

Question no : 01

1. (a) What is Trunk switch?
- (b) Explain circuit switching, message switching and packet switching.
- (c) Describe technique of operating circuits.

Answer to the question no:-1 (a)

Trunk switch:

Trunk switch also called traffic switch. Trunk switch is defined as one to one connection which has one specific inlet that is must connect to one specific outlet.

(b) Answer to the question no:-1 (b)

Circuit switching

↳ A path is established between the caller and destination.

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- ↳ Real time connection formed
- ↳ Example :- PSTN
- ⇒ Message switching
- ↳ Also called store and forward.
- ↳ A message is first stored in a buffer and then sent on in its entirety.
- ↳ No real time connection (i.e. connectionless)
- ⇒ Packet switching
- ↳ A message is broken down into parts and each part is sent separately (possibly via different routes)
- ↳ Example: Internet UDP protocol.

Answers to the question No : 1 (c)

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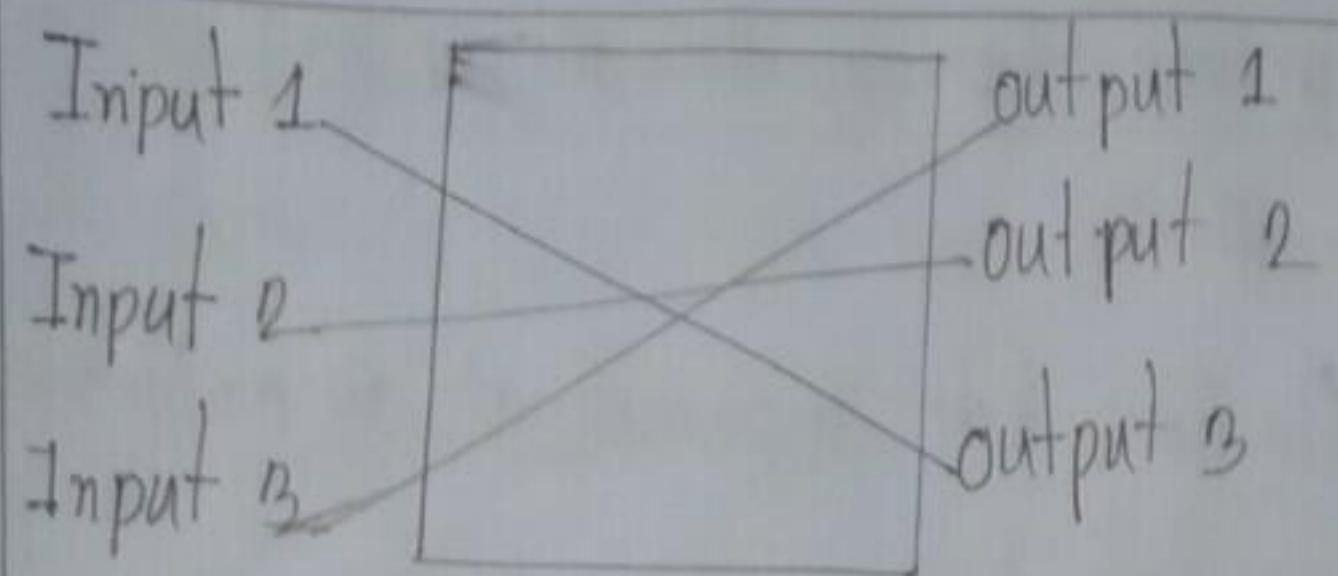
### Separation circuits

Q) Four technologies for separating circuits.

- (i) Space
- (ii) RF Frequency
- (iii) Time
- (iv) optical wavelength.

Q) There is logically connect circuits coming in to a switch with circuits at the output.

Q) Example "space division" equivalent inter connection pattern.



Question no : 02

2. (a) what is access switch ?
- (b) How does a time-space-time switch work
- (c) Explain time slot interchanger (TSI)

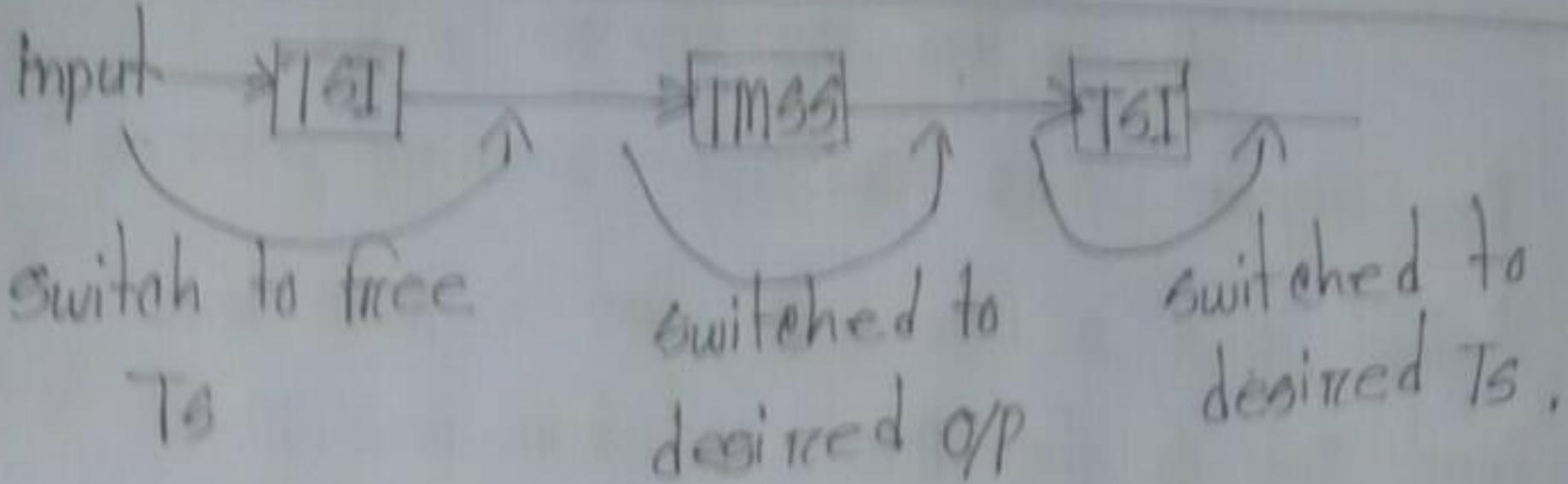
Answer to the question no :- 2(a)

Access switch is considered as one to one connection which has one specific inlet must connect to one free outlet

Ans to the question no : 0(b)

Time - space - time switching working process :

- ↳ first , find a time slot that is free from the input TSI to the TNSS , and from the TNSS to the output TSI to connect to .
- ↳ Next , switch the input channel's time slot in question to the free time slot .
- ↳ Then at the TNSS , connect the proper input line to the proper output line during free time slot .
- ↳ finally , at the output line's TSI , switch the free time slot to the time slot we wish to switch to



Answer to the question no:-02 (c)

Time Slot interchanger :

- ↳ In a TSI, one time slot is switched to another.
- ↳ Performed through use of two memory stores.
- ↳ speech store is RAM with to store one full frame of data.
- SP • For DS1 (1.544 Mbps) with 24 channels of 8 bits, the speech store is 24 bytes long.

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- ↳ speech address memory on time switch connection, store is RAM with capacity to store a word for each time slot, each word being a 32 number identifying a specific time slot.
  - ↳ For DS1 the SAM has capacity to store 24 words of 5 bits per word (need 5 bits to store a number between 1 and 24)

### Question no:- 03

- B. @ What is traffic offered ?
- ⑥ Describe traffic engineering trade offs.
  - ⑦ Explain types of blocking model .

Answer to the question no: B(a)

offered traffic (to) equivalent to traffic intensity (A). It takes into account all attempted calls whether blocked or not and uses their expected holding times.

Answer to the question no: B(b)

Traffic Engineering Trade off.

- Designs number of transmission paths or channels.
  - ↳ How many recognized normally
  - ↳ what if there is an overload.
- Design switching and routing mechanisms
  - ↳ How do we route efficiently?
  - ↳ E.g

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- High usage trunk groups
- overflow trunk groups.
- Where should traffic flows be combined
- Design network topology
  - ↳ Number and sizing of switching nodes and locations .
  - ↳ Number and sizing of transmission systems and locations .
  - ↳ survivability .

### Answer to the question no: B (c)

- Bot Blocked calls cleared (BCC)
  - Blocked calls leave system and do not return .
  - Good approximation for calls in 1st choice trunk group .

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- Blocked calls hold (BCH)
  - ↳ Blocked calls remain in the system for the amount of time for.
  - ↳ If a server feeds up, the call picks up in the middle and continues.
  - ↳ not a good model of real world behaviour
  - ↳ tries to approximate call attempts efforts
- Blocked calls wait (Bcw)
  - ↳ Blocked calls enter a queue until a server is available.
  - ↳ When a server becomes available the calls holding time begins.

Question no : 09

1. a) what is poison Traffic model ?
- b) Differentiate time congestions and call congestion.
- c) calculate probability of blocking

Answer to the question no : 9 (a)

Poisson Traffic model :

- Poisson approximates Binomial with large m and small A/m

$$P_K = \frac{\lambda^k \cdot e^{-\lambda}}{k!}$$

where  $\lambda$  = mean # of Busy sources and

Poisson =  $\lim_{m \rightarrow \infty} (\text{Binomial})$

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Answer to the question No: 4 (b)

Time congestions vs. call congestion

- Time congestion
  - ↳ Proportion of time a system is congested  
(all servers busy)
  - ↳ Probability of blocking from point of view of senders, busy
- call congestion
  - ↳ Probability that an arriving call is blocked.
  - ↳ Probability of blocking from point of view of calls.

For call,  $P(B) = A \cdot P(K > n)$

Probability that there are more service than there are servers

For time

$P(B) = P(K \geq n)$

Probability that all servers are busy.

Answer to the question no: 9(c)

Probability of blocking:

$$P(B) = P(K > n) = P(n) + P(n+1) + \dots + P(\infty)$$

$$= \sum_{K=N}^{\infty} \frac{e^{-A} \cdot A^K}{K!} = \sum_{K=N}^{\infty} \frac{K^K}{K!} e^{-A}$$

Where  $P(K)$

$$= \frac{e^{-A} A^K}{K!}$$

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$$= 1 - \sum_{K=0}^{N-1} \frac{A^K}{K!} e^{-A}$$

$$K=0$$

$P(B) = P(N, A)$  ← offered traffic  
Poisson  $N = \# \text{ Servers}$ .

Example,  $P(7, 10)$

Poisson  $P(B)$  with 10E offered to 7 servers

Question no: 05

5. a) What are the failure of the poisson model as not valid for situations with high blocking?

b) Explain Erlang B model.

c) Explain B Birth-Death process

Answers to the question no: 5(a)

Failure of the poisson model.

- ① Poisson only good approximation when low blocking
- ② Use Erlang B if high blocking.

Above are the failure of poisson model as valid for situations with high blocking.

Answers to the question no: 05 (b)

Erlang B Model

- More sophisticated model than Binomial or poisson.
- Blocked calls cleared (Bce)
- Good for calls that can reroute to alternate route if blocked.

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- No approximation for reattempts if alternate route blocked too.
- Derived using birth-death process.

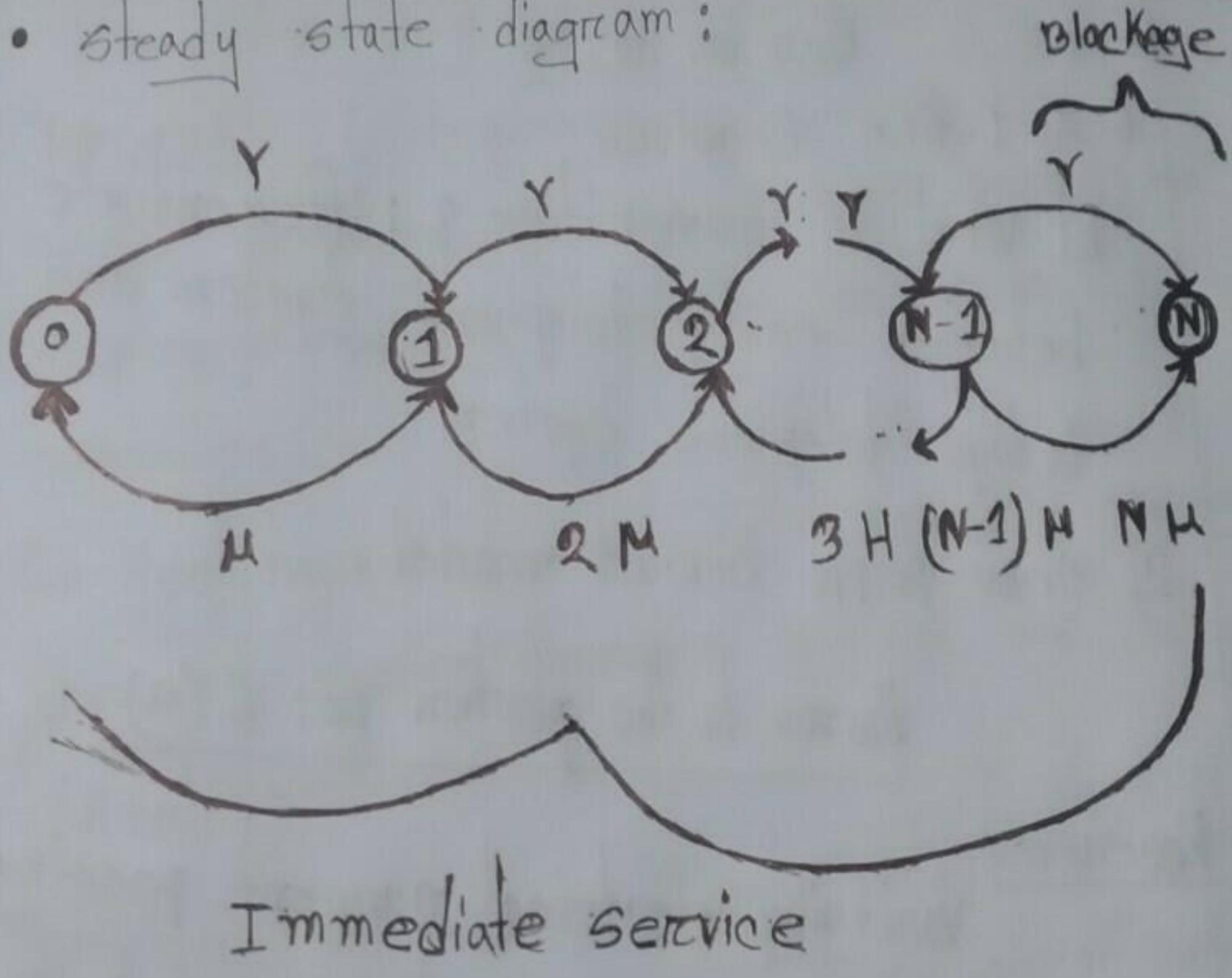
Ans to the question no : 05 (c)

### Erlang B Birth-Death process

- Consider infinitesimally small time "dt" during which only one arrival or departure (or none) may occur.
- Let  $\gamma$  be the arrival rate from an infinite pool of sources.
- Let  $\mu = 1/h$  be the departure rate per call  
 $\hookrightarrow$  if  $K$  calls in system; departure rate is  $K\mu$

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- steady state diagram :



Question no: 06

6. a) Define Receiver  
b) What is transmitter? Differentiate between early telephone system and today's telephone system.  
c) Show pSTN circuit model.

Answer to the question no: 6 (a).

Receiver: Varying electrical current passing through windings on magnet moves a diaphragm, same as in a microphone. Loudspeaker

Answer to the question no: 6(b)

Transmitter: (carbon granule microphone)

↳ Air pressure of sound waves impact on diaphragm varying pressure on carbon granules.

↳ Resistance of electrical current passing through carbon granules varies the current (Analog)

Differentiating between Early telephone system and today's telephone system are given below

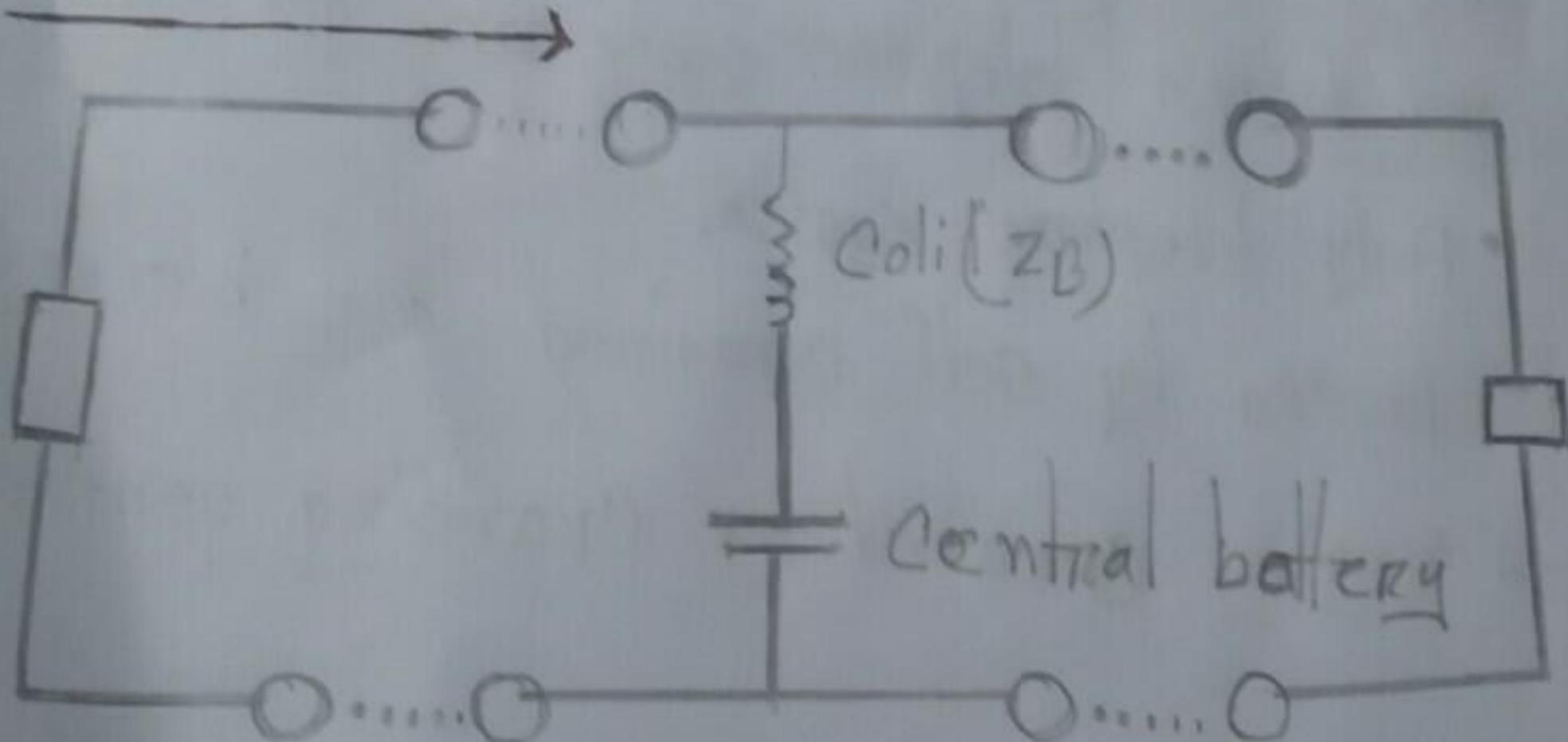
- Early telephone system
  - Powered by self contained local battery
  - Ringing created by cranking generator

- Today's telephone system
  - ↳ Powered through the line by battery at the central office (-48v)
  - ↳ circuit is closed when handset is lifted from the cradle.

Answer to the question no : 6(c)

PSTN or POTS simplified circuit model of any

Speech Current Connection :



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"The coil is a transmission bridge coil with a high impedance ( $Z_B$ ) preventing out the speech current from shorting out at the central battery"

Answer -

Question no : 7

7. a) What is DTMF signalling?
- b) What are the procedures of establishing  
a. call ?
- c) Describe pulse dialling.

Answer to the question no : 7 (a)

DTMF Signalling

- Faster than pulse dialling (1-0 seconds for ten digit numbers)

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- ↳ Reduces call set up time.
- Each digit produced by combination of 12 pure frequency tones.
- ↳ Reduces changes of error or interference.

Answer to the question no: 7 (b)

### Establishing a call:-

1. Calling customer takes phone off hook which closes the circuit to the C.O.
2. C.O. detects the loop and indicates readiness with dial tone.
3. Calling customers hears dial tone and dials number.

1. The network checks on the called party status and decides on a routing for the connection.
2. If connecting possible the called party is alerted
3. Ring tone is returned to the caller
4. The called party picks up the handset and closes his / her loop and opens second Loop
5. Exchange deletes trips on stop ringing
6. Call opens .. loop by hanging up
7. One party opens connection and exchange clear connection.

Answer to the question no: 7 (c)

### Pulse dialling:

- Line is rapidly disconnected and reconnected in sequence with one pulse for digit value "1"; two pulses for digit value "2"
- Each pulse lasts 0.1 second
- Inter pulse - digit pause (IDP) must be  $> 0.5$  second.
  - ↳ If not current digit may combine with previous digit
- Ten digit phone number typically takes 6-15 seconds total.
- This is the kind of signalling old "rotary"

"dial" phones produced.

Question no : 08

8. a) Define SRL
- b) Describe "Subscriber loop".
- c) How do you determine the target resistance?

Answer to the question No : 8(a)

SRL defines as singing return loss which has minimum attenuation to reflected power at any frequency coming back from the  $2w-4w$  interface.

Answer to the question no: 8(b)

### Subscriber loop

- Wire network from the central office to the station sets.
- Largest portion of capital capabilities (50%) and workforce requirements (30% - 40%)
- Prime candidate for replacement by optical fiber but costs often prohibitive.
- Main goal is to design and work with length limits.  
↳ Limited by resistance and attenuation long line.

Answer to the question no : 08 (c)

Target resistance determination.

↳ we need a high enough current at the customer premises to operate the station set (20mA minimum in North America)

↳ Use  $V = IR$ ; with a know battery voltage of

$$\hookrightarrow 4.8V \Rightarrow 20mA \times R \rightarrow R \leq 240\Omega \text{ or total.}$$

↳ Budget  $\approx 400\Omega$  for the battery feed bridge at the CO

↳ Budget  $\approx 300\Omega$  for other miscellaneous wire resistance (e.g. subset wiring, etc)

↳ The subscriber Loops wire resistance must not exceed  $1700\Omega$ .



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