CBCS SCHEME

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

Sixth Semester B.E. Degree Examination, Aug./Sept. 2020
Digital Switching Systems

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain the hierarchy of a national public switched telecommunication network with the help of a neat diagram. (10 Marks)
b. Explain the operation of four wire circuit used in the two way transmission system. (06 Marks)

OR

2 a. Explain different network structures in brief. (06 Marks)
b. Explain in brief power levels encountered in telecommunication transmission system. (06 Marks)
c. Explain the power levels in dBm and dBw. i) 1mw ii) 1w iii) 2mw iv) 100 mw (04 Marks)

Module-2

3 a. Explain in brief what do you mean by message switching and circuit switching. (04 Marks)
b. Explain stored program control switching systems with diagram. (04 Marks)
c. With the help of a neat diagram. Explain the intra LM call processing. (08 Marks)

OR

4 a. Explain in brief different functions of a switching system. (08 Marks)
b. Explain distribution frames in stronger exchange with neat diagram. (08 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 an expression for the second erlangs distribution formula from basic principles. (10 Marks)

OR

6 a. What is grading? Explain different types of grading. (06 Marks)
b. Design a 3 stage network for 100 incoming and 100 outgoing trunks. Draw the diagram and derive the expressions used. (10 Marks)

Module-4

7 a. Discuss the need for frame alignment in time division switching networks (08 Marks)
b. Explain single ended and double ended unilateral and bilateral synchronization system. (08 Marks)

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 common characteristics of (DSS) Digital Switching System. (08 Marks)
b. Explain the organizational interfaces of typical DSS with neat diagram. (08 Marks)

OR

10 a. Explain in brief generic switch hardware architecture. (08 Marks)
b. Explain with a neat diagram a strategy for improving software quality. (08 Marks)

* * * * *

Scheme & Solution prepared by

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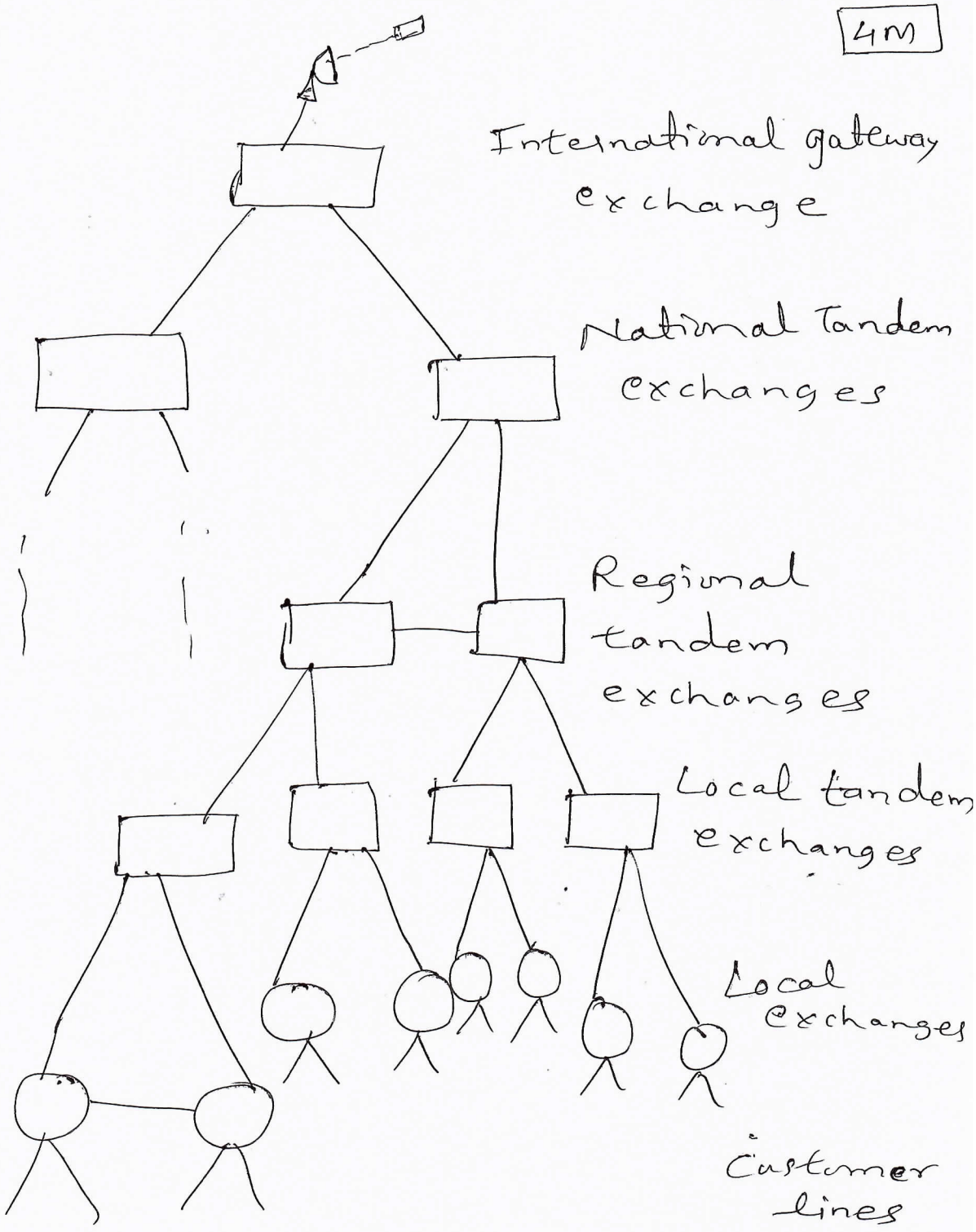
Q. 1a. National Telecommunication Network. [10 M]

[4M]



Explanation in Brief — 6 M

→ Local Networks which connects customers' stations to their local exchanges.

→ Junction networks - which interconnect a group of local exchanges serving an area & a tandem or trunk exchange.

→ Trunk network or toll network which provides long distance circuits b/w local areas throughout the country.

→ International gateway exchanges.

→ Private Branch Exchange (PBX)

→ (VANS) Value added Network Services.

→ Customer nodes

→ Switching nodes

→ Transmission nodes

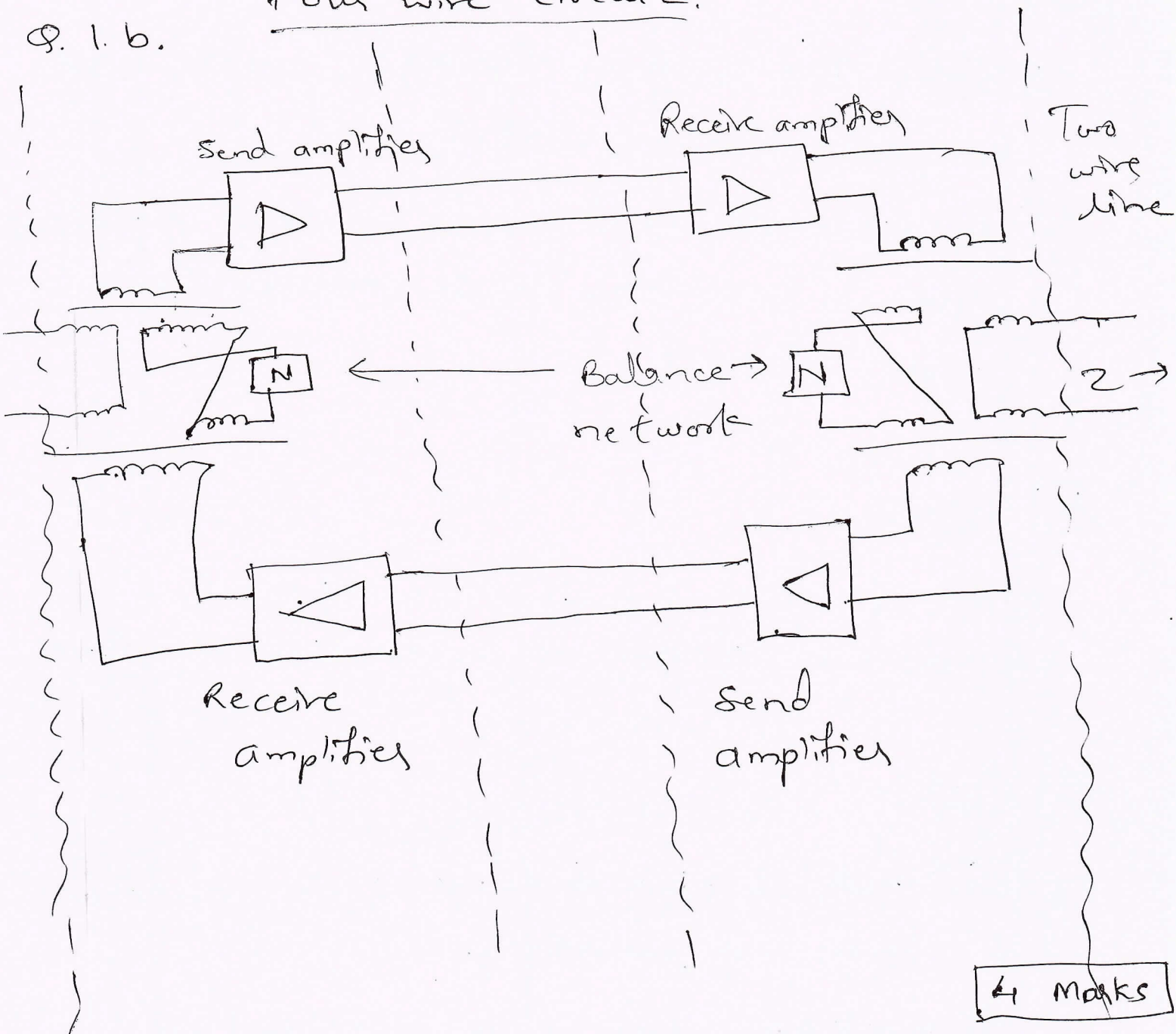
→ Service nodes.

6 Marks

14

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

(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

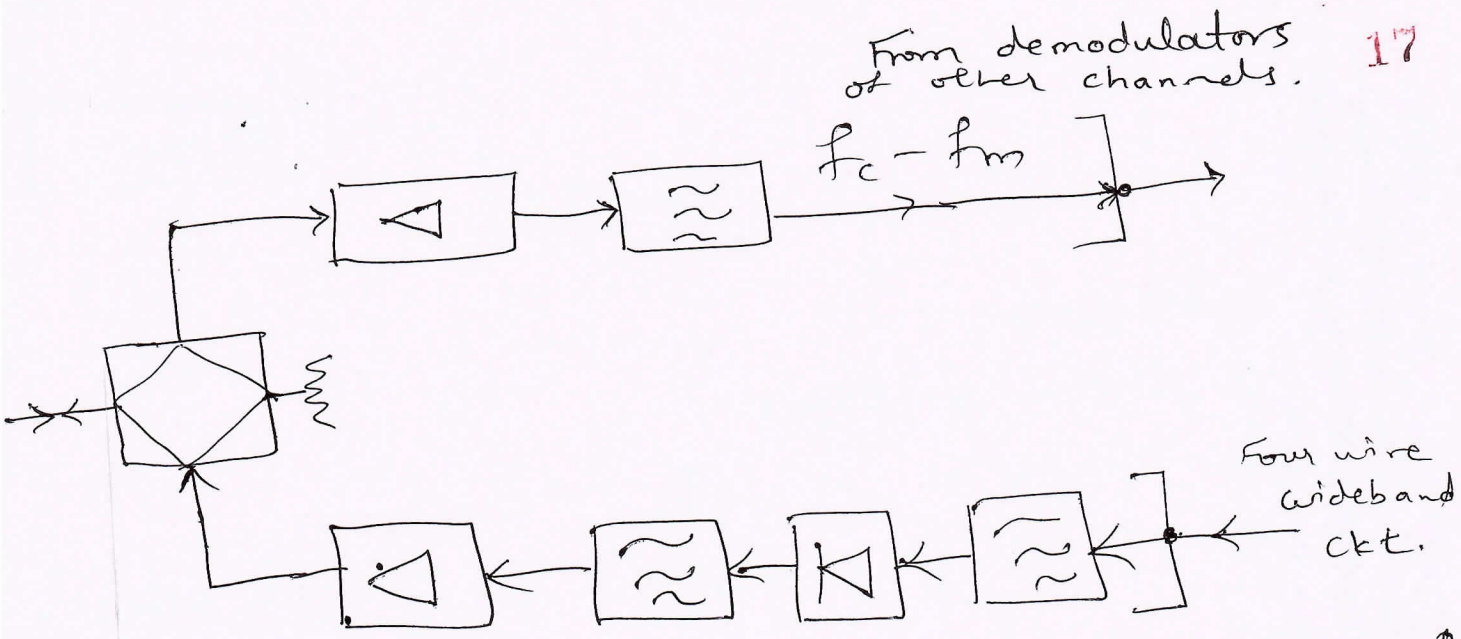
(1) No. of lines required is $N = n$

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

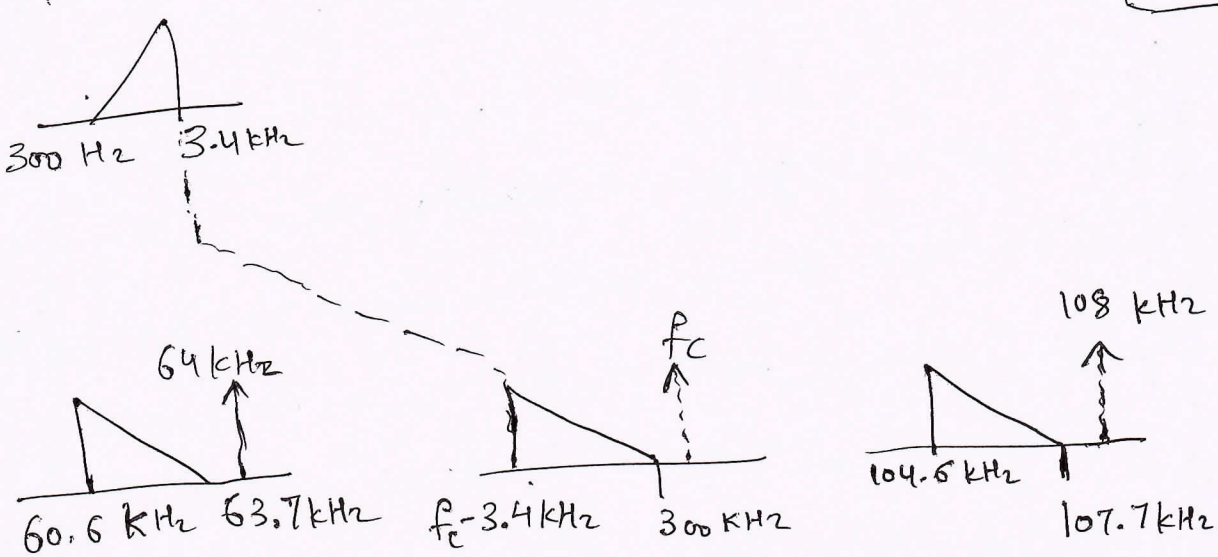
(5) Tree

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

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



2 masks



2 mask

6 marks

Q. 2.6. Transmission Systems

→ Categories

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

2 marks

→ Brief points about power levels.

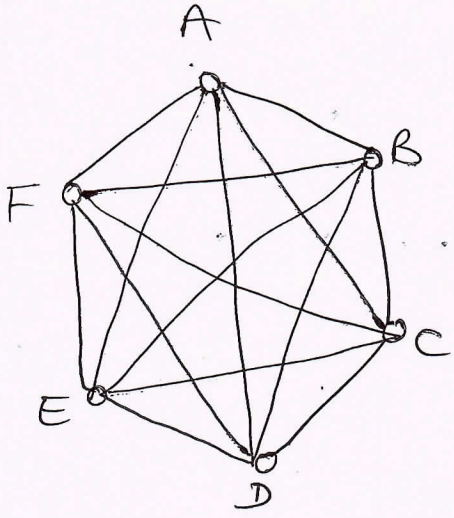
1. Low resistance.
2. Use of analog carrier systems.
3. FDM – served by four wire circuit.
4. Systems provide pair gain
5. ISDN – basic rate access – 144 kbit/sec
6. For primary rate access – 24 channel or 30 channel PCM system used.
7. Optical fibres used for many circuits.
8. FDM carrier system – trunk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

4 marks

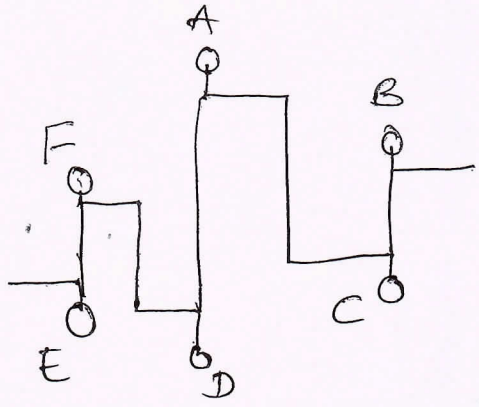
Q.2a. Network Structures (Topologies) used in Communication System

6 Marks

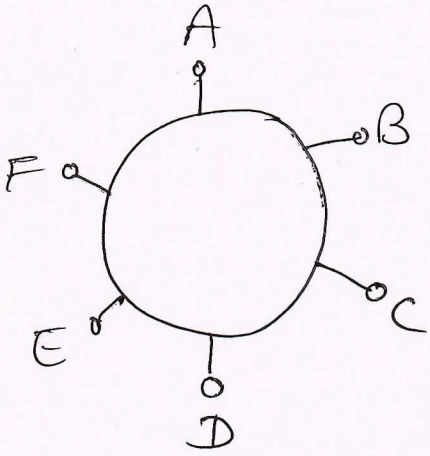
1.) Mesh



2.) Bus



3.) Ring



4.) Star

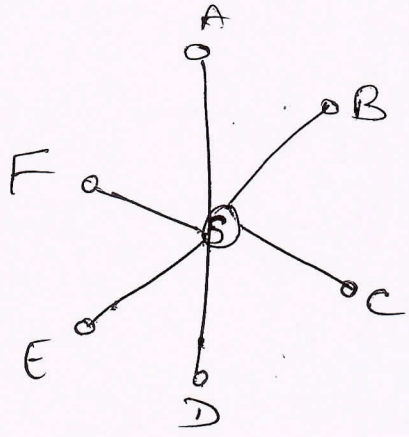
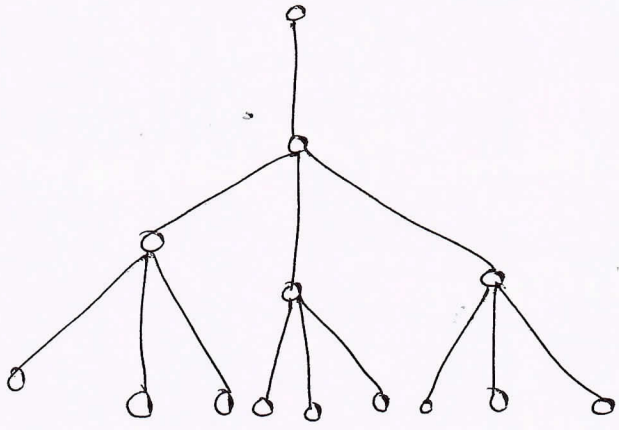


Diagram ⇒ 4M

(6)

(5) Tree



Explanation ⇒ 2m

(1) Mesh –

(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.

4 m

Q. 2c.

(i) 1 mW = 0 dBm = −30 dBW

(ii) 1 W = 0 dBW = +30 dBm

(iii) 2 mW = 0 dBm + 3dB = −30 dBW + 3 dB = −27 dBW

(iv) 100 mW = 0 dBm + 20 dB

= +20 dBm

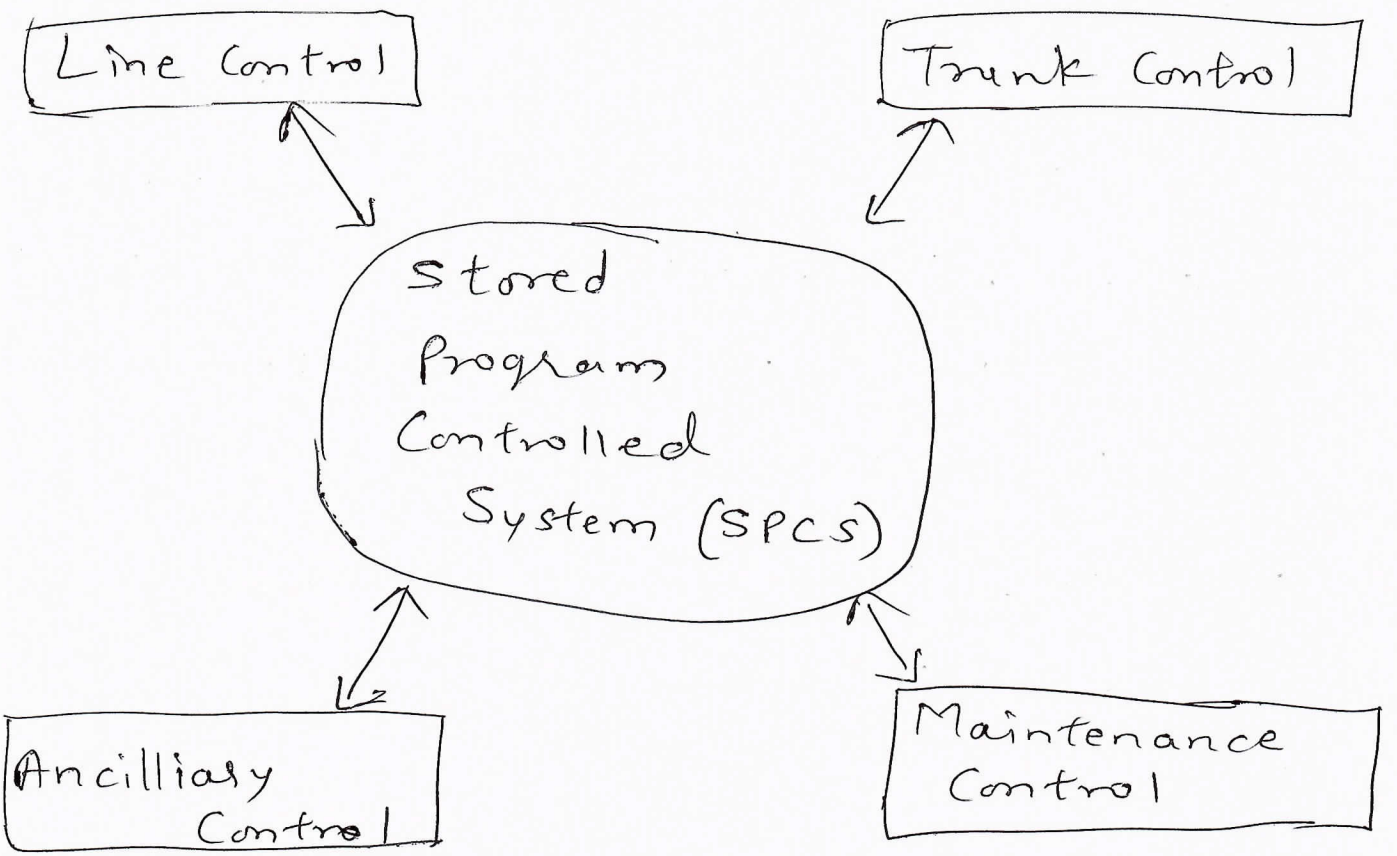
= −30 dBW + 20 dB

= −10 dBW

1 mark each

4m

3b. Stored Program Control Switching System



2m

Imp points -

→ To control line originations & terminations
→ To provide trunk routing to other central or tandem offices.
→ special feature - Ancilliary control
→ Maintainance functions - SPC systems

2m

Q. 3c. Intra LM Call Processing — 8m — 37

- 4m

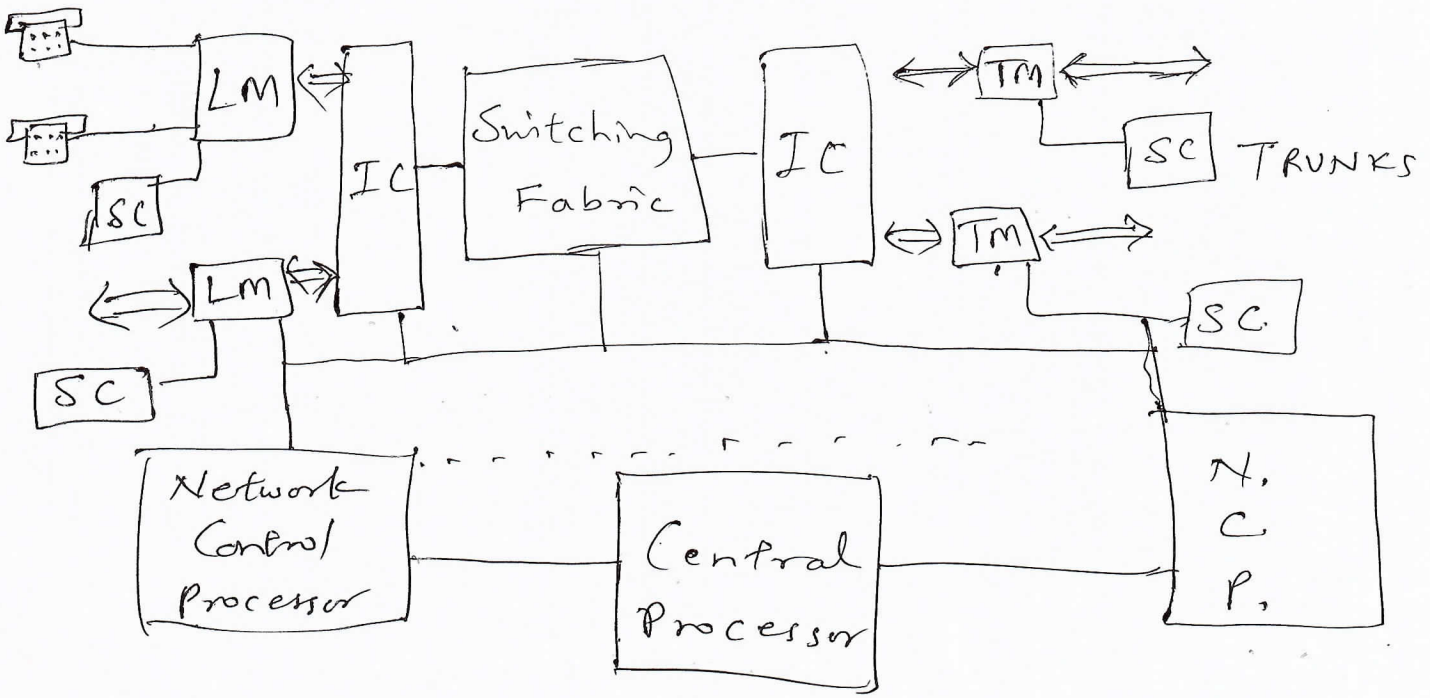
→ Customer dialing - telephone connected to a specific line module & calls another customer who is also connected to the same line module.

→ The off hook is detected & service circuits are attached to supply dial tone to calling customer.

→ Switching Fabric - ring the line

→ Control origin & termination of call

Diagram — 4m



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Q.4a. 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

14 marks

4 marks

Q.3 a. Message Switching

→ Briefly Explain the meaning & highlight points.

→ Sending message by telegraphy from one place to other.

→ Improvements needed in message switching.

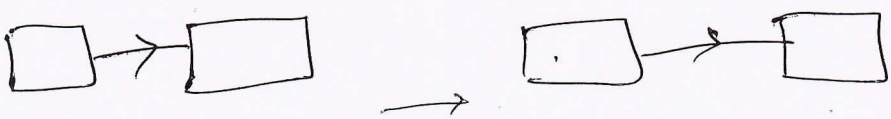
→ Torn tape Relay System - automatical function.

→ It is delay system or queing system.

→ Packet switching - widely used.

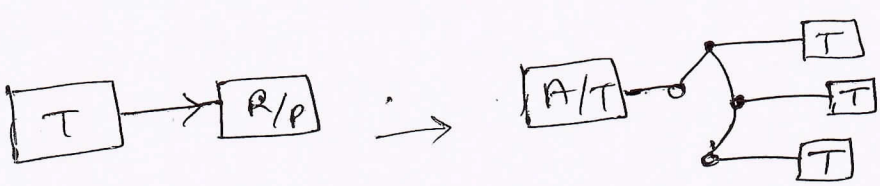
- Ex - VDU (visual Display Unit)

a.)

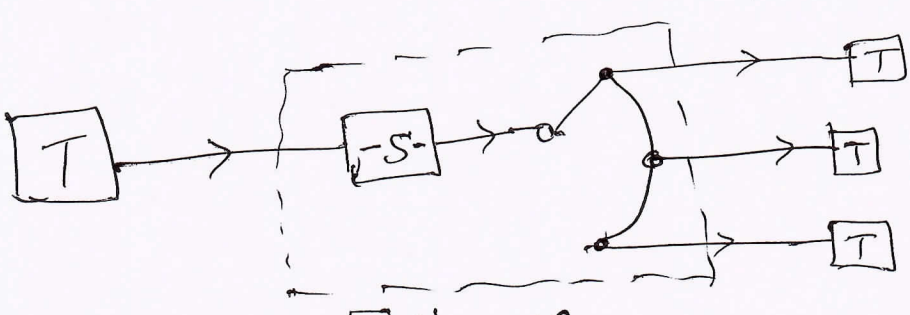


b.)

c.)



d.)



(14) (13)

Q.4b. Distribution Frames

23

8 marks.

Imp. points

→ PBXs increase no. of exchange lines.

→ Growth of traffic - flexibility required

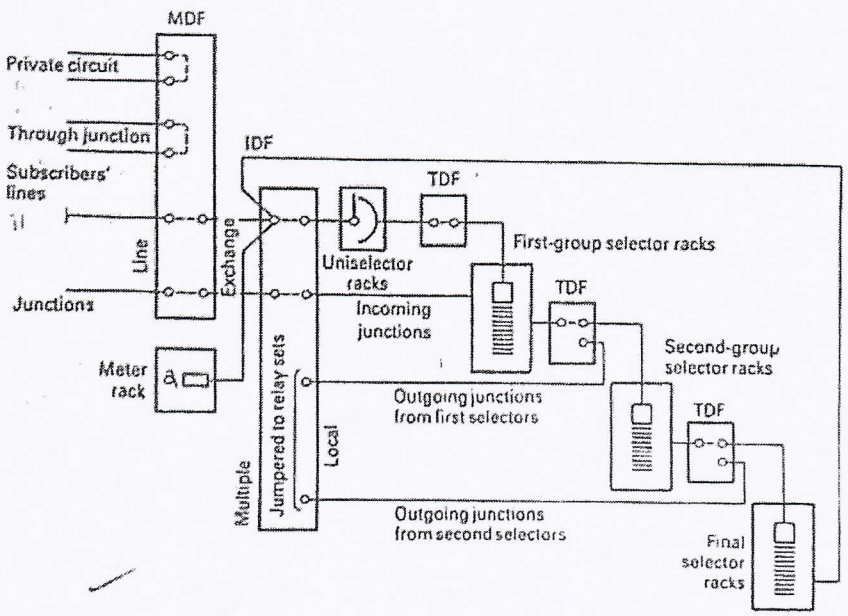
→ Distribution frames help by use of jumpers.

→ It distributes traffic evenly

→ EN - to - DN translation is provided.

→ Digital Distribution Frame used.

5 marks

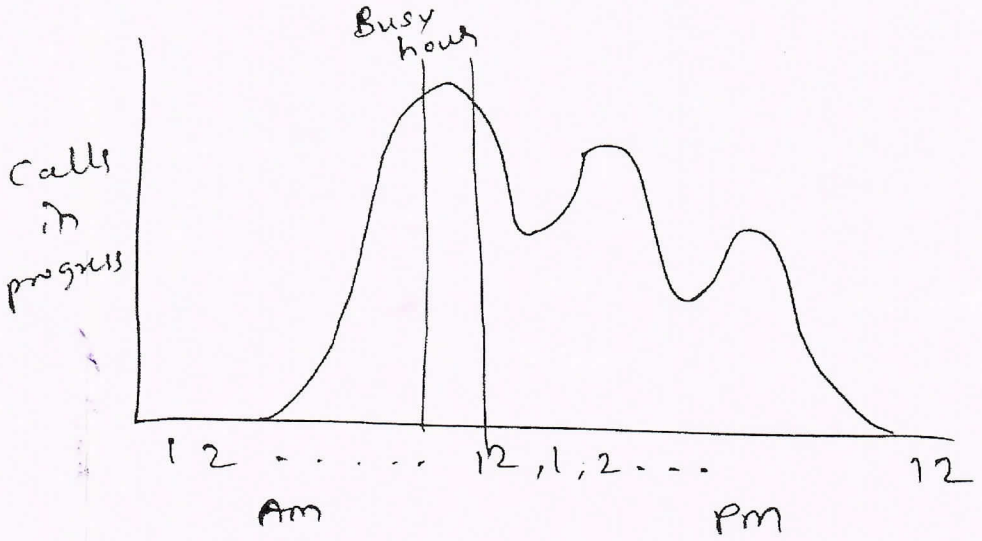


3 marks

21

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

i) Traffic Intensity – Definition — 2 mark



1 mark

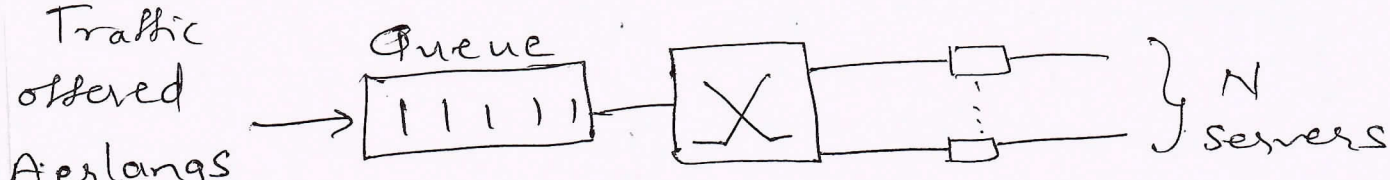
ii) Grade of Service – Probability of a call being blocked or queued for some period of time due to limited system resources during the busy hour of the day — 1 mark

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

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

10 marks
25

Q. 5 b. Second Erlange Distribution



⇒2 marks

Derivation

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

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

⇒5M

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

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

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

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

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

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

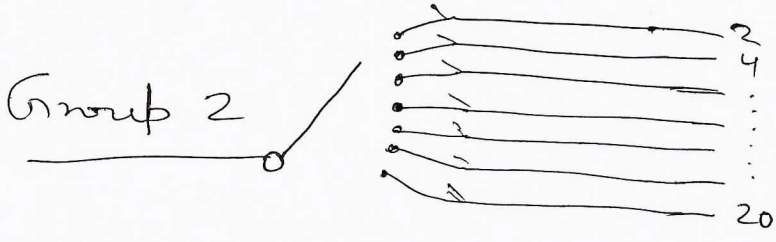
$$P(0) = e^{-A} \quad \& \quad P(x) = \frac{A^x}{x!} e^{-A}$$

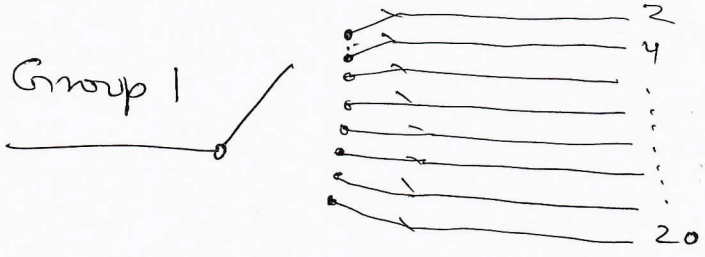
Call arival has Poisons Distribution.

Q. 6.a. · Grading — 6M

— Defn — 1M

→ Each incoming trunk has access to a sufficient number of trunks on each route to give required grade of service.





→ Interconnecting multiples of switches is called Grading.

Q. 6.b.

10 m.

$\sqrt{100/2} = 7.07$

∴ Use $n=5$ or $n=10$

1. If $n=5$, there are

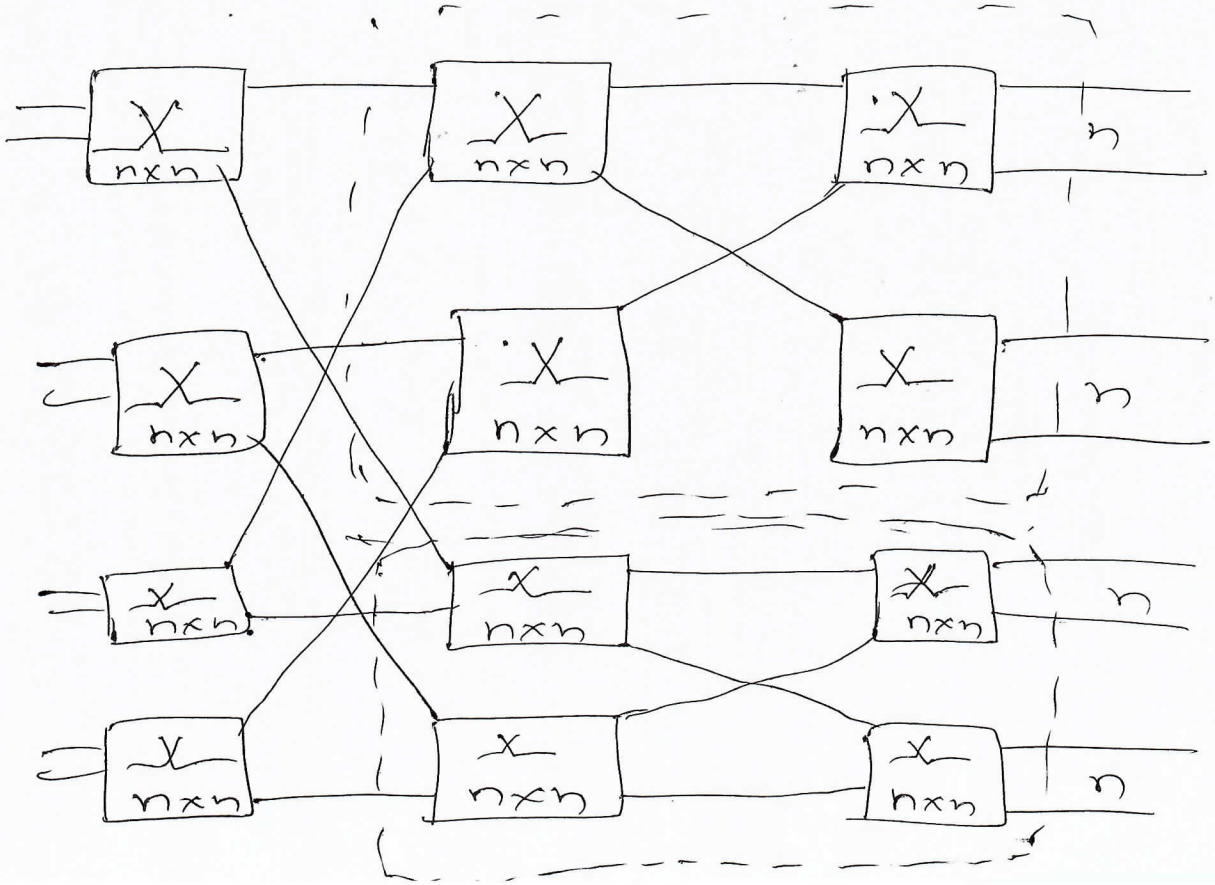
20 primary switches ~~of~~ size 5×5.

5 secondary switches of size 20×20

20 tertiary switches of size 5×5

If $n=10$, there are 10 primary switches,

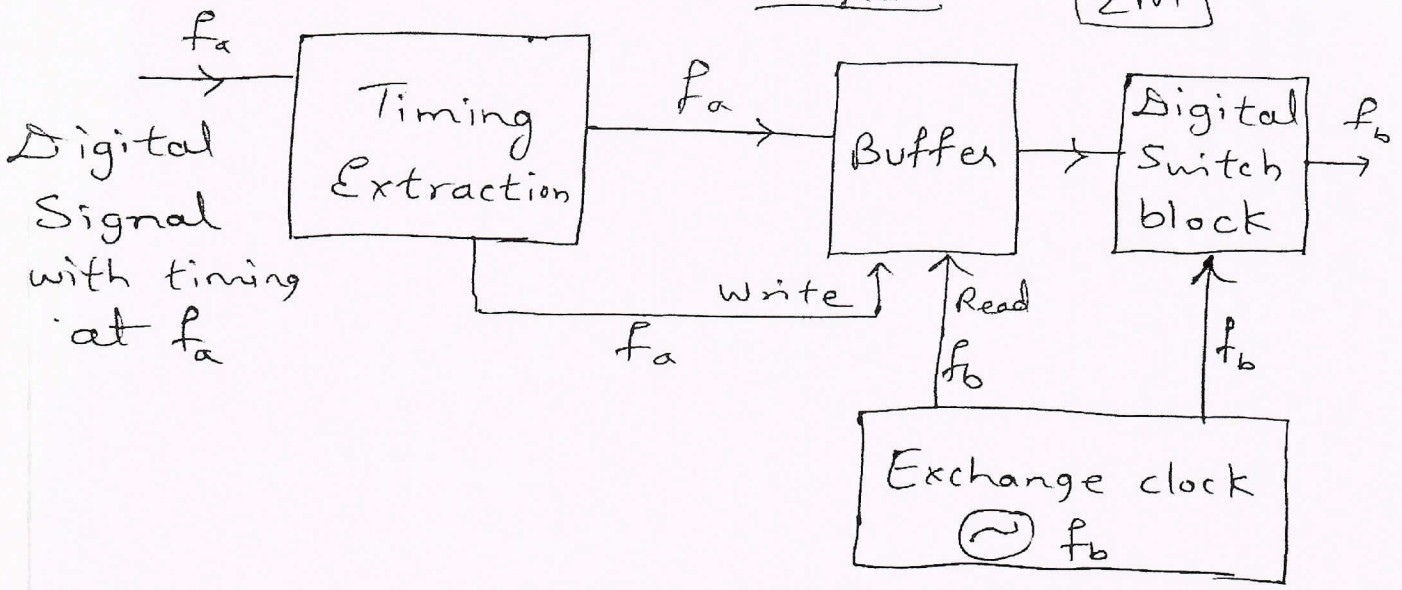
10 secondary switches.



Q. 7. a.

Frame Alignment. 8M

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.

30

(20)

Q.7 b.

Synchronization Networks — 8M

→ Despotic control.

→ PSTN – link exchange clocks to national reference standards. — 2M

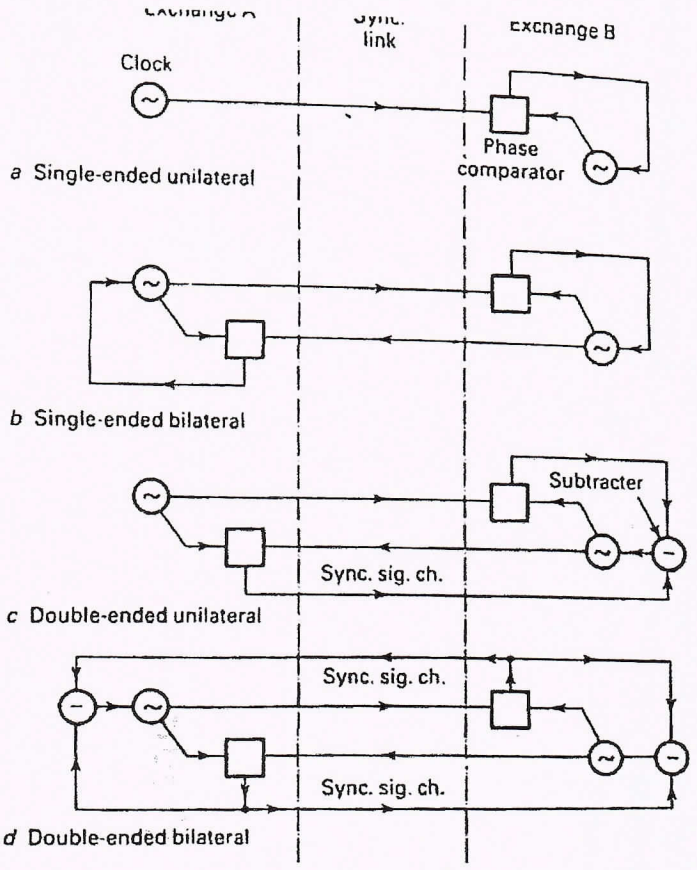
→ Plesiochronous network – have some slips.

→ Mesochronous working.

→ Unilateral sync. system.

→ Master slave configuration

Diagram



6M

Q. 8 a.

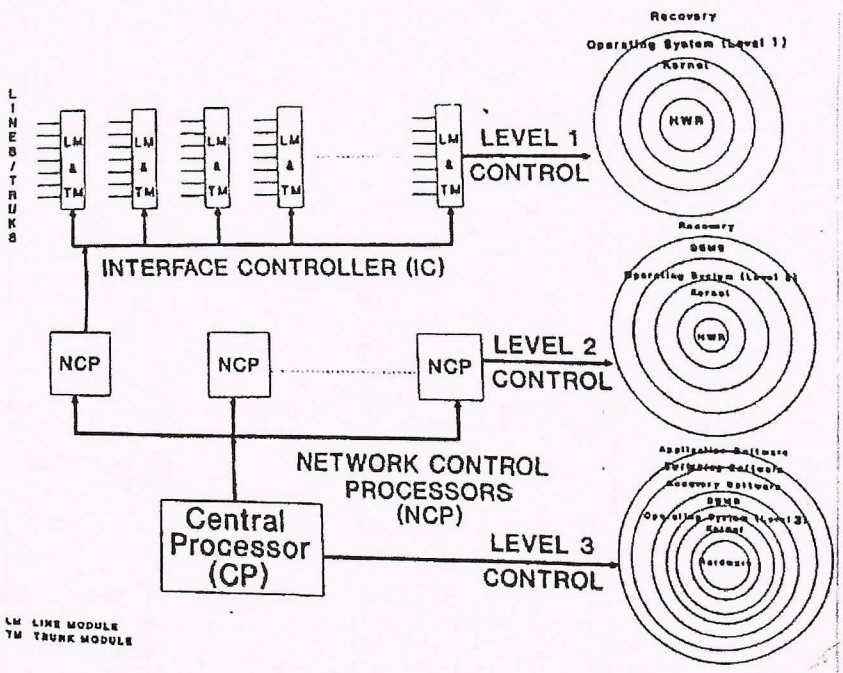
10 Marks
31

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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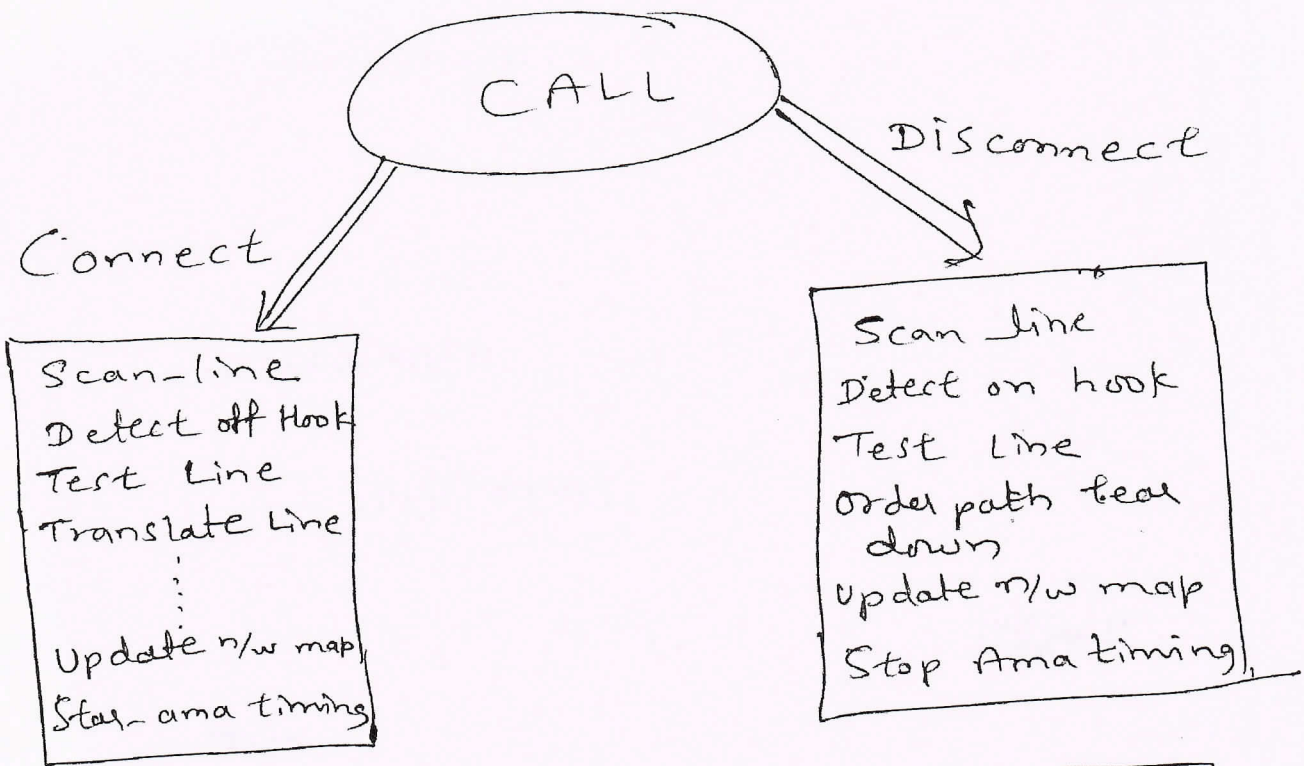
Q.8b.) Call Models — 6 M

→ 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 vtg, line cross.

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Q.9 a. 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

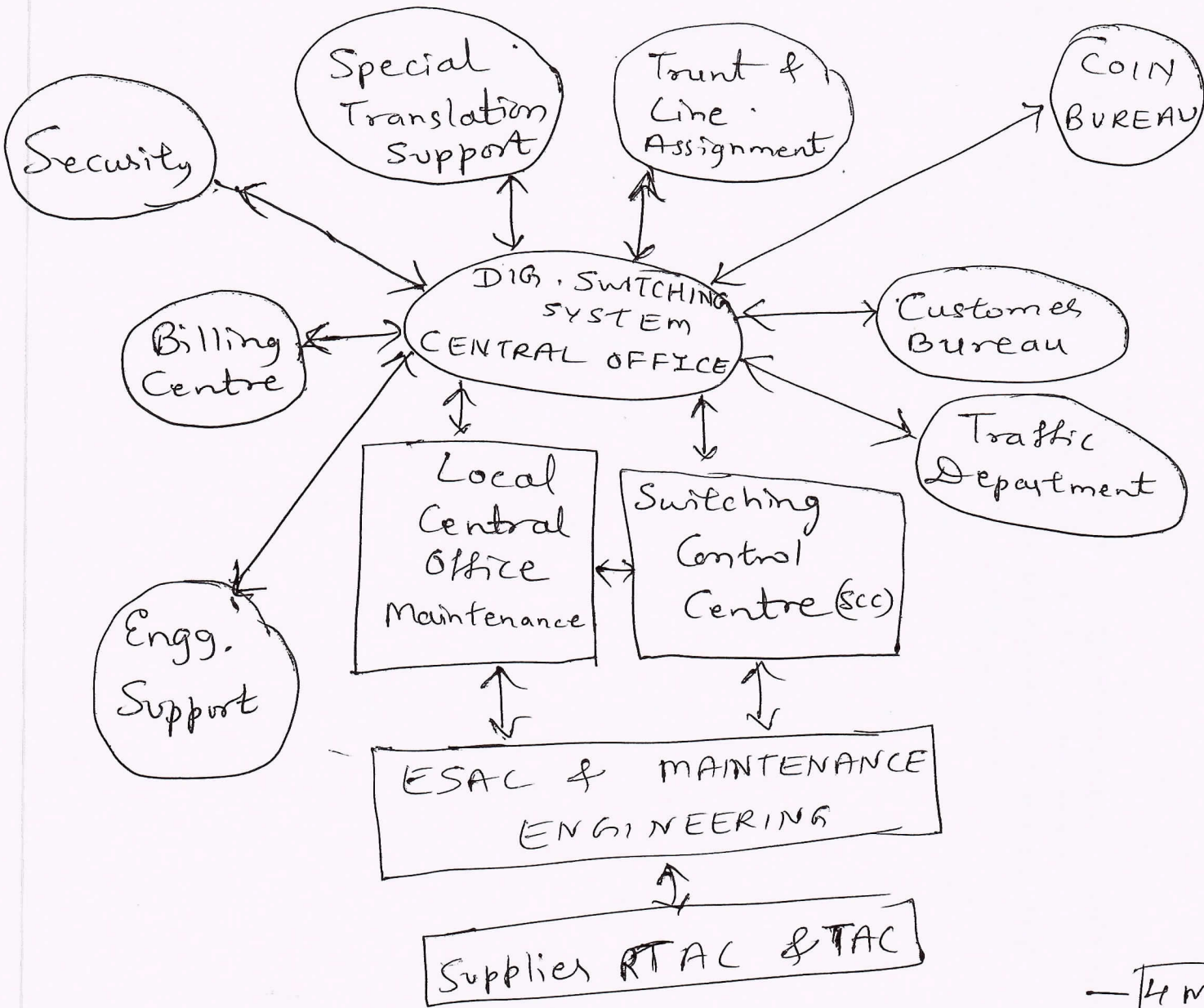
→ Remote Operation – RSM's to Support switching functions.

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

Q.09 b.

08 M 35

Typical Digital Switching System Central Office



4 M

→ Few imp points

4 M

1. CO's usually assigned to SCCs

(2.) Interact with Digital Switch

→ Engineering Support

→ Billing Centre

→ Security

→ Special Translation Support

→ Trunk & Line Assignment

→ Coin Bureau

→ Customes Bureau

→ Traffic Department.

Q.10 a. Generic Switch Hardware Architecture 8 m

Briefly Explain architecture - 6 m

→ Central Processor

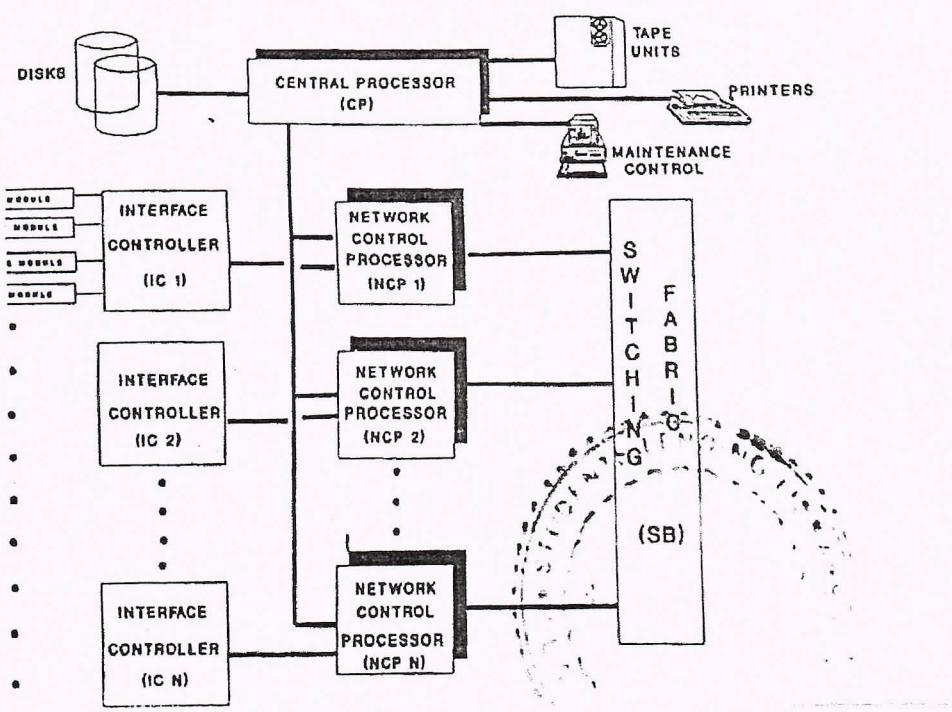
→ Network Control Processors

→ Interface Controllers

→ Interface modules

→ Switching Fabric

Diagram - 2 m



32

8m

Q. 10 b. Strategy for improving Software Quality

→ Imp Points - 4m

Program for Software Process Improvement

→ Software Processes

→ metrics

→ Defect Analysis

- Analysis Example
- Field trouble report

→ Typical Analysis