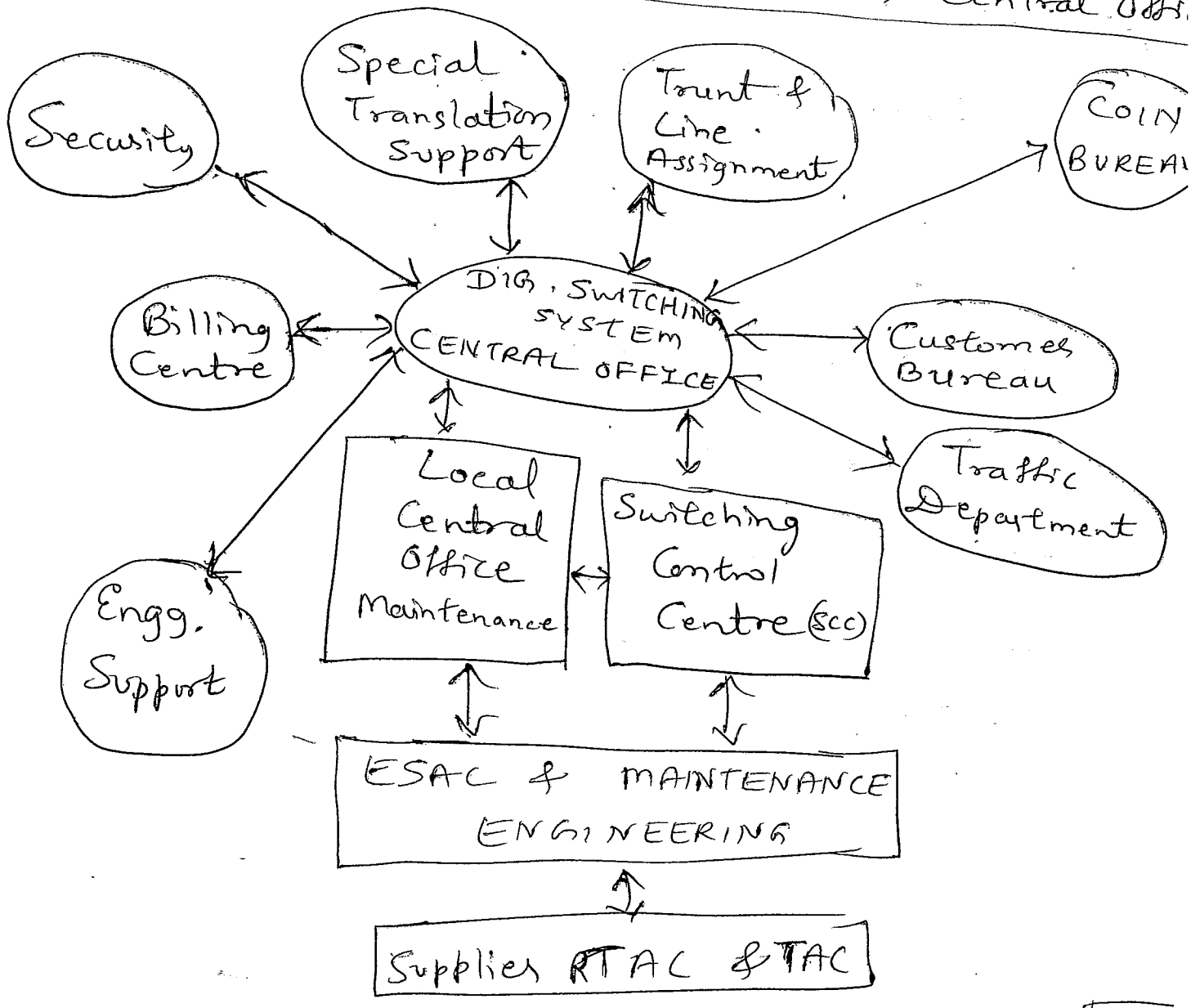
→ Advanced Feature Support
– ISDN
– STP
– SCP
– AIN

Q. 10 a.

Typical Digital Switching System Central Offs.

10M

35



→ Few imp points — 4M

1. CO's usually assigned to SCCs

6M

(2.) Interface with Digital Switch

→ Engineering Support

→ Billing Centre

→ Security

→ Special Translation Support

→ Trunk & Line Assignment

→ Coin Bureau

→ Customes Bureau

→ Traffic Department.

Q.10.b. 6M

37

Recovery Strategy 3M

Imp. Points

→ Level 1 Initialization (INIT 1)

Ex- Direct local recovery of modules.

→ Level 2 Initialization (INIT 2)

→ Initializing n/w control processor/s.

→ Ex- NCP switch - failing.

→ Level 3 Initialization (INIT 3)

→ Initializing central processor & all network control processors.

Ex- Digital switching system - slow dial tone - again & again.

→ Improve robustness of system.

→ Manual Recovery.

↳ INIT 1, INIT 2, INIT 3 - back on line.

38

Reliability Analysis [3M]

Imp. Points

→ Component failure rates

- Describe ~~case~~ EFR for different circuit packs used in digital switch.

→ System Reliability

- Hardware modeling of subS/ms of digital switch

→ Software Reliability Analysis

- S/w analysis of DSS software.