INSTITUTE OF ENGINEERING

Examination Control Division

2072 Ashwin

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Big Data Technologies *(Elective II) (CT76507)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What are the technical challenges and characteristics of a big data? Who are the data scientists, list out their roles and skills. [6+6]

2. With diagram, explain general architecture of Google File System. [10]

OR

a) Why do we have single master in a GFS and millions of chunk servers? [4]
b) A cluster contains 1500 machines, each having 500GB disc capacity. Calculate approximate the number of the chunck servers, the blocks and the total available size if default chunck replica is 3 and 5 respectively. [6]

3. a) What is a map reduce? Explain the execution overview of the map reduce. [6]

   b) Draw the output of mapreduce of the following lines: [4]
   "big users big volume data cloud contributes bid data"
   "facebook has big users facebook operates big data"

4. a) Explain a CAP theorem. [5]

   b) Differentiate between a RDBMS and a NoSQL Databases. [3]

5. Explain taxonomy of a NoSQL databases. Explain Cassendra database in brief. [10]

OR

Using a MongoDB database,

a) Create a collections named "posts", insert following records: [3]
title: MongoDB, description: MongoDB is a NoSQL database, by: Tom,
Comments: We use MongoDB for unstructured data, likes: 100

   i) Now write a query to search title of the post written by Tom. [3]
   ii) Write mapReduce function to count number of posts created by various users. [4]

6. What is the Lucene? Describe the typical components involved in the search application. · [10]

7. Explain various components of Hadoop in brief. [10]

8. Write short notes on: (any two) [5×2]

   i) Combiner Functions
   ii) Fault tolerant systems
   iii) JSON
   iv) Unstructured data

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35B   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Big Data Technologies *(Elective II) (CT76507)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What are the BIG-DATA challenges? Explain the data analytics process in terms of BIG-DATA. [3+7]

2. a) Explain the control flow of write mutation with diagram. [7]

   b) Explain the meta data stored by GFS master. [8]

3. a) Explain garbage collection implemented by GFS. Explain its purpose against implementing eager deletion for storage reallocation. [7]

   b) Explain CAP theorem and Eventual consistency. Also, explain the reason why some NoSQL databases like Cassandra sacrifice absolute consistency for absolute availability. [8]

4. How map-reduce works in distributed fashion? Describe the parallel efficiency of map-reduce with suitable block diagram. [3+7]

5. List out the HADOOP daemons. How HADOOP and GFS are similar interms of design architecture. [2+8]

6. Explain the term "NO-SQL". Justify "for distributed scenario normalization contradict the data availability". [3+7]

OR

Write down the map-reduce program to find the word frequency. [10]

7. What are the data indexing steps? Describe the components of search application. [3+7]

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35E   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Big Data Technologies *(Elective II) (CT76507)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **_All_** questions.
✓ The figures in the margin indicate **_Full Marks_**.
✓ Assume suitable data if necessary.

1. a) Suppose you are working in a company that works on analyzing data. How would you determine if they have hit the big data phenomenon? Also, how would you explain your boss about the need to shift into new domain? [7]

   b) Explain Vertical and Horizontal Scaling. Explain their significance in Big data. [8]

2. Why GFS creates multiple replicas for a chunk? Explain the GFS architecture with suitable block diagram. [3+7]

3. What are the beauties of functional programming? Differentiate the terms mapping and folding with suitable example. [4+6]

4. How NoSQL differs from traditional relational database? Explain. [7]

5. a) Explain Bigtable/Hbase as a NoSQL database. [7]

   b) Explain document search. Explain Elastic Search as a search engine technology. [8]

6. List components in a basic MapReduce job. Explain with diagram how does the data flow through Hadoop MapReduce. [8]

7. Below is a data schema of two files used to detect possible crime that can happen on citizens. Field id in citizen file is referenced by citizen_id in Crime file. Same citizen_id can occur multiple times in Crime file i.e. a citizen can do multiple crime at different times. [5]

   Write map/reduce program that finds count of crime for citizen. The output must be of the form (first_name + last_name) => {count of crime}

Citizen	
•id	String
•first_name	String
•last_name	String
°phone_number	String
•gender	boolean
•address	String

Crime	
•citizen_id	String
•crime_id	String
•crime_description	String
•timestamp	long

8. Write short notes on: (any two) [2×5]

   a) GFS Consistency Model
   b) CAP Theorem
   c) HADOOP and Amazon Cloud

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Big Data Technologies *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ __All__ questions carry equal marks.
✓ Assume suitable data if necessary.

1. Explain the implications of "Big Data" in the current renaissance of computing. Describe the role of distributed system to solve the Big Data problems.

2. With diagram, explain general architecture of Google File System.

3. Why do we have single master in GFS managing millions of chunk servers? What are done to manage it without overloading single master?

4. List components in a basic MapReduce job. Explain with diagram how does the data flow through MapReduce.

5. Why does normalization fail in data analytics scenario? Explain CAP theorem.

6. Explain Eventual consistency and explain the reason why some NoSQL databases like Cassandra sacrifice absolute consistency for absolute availability.

7. Describe different components of enterprise search application.

8. You are asked to build a spam filter to know the words frequently used in the millions of spam emails received. Looping through all the documents using a single computer will be extremely time consuming. How do you speed it up by rewriting the program so that it distributes the work over several machines and processes at different phases/passes? Also describe how your algorithm will be applied to subset of data at different machines and then recombine it in next phase to produce the final output.

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Multimedia System *(Elective III) (CT78503)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Explain the global structure of multimedia system with diagram. (9)

2. Differentiate between MIDI and digital audio. Explain the Computer representation of sound with example. (4+6)

3. What is image enhancement? The table on the left below represents an indexed image. The table on the right is colour index table. What is the colour of the following pixels: (0,2), (1,1),(1,3) (2,1), (2,2),(3,0). (3+6)

	0	1	2	3
0	2	3	0.	3
1	7	2	1	5
2	5	6	4	4
3	2	7	5	0

	R	G	B
0	0	255	0
1	255	0	0
2	0	0	255
3	0	0	0
4	255	255	0
5	127	127	127
6	255	0	255
7	255	255	255

4. Differentiate between Video and animation. Explain the RGB color model and CMY colour model. (4+7)

5. Explain the data compression methods. Explain the steps to create Huffman code tree with example. (6+8)

6. What are the design guidelines for designing the multimedia user Interface for Multimedia system? Explain with example. (9)

7. Explain the Libraries, system software, higher programming languages and object-oriented approaches in terms of multimedia system. (9)

8. Explain the applications of multimedia in media entertainment. (9)

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46B   TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2069 Bhadra

Exam.		lar / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Multimedia / Virtual Reality *(EG795CT) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. Explain the global structure of Multimedia system in terms of application domain, system domain and device domain.

2. What do you mean by multimedia development life cycle? Explain.

3. Explain the audio hardware. Calculate the file size if we record the 10 second of stereo music at 44.1 KHz with 16 bits.

4. What are the different types of color model? Explain and compare them.

5. What are the major differences between lossy and lossless data compression?

6. Explain the steps to create the Huffman code tree with example.

7. Differentiate between Icon based authoring tools and time-based authoring tools.

8. What are the applications of multimedia in Entertainment? Explain.

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Multimedia and Virtual Reality *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. What do you mean by global structure of multimedia system? Explain with example. (10)

2. Differentiate between MIDI and digital audio. (5)

3. Mention different types of colour model and compare it. (10)

4. Explain the data compression methods with example. (10)

5. A bitmap image has resolution 640x 480 pixels. Each pixel is 32-bit deep. What is the size of the bitmap in bytes? (5)

6. What do you mean by abstraction levels of the programming of multimedia systems? Explain. (10)

7. Explain the user interface design steps in multimedia system. (10)

8. How can you apply multimedia system in tele-sevices? Explain (10)

9. Write short notes on (2x 5 =10)
   a) Image and graphics software
   b) MIDI device

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Multimedia and Virtual Reality *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Explain the global structure of multimedia system. [10]

2. What are the steps uses in multimedia system development life cycle? Explain. [10]

3. Explain the computer representation of sound. [10]

4. Explain the Huffman coding with example. [10]

5. Mention the different types of colour models and compare each of them. [10]

6. Explain the abstractions for programming such as libraries, system software, higher programming languages and object-oriented approaches. [10]

7. Explain the steps to design the user interface in multimedia system. [10]

8. Write short notes on: [2×5]

   a) JPEG
   b) MIDI

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Multimedia and Virtual Reality *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Explain the global structure of multimedia in terms of application domain, system domain, device domain and cross domain. (10)

2. What are the properties of a multimedia system? Explain (10)

3. Explain the MIDI software and it types. (10)

4. Explain the multimedia development life cycle. (10)

5. Differentiate between lossy and lossless data compression. (5)

6. Suppose if we record the 5 seconds of stereo music at 44.1 KHz with 32 bits. Calculate the file size? (5)

7. What are the applications of multimedia in entertainment? Explain. (10)

8. Explain the abstraction levels of programming in the multimedia systems. (10)

9. Write short notes on (5×2)
   a) Sound editing tools
   b) Time-Based authoring tools

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Subject: - Multimedia and Virtual Reality *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain multimedia system in terms of application domain, system domain, and device domain. (10)

2. What are the major steps of multimedia application development life cycle? Explain (10)

3. Explain the computer representation of sound and MIDI software.(10)

4. Differentiate between Bitmap and Vector graphics. (5)

5. Suppose if we record the 30 seconds of stereo music at 33.1 kHz with 8 bits. Calculate the file size. (5)

6. What do you mean by authoring tools? Mention the different types of authoring tools and explain it. (10)

7. What do mean by Huffman coding? Explain with example.(10)

8. Explain the application of multimedia in education sector. (10)

9. Write short notes on (5x 2=10)
   a) Dithering
   b) CMY colour model

| Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Geographic Information System *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

[1]   Define GIS. Explain how you model GIS in computer.   [6+4]

[2]   Explain Geo-Phenomena with respect to boundaries. How do you represent following geo-phenomena using irregular tessellation.   [4+8]
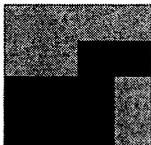
[3]   What is Spatial Database? Describe functional components of GIS system architecture.   [2+8]

[4]   What are the properties of map? Explain basic map projection techniques with example.   [4+6]

[5]   Explain raster data analysis techniques with example.   [10]

[6]   Explain the model of cartographic communication process? Describe about complexities of GIS data sharing.   [6+4]

[7]   What are the quality parameters that standardize the GIS data quality? Explain.   [10]

[8]   Write notes on (**any two**)   [4+4]

   [a]   SDI and NSDI

   [b]   ITRS and Dataum Transformation

   [c]   System Analysis and Design of GIS

   [d]   Challenges of GIS implementation in Nepal

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Geographic Information System *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

[1] Explain the applications of GIS. How do you model real world in GIS ? [8]

[2] What is Geo-Phenomena? Differentiate between geographic fields and objects. [2+6]

[3] What is tessellation? Explain the steps to represent raster data using region quadtree as an implementation of irregular tessellation. [2+8]

[4] Describe the functional components of GIS software. [10]

[5] Explain the data capture methods for GIS? How many ways can you project real world phenomena into 2D space. [4+8]

[6] What do you mean by spatial analysis? How do you perform the raster overlay operations using relational operators? Explain with example. [2+8]

[7] Explain different nature of data available and visual variables under cartographic toolbox. [10]

[8] Explain the working principle of clearinghouse? Why GII is needed for each country? Explain with sufficient reasons. [3+3]

[9] Write short notes on (**any two**) [3+3]
    [a] Datum and Datum Transformations
    [b] Remote Sensing and GPS
    [c] Vectorization Process
    [d] Phases of GIS development

Exam.		Regular/Back	
Level	BE	**Full Marks**	80
Programme	BEX, BCT	**Pass Marks**	32
Year / Part	IV / II	**Time**	3 hrs.

Subject: - Geographic Information System (GIS) *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt any **Five** questions.*
✓ *__All__ questions carry equal marks.*
✓ *Assume suitable data if necessary.*

1. Explain briefly four basic functions of GIS.

2. a) What are the database models used in GIS? Briefly describe relational database.

   b) Explain spatial, spectral and temporal resolution of satellite data.

3. a) Explain the spatial functions used in GIS.

   b) What are the advantages and disadvantages of raster and vector model?

4. a) Explain the differences between cylindrical and conical map projection.

   b) What are the advantages of spaghetti and topological digitizing? Explain.

5. a) Explain briefly the network model database.

   b) Why is spatial analysis important in GIS? Explain.

6. a) What is DEM? Explain any one method for interpolation of DEM.

   b) Explain how remote sensing can be related to GIS.

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Geographic Information System *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Seven** questions. **Question No. 10 is compulsory.**
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. Define GIS. What are various functions and components of GIS?

2. What are the major components (segments) of Global Positioning System? Discuss on the importance of GPS in GIS.

3. What do you understand by Digital Elevation Model? How the point, line and Area spatial entities are used in modeling geographic surfaces? Explain with suitable diagram

4. What are various analog and digital data sources in GIS? Discuss on data development process in GIS. How stream mode of digitizing is different from the point mode.

5. Define remote sensing. Discuss on the principle of remote sensing. How different spectral reflectance of various object useful in remote sensing?

6. Explain the need for data sharing in GIS. Highlight the importance of GSDI in standardization and data sharing

7. What do you understand by cartography? Develop model of cartographic communication. What are various components of Map?

8. How the graphic overlay differs from topological overlay in GIS? Develop resulting attribute table when the following district road network is topologically overlaid on the district area map as shown with the given attributes

Distric Boundries

Road network
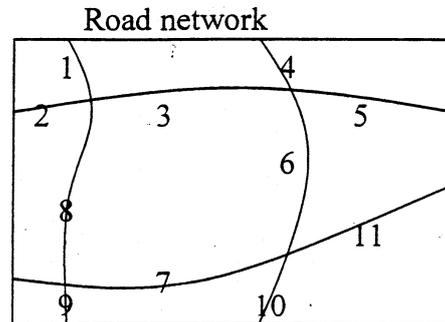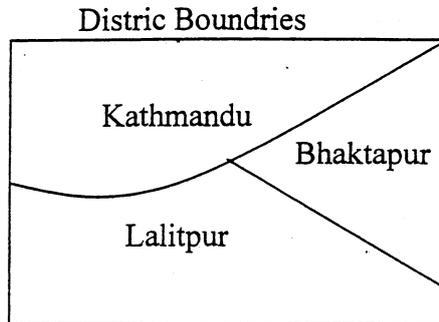
ID	Dist
1	Katmandu
2	Bhaktapur
3	Lalitpur

ID	Road Name
1	A
2	B
3	C
4	D
5	E
6	F
7	G
8	H
9	I
10	J
11	K

9. What are various steps in GIS database design methodology? Design ER diagram of parcel database to assist tax management for GIS database development

10. Write short note on following topics (Any two)
    a. Atmospheric windows
    b. Metadata
    c. Map Scale
    d. Map Generalization

35E   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Networking with IPV6 *(Elective II) (CT76503)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain IPv6 header with any two extension headers. [6+2+2]

2. What are the importances of IPv6 link layer address? Discuss with example, how do IPv6 machines generate its link layer address? [3+6]

3. Discuss ICMPv6 simplified header format for error and informational message types with path MTU discovery process. [6+4]

4. "*IPv6 has better quality of service*", justify it. Also discuss with mode, how authentication occurs in IPv6. [4+6]

5. How and on which state the DR and BDR election process occurs in OSPF IPv6 routing? How does OSPF IPv6 router come into fully adjacency state? Discuss. [4+6]

6. Compare tunneling, dual stack and translation approach of IPv6 network migration. Your ISP network is fully migrated into IPv6 but some limited IPv4 network still exists outside of your ISP network. In this scenario, how can you provide access to those IPv4 network & servers to your customers? [4+7]

7. Suggest with your plan for low cost, low risk IPv6 network deployment for the developing country like Nepal. [8]

8. Write Short Notes on (**Any Three**). [4+4+4]
   a. IP layer functionality in OSI Model
   b. IPv6 unicast and multicast address format
   c. Stateless address auto configuration in IPv6
   d. MPLS
   e. Issues of IPv4.

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Exam.	'	Regular / Back ●	
Level	BE	**Full Marks**	80
Programme	BEX, BCT	**Pass Marks**	32
Year / Part	IV / II	**Time**	3 hrs.

Subject: - Advance Computer Networking with IPV 6 *(EG785EX) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. Compare and Contrast the IPv6 header with IPv4 Header Structure. What is purpose of extended header in IPV6?
2. Describe different types of IPV6 address with their address format.
3. What are different types of ICMPV6 error message? Describe each with header format.
4. What are the major security elements of IPv6? Explain Security Association Negotiations and Key Management in IPv6.
5. Does Tunneling and NAT represent same mechanism? Describe dual stack for address translation.
6. What is multicasting? Describe different types of multicast address with address format.
7. The IPv4 address of a node in hex format is AE.C0.98.60, calculate the following.

    [a] 6to4 Address Prefix

    [b] IPv4 Compatible IPv6 Address

    [c] IPv4 Mapped IPv6 Address

    [d] ISATAP Addresses, provided the prefix is: 2003:101::/64

8. Write short notes on(Any two)
    i.   IPv6 Deployment; Challenges and Risks
    ii. Path MTU Discovery
    iii. Delay, Latency, Packet loss and throughput
    iv. IPSec

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Exam.	Regular / Back •		
Level.	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Biomedical Instrumentation *(EG785EX) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. a) How the capacitive properties of the piezo-electric transducer affect the response of the transducer? Plot the output signal of a piezo-electric transducer under different conditions? How ultrasonic blood flow meter is used to detect blood flow in certain blood vessel? Explain it with relative features.

   b) What is biopotential electrode? What does the equivalent circuit of the biopotential electrode look like while measuring the bioelectric potentials? How external or internal surface electrodes are used in DC defibrillator to deliver electric shock to the patient? Explain with suitable diagram.

2. a) How evoked potentials are generated? How these potentials are measured? Explain both monopolar and bipolar recording techniques. Design EEG pre-amplifier which is capable to receive evoked responses.

   b) What are the system components of CT scan machine? Describe its basic principle. How scanning system help to acquire information to reconstruct a picture for an accurate diagnosis? Explain.

3. a) How compressional disturbances travelling through a material is given by a wave equation? Draw a basic pulse echo apparatus and explain how transmitting pulse from transmitter helps to generate large amplitude pulses for producing US beam from the transducer. Discuss some applications of B-mode display formate.

   b) What is Nuclear Medicine Machine? How low-level radiation tracer detection device is used to measure target organ function? Explain with necessary diagram. How 'free radicals' are formed with ionising radiation in human body?

4. a) Write down the properties of X-rays for the application in medical diagnosis. How intensity of X-ray beam is varied? Explain exposing system of X-ray machine with self-rectification of the X-ray tube with complete diagram.

   b) What are the main components of Lithotripter system? How kidney stone is reduced to 1-2m fragments by the help of shock-waves? Describe it with complete diagram.

5. Write short notes on: (any two)

   a) Safety aspects of medical instruments
   b) PC based ECG machine
   c) EMG recording technique
   d) Man-instrument system and their objectives

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Biomedical Instrumentation (Elective I)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate _**Full Marks**_.
✓ Assume suitable data if necessary.

1. a) Describe the five main objectives of man instrument system with suitable examples. What are the basic components involved in designing a microprocessor based system? Draw a schematic block diagram illustrating the concept of micro processor based ECG system. [8]

   b) What is Electrode? Discuss the Electrode theory. What does the equivalent circuit of the electrode look like while measuring the bioelectric potentials? How external surface electrodes are used to deliver electric shock to the heart to reestablish a more normal ECG signal. Explain with necessary circuit diagram. [8]

2. a) How the capacitive properties of the piezo electric transducer affect the response of the transducer? Discuss the ultrasonic blood flow meter giving the working principle and other relative features. [8]

   b) What are the differences between EEG potential and Evoked potential? Explain these potentials are measured? Explain both monopolar and bipolar recording technique. Design EEG pre-amplifier with its desirable features. [8]

3. a) How intensity of the X-ray beam rises and falls directly with the tube current? Explain the operating and exposing system of X-ray machine with necessary functional diagram showing self rectification circuit of the tube. [8]

   b) What are the system components of computer tomography (CT)? Describe the basic operating principle of CT-scan machine with image scanning procedures. Write important applications of CT-Scan. [8]

4. a) What is ultrasound? Describe its wave equation. Discuss basic pulse echo apparatus with complete diagram. Explain some important applications of B-mode display. [8]

   b) What is dialyzer? How waste products are removed from blood plasma? Explain with suitable diagram. Draw a neat diagram of extra corporeal shock-wave Lithotripsy system. [8]

5. Write short notes on : (any two) [8+8]

   a) EMG Recording Technique
   b) Magnetic Resonance Imaging (MRI) system
   c) Resting and Action Potentials
   d) 12 leads configuration of ECG machine

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INSTITUTE OF ENGINEERING

Examination Control Division

2065 Baishakh

Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Biomedical Instrumentation *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **_All_** questions.
✓ The figures in the margin indicate **_Full Marks_**.
✓ Assume suitable data if necessary.

1. a) "The bioelectric potentials associated with muscle activity constitute the electromyogram". How these potentials are measured? Draw an equivalent circuit for the electrode. What does the equivalent circuit of the electrode look like while measuring the bioelectric potentials? [8]

   b) Discuss the principle of ultrasound imaging system with wave equation. Describe basic scheme of generation of ultrasound with neat diagram. Draw a complete block diagram of basic pulse echo apparatus. [8]

2. a) Describe the basic principle of CT-Scan Machine with a neat diagram. How images are scanned in CT Scanner? What are the differences between CT and MRI? [8]

   b) What is EEG? What are the differences between unipolar and bipolar EEG recording configuration? Give a simple design of EEG amplifier to minimise the noises with its desirable features. [8]

3. a) What is ECG? Describe mechanism of blood flow in human body. Why SA node is called pace-maker of the heart? List the typical characteristics of the normal ECG. [8]

   b) What is EMG? With a neat diagram explain the electromyegraphy technique. What are the differences between ECG and EMG? [8]

4. a) Discuss ultrasonic blood flowmeter based on Doppler principle. How blood flow is determined by radiographic method? [8]

   b) What is MR phenomenon? Discuss the basic theory of MRI system pointing the components. Draw a complete diagram of the image reconstruction system and explain. What are the differences between CT and MRI? [8]

5. Write short notes on any two: [8+8]

   a) The Man-Instrument System
   b) Common blood types and its cross-matched
   c) Safety of the medical equipments
   d) Electrodes and physiological transducers

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32F   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2064 Poush

Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Biomedical Instrumentation *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. a) What is man-instrument system? In designing an instrument system for measurement of physiological variables, which of the components of man-instrument system should be determined first and why? Which would you determine next? Write in brief about basic objectives of man-instrumentation system. [8]

   b) What is EEG? Discuss the EEG recording configuration. Which instrumentation circuitry should be designed to measure evoked potential and give a high volume of input impedance with its desirable features? [8]

2. a) How physiological transducers will convert all physiological variables into electrical signals? How piezoelectric transducer is used to both transmit and receive ultrasonic signals? [8]

   b) Describe the basic principle of CT-Scan Machine with a neat diagram. How images are scanned in CT scanner? [8]

3. a) How Computed Tomography (CT) differs from Image Intensifier TV (IITV) x-ray system? Explain the operating and exposing system of x-ray machine with a functional diagram. [8]

   b) Draw a complete block-diagram of basic pulse echo apparatus, by explaining the transmitting pulses from the transmitter to generate large amplitude pulses for generating US energy, describe A-mode and B-mode display system and its advantages. [8]

4. a) What is MR Phenomenon? Discuss the basic theory of MRI system pointing the components. Draw a complete diagram of the image reconstruction system. What are the differences between CT and MRI? [8]

   b) What is bioelectric potential and how it is associated with body? How action and resting potential are generated? [8]

5. Write short notes on any two: [8+8]

   a) ECG machine and its recording techniques
   b) Electromyography
   c) Ultrasonic blood flowmeter
   d) Active and passive transducer

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Data Mining *(Elective I) (CT725)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. a) What is "curve of Dimensionality"? How can it be avoided? [5]

   b) Discuss the impact of noisy data in data mining? [5]

2. Explain rule based classifier? How can CN2 Algorithm be used for rule based classification? Define "Accuracy" and "Laplace" measures used for rule evaluation. [9]

3. An input sequence "A A B B B A A A B B" was used for classification. The Classifier 'X' predicted the sequences as: "A A B B B A A A B B" where as the Classifier 'Y'predicted the sequences as: "A A A A B B A A A B". Develop the corresponding confusion matrix for the classifiers and find their corresponding. [10]

   i) Accuracy
   ii) Precision
   iii) True Positive Rate
   iv) False Positive Rate

4. Explain Apriori algorithm. Use Apriori to generate frequent item sets with support of 50% for the following transaction database. [10]

TID	Items
1	ACD
2	BD
3	ABCE
4	BDF

5. Why is pattern evaluation important in association rule mining? Explain with example the statistical based measures used for measuring interestingness of association rules. [8]

6. What is a density based cluster. Explain an algorithm that can be used to generate density based clusters. [8]

7. What is Hierarchical Clustering? Differentiate between agglomerative and divisive approach of hierarchical clustering. Augment your answer with appropriate illustrative examples. [10]

8. Write short notes on: [15]

   i) Data ware house and Data mart
   ii) Base Rate Fallacy
   iii) Web mining
   iv) Anomaly Detection
   v) Convex Hull Method

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INSTITUTE OF ENGINEERING
Examination Control Division
2069 Bhadra

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Data Mining and Warehousing *(EG795CT) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. What is data mining? What are the advantages of data mining? [8]

2. What is knowledge discovery in database (KDD)? Discuss any two stages of KDD with example. [8]

3. What is online analytical processing (OLAP)? Explain differences between OLAP and OLTP. [10]

4. What is Apriori algorithm and using this generate few rules for given data set. [10]
   (Take supports = 35% and confidence = 70%)

Instance	Transaction
1	A,C,D
2	B,C,D,E
3	A,D,E
4	B,D,E
5	A,C,D,E
6	A,D,E
7	A,B,C,E

5. What is ID3 algorithm? Explain with an example. Calculate TPR, FPR and precision for given confusion matrix. [10]

a	b	◄......... classified as
40	20	a = Yes
30	30	b = No

6. Explain different managers in data warehouse along with their major tasks. [10]

7. What is data warehouse schema? Explain different types of data schema. [8]

8. Explain the use of data mining in Web mining and image mining. [8]

9. Write short notes on: (any two) [4×2]
   a) DSS
   b) Handling of missing data
   c) Data mart

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Data Warehousing and Data Mining *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What is data mining? Explain its importance and applications. [7]

2. What is data dimensionality? Explain its impact on data mining with techniques used for data dimensionality reduction. [10]

3. Explain Bayes classifier. What assumption of Naive Bayes makes the classification task simpler? [10]

4. What is tree induction? Explain Hunt's algorithm used for decision tree induction. [10]

5. What is clustering? Explain K-means algorithm. [8]

6. Explain FP Growth Algorithm. [15]

7. Write short notes on: [5×4]

   a) Base Rate Fallacy
   b) SVD
   c) Anomaly Detection and its applications
   d) Data Aggregation

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: Data Mining and Data Warehousing *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What is data mining? Explain the descriptive and predictive approach of data mining. [2+6]

2. List the different stages of knowledge discovery in database (KDD) with major issues of each stages. [9]

3. What is data warehouse? Explain the role of different system managers within the data warehouse. [2+9]

4. What is decision tree? Find root node of the following data set using ID3 algorithm. [2+8]

Day	Outlook	Temp.	Wind	Play
1	Sunny	Hot	Weak	No
2	Sunny	Hot	Strong	No
3	Overcast	Hot	Weak	Yes
4	Rain	Mild	Weak	Yes
5	Rain	Cold	Strong	Yes
6	Rain	Cold	Weak	Yes
7	Overcast	Cold	Weak	Yes
8	Sunny	Mild	Weak	No
9	Sunny	Cold	Weak	Yes
10	Rain	Mild	Strong	Yes
11	Sunny	Mild	Strong	Yes
12	Overcast	Mild	Strong	Yes
13	Overcast	Hot	Weak	Yes
14	Rain	Mild	Strong	No

5. Write Apriori algorithm. Identify the candidate, frequent item sets and some association rules for the following transaction table using apriori algorithm. [2+8]

Transaction ID	Items
1	T-shirt, Jeans, Jacket
2	Jacket, Shoes
3	Shoes, T-shirt, Jeans, Jacket
4	Shoes, Cap, T-shirt
5	Jeans, T-shirt, Jacket
6	Jeans, T-shirt, Jacket

Take minimum support = 30%, minimum confidence = 70%

6. Why does an organization need Online Analytical Processing (OLAP)? Explain operations associated with OLAP. [3+5]

7. What is fact and dimension table? Explain different types of data warehouse schemes. [4+6]

8. Describe the application of data mining in web mining and image mining. [4+4]

9. Write short notes on: (any two) [2×3]

   a) Decision support system   b) Confusion matrix
   c) Data marting   d) Data coupling

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Data Warehousing and Data Mining *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ *All* questions carry equal marks.
✓ Assume suitable data if necessary.

1. What is data mining? Explain with example problems which are solved using data mining algorithm.

2. Why is dimensionality reduction needed? Explain how principal component analysis is used for dimensionality reduction.

3. What is classification? Explain how GINI Index can measure the quality of split while making decision trees for classification.

4. Explain Baye's classifier. How is Naive Bayes classifier different from Baye's classifier?

5. Explain the process of generating FP tree from a given transaction database with an example.

6. Explain K-mean clustering algorithm. What type of clusters does the classical K-means algorithm generate?

7. Explain how Apriori algorithm can be used to generate association rules from the given frequent item sets.

8. What is anomaly detection? Explain Bare Rate Fallacy.

9. Explain data ware house. How is it different from Data Mart?

10. Write short notes on:

    a) Properties of distance metric

    b) DBSCAN

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Data Mining and Warehousing *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **_All_** questions.
✓ The figures in the margin indicate **_Full Marks_**.
✓ Assume suitable data if necessary.

[1] Compare Data Mining with RDBMS SQL in Knowledge Extraction. Explain the Cause of DM & DW Project Failure.   [4+4]

[2] Define the terms Data Mart, Metadata, Fact table and Dimension table with example.   [8]

[3] Explain ten golden rules to setup perfect KDD environment   [10]

[4] Explain the application areas of Cluster Analysis. Describe K-means clustering algorithm with example.   [3+9]

[5] How could you solve the problem of over fitting in ID3 Implementation? Explain the rules and conditions to generate decision tree using ID3.   [4+4]

[6] What is DMQL? Where is it applicable? Differentiate between Transactional databases with Data warehouse databases.   [2+2+4]

[7] What is Association Analysis? Explain Apriori Algorithm with its pruning principle.   [2+6]

[8] Explain Web Structure/Content/Usage mining. Explain the privacy Aspects of Data Mining.   [6+3]

[9] Write short notes on (**any Three**)   [3+3+3]

   [a]   Characteristics of Neural Network & Perceptron Learning rule
   [b]   OLAP & OLTP
   [c]   Likelyhood and Distance
   [d]   Warehouse process architecture
   [e]   KDD

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

33D   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Ashadh

Subject: - Data Warehousing and Data Mining *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What are the different mining techniques applied over Warehouse multi-dimensional data? Explain the usage and importance of Data warehouse and Data Mining with example. [2+6]

2. Define data-mart and metadata development within warehouse system. Explain with example, why warehouse data is characterized with time, subject and non-volatility nature. [4+6]

3. Explain the warehouse schemas for multidimensional data management with DMQL syntax and lattice cube structure representation. Explain the OLAP operations applied over multidimensional data cube. [6+4]

4. What are the relationships with warehouse system architecture and process architecture? Explain the roles and responsibilities to be fulfilled by warehouse manager and his/her coordination with other managers. [3+7]

5. Describe two styles of data-mining. Define No/Loose/Semi-Tight/Tight coupling of data mining with data warehouse/database system. [4+6]

6. What is confidence and support in association analysis? Explain A-priori algorithm and its pruning principle with example. [4+8]

7. What is the use of entropy and information gain in ID3 tree generation? Describe the algorithm of ID3 tree for classification with its pruning principle. [4+7]

8. Write short notes on (**any three**) [3+3+3]
   a. DSS for Business Data Model
   b. Preprocessing phases of KDD
   c. Data preprocessing steps with binning method to handle noisy data
   d. WWW mining taxonomy
   e. Genetic Algorithm

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Data Warehousing and Data Mining (Elective II)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Does any organization needs Data Warehousing / Data Mining? Explain with its importance and applications. [3+7]

2. What are OLAP and OLTP? Explain OLAP operations with example. [4+6]

3. Explain the components of data warehouse system architecture with example. [10]

4. Explain ID3 algorithm with its tree pruning principle. [10]

5. What are the preprocessing steps of data mining? Explain the coupling of data mining system with data warehouse system. [4+6]

6. Write down the characteristics of neural network. Explain perceptron learning rule with example. [3+7]

7. Explain the applications of clustering. Write K-means clustering algorithm with example. [4+8]

8. Write short notes on: (any two) [4+4]

   a) Data Warehouse Schema and DMQL
   b) KDD
   c) K-nearest neighbor and its implementations
   d) Word Wide Web Mining

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32C   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Baishakh

Exam.		Back	
Level	BE	**Full Marks**	80
Programme	BCT	**Pass Marks**	32
Year / Part	IV / II	**Time**	3 hrs.

Subject: - Data Mining and Data Warehousing *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. What is data mining? Describe the application of data mining in banking in bio-medical. [2+4+4]

2. What is Online Analytical Processing (OLAP) in data mining? List the operations associated with OLAP. [4+6]

3. Clusters the following instances of given data (2-Dimensional form) with the help of K-means algorithm. (Take K = 2) [8]

Instances	X	Y
1	1.0	2.5
2	1.0	4.5
3	2.5	3.0
4	2.0	1.5
5	4.5	1.5
6	4.0	5.0

4. Write the Apriori algorithm. Use this algorithm to find frequent item set and generate few rules associated with the transaction. [2+8]

(Take minimum support = 25%, minimum confidence = 65%)

Transaction ID	Items
1	A,C,D
2	C,D,E
3	A,D,E
4	B,D,E
5	A,C,D,E
6	A,D,E
7	A,B,C
8	C,E

5. Describe the architecture of data warehouse along with different components of it. [10]

6. Describe the major task performed in each stage of Knowledge Discovery in Database (KDD) with example. [1]

7. Explain the characteristics of Data Warehouse. How operational database is different from Data Warehouse. [6+4]

8. Write short notes on (any four) [3×4]

   a) Decision Support System
   b) Likelihood and Distance Technique
   c) Data Warehouse Schemas
   d) Portioning and Hierarchical Clustering
   e) Noise in Data Warehouse
   f) Decision Trees

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Data Mining and Data Warehousing *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **_All_** questions.
✓ The figures in the margin indicate **_Full Marks_**.
✓ Assume suitable data if necessary.

1. Define Knowledge Discovery in Database (KDD). Explain different stages of KDD with example. [2+8]

2. What is Decision Support System (DSS)? What are the basic requirement of designing a DSS? [2+8]

3. Write the K-means algorithm for clustering and using this algorithm create clusters for the given data (In two-dimensional form) (Take K = 2). [3+8]

Instances	X	Y
1	2.0	2.5
2	2.0	4.5
3	1.0	1.5
4	1.0	3.5
5	3.0	5.0
6	5.0	4.0

4. Why does an organization need Online Analytical Processing (OLAP)? Explain different operations of OLAP. [4+6]

5. What is data warehouse? Explain the major process associated within a data warehouse. [2+8]

6. Define Association Rule? Find the frequent item set and hence generate the rules from the following transaction database. (Take minimum support = 30% and confidence = 65%) [2+8]

Transaction ID	Items
1	Tea, Biscuit
2	Coke, Bread, Butter
3	Tea, Bread, Butter
4	Tea, Bread, Peanut
5	Coke, Biscuit, Peanut
6	Bread, Butter

7. Explain the data mining in market analysis and in telecommunication. [10]

8. Write short notes on (any three) [3×3]
   a) Meta Data
   b) Genetic Algorithm
   c) Fact Table and Dimension Table
   d) Effect of missing data in Data Warehouse

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Exam.		Back	
Level	B.E.	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Data Mining and Warehousing *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Ten** questions selecting **Two** from **Group A** and **Eight** from **Group B**.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

Group A   (12×2)

What is the role of Data Mining in Marketing? Explain with reference to E-Commerce, Web Mining and Multimedia.

Explain the architecture of Data Warehouse and explain in detail the function and significance of each block.

What are the tools required to manage Data Warehouse? Why there are different tools to manage the different process managers in Data Warehouse?

Group B   (8×7)

Explain the Knowledge Discovery Process with the help of complete block diagram.

Association rules are always defined on binary attributes"? Justify your statements with suitable example.

What are the steps required for the construction of a Genetic Algorithm? Explain

What are the golden rules in setting up a KDD environment?

What do you mean by estimating load in Capacity Planning? How do you characterize the various factors that affect Capacity Planning?

Define Aggregation and show how the aggregate data can achieved using summary tables and fact table.

What do you mean by Star flake Schema? How the FACTS and DIMENSIONS are identified in Data Mining?

Is the Data Warehouse an Operational System or not? Justify your statements.

Why Data Marting is important in Data Warehouse Designing? When is Data Marting Considered as appropriate in Data Warehousing?

How do you develop the test plan while testing a Data Warehouse? How do you test the application?

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Web Technologies and Applications *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **_All_** questions.
✓ The figures in the margin indicate **_Full Marks_**.
✓ Assume suitable data if necessary.

1. a) Explain how the Internet and the Web work together. [5]

   b) Write a brief account on the history of the Web. [5]

2. a) What are the different components that make up the Web? Describe briefly. [5]

   b) How is XHTML different from HTML? [5]

3. a) What is server-side programming? Explain how a Java Servlet works. [6]

   b) Explain the CGI server-side script execution mechanism. [6]

4. What is JavaScript? What is the significance of JavaScript DOM (Document Object Model)? [6]

5. a) What is a Content Management System (CMS)? How is it different from a web application framework? [5]

   b) Describe the MVC (Model View Controller) architecture. [5]

6. a) What is the difference between the traditional Web (Web 1.0) and Web 2.0? [5]

   b) Briefly explain how AJAX request and response work. [5]

7. a) What is XML? What is the significance of XML in the Web? [5]

   b) What is RSS? Discuss possible ways of using RSS. [5]

8. Explain the Web services architecture. What are the roles of SOAP and WSDL? [7]

9. Briefly explain the main aspects of Semantic Web. [5]

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46D   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Bhadra

Exam.		Regular / Back.	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject *- Image Processing & Pattern Recognition (EG795CT) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt __All__ questions.*
✓ *The figures in the margin indicate __Full Marks__.*
✓ *Assume suitable data if necessary.*

1. a. Draw the block diagram of basic Image Processing and Pattern Recognition. [4]
   b. Explain different types of Image Operations. [4]

2. How can you derive the transform matrix for Hadamard Transform? Describe the method for determining sequence from natural order. [5+3]

3. Explain the following Image operations [2+3+3]
   a. Log Transform
   b. Contrast Stretching
   c. Bit Plane Slicing

4. a. Explain the steps for applying frequency domain filters in an image. [4]
   b. What are the differences between first order and second order derivative based filter? What is the different first order derivative based filters. [2+2]

5. What do you mean by histogram and normalized histogram? Explain the steps for histogram equalization. [2+1+5]

6. Derive the matrix for elliptical filter and write the algorithm to implement it. [6+2]

7. From the given histogram of an image construct the Huffman Code for each gray level, and calculate compression ratio and relative redundancy. [6+1+1]

Gray Level	0	1	2	3	4	5	6	7
Frequency	12	780	281	41	234	105	81	600

8. What do you mean by segmentation? Explain the region growing method for segmentation with algorithm. [2+6]

9. What do you mean by pattern recognition? Explain Nearest Neighbor and Correlation Based pattern recognition methods. [2+3+3]

10. a. What is neural network, how can you implement it in pattern recognition? [2+2]
    b. Describe delta learning rule for perceptron network. [4]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Image Processing and Pattern Recognition *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. a) What is digital image processing? Give some of the application areas of image processing. [3+5]

   b) Define discrete cosine transform and Haar transform. Mention the properties of Haar transform and its role in digital image processing. [3+3+2]

2. a) What is contrast stretching? Gray level histogram of an image represented in three bit system is given below. [2+6]

Gray Level	1	2	3	4	5	6	7
Frequency	0	40	75	100	125	60	0

   Stretch the contrast of the given image over the entire range.

   b) Explain how image averaging and directional smoothing reduce noise in a digital image? [4+4]

3. a) Define coding efficiency, average code word length and explain lossless predictive coding technique with block diagram. [2+2+4]

   b) What is image coding? Explain object moment and Fourier descriptors technique for image coding. [2+2+4]

4. a) What is Hopfield network? Explain the working principal of Hopfield network and mention the application of Neural Network in pattern Recognition. [2+4+2]

   b) "High frequency noise is emphasized by derivative filters" do you agree with this statement? What do you suggest to minimize this effect? Develop the window for Prewitt filter. Suggest the filter to determine line and spot in digital image. [8]

5. a) Define feature extraction. Explain Hough transform for line detection. [2+6]

   b) Mention the various features that should be satisfied by segmentation technique and describe the region splitting and merging technique for image segmentation. [3+5]

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Image Processing and Pattern Recognition *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Explain how digital image is formed in detail with required equations. (8)

2. Draw the point function of the following image function and explain what types of point processing has been applied to the image and its effect in the image. $g(L) = \sqrt{L}$ (8)

3. Derive the point function for the Histogram equalization and explain its importance? (8)

4. $p_A(l) = [0.1; 0; 0.3; 0.2; 0; 0; 0.3; 0.1]$ be probability of image A. Calculate a point function $g(l)$ such that $C(i; j) = g(A(i; j))$ has histogram equalized image . Assume all images have a total of 10 pixels. Calculate the histogram $h_C(l)$. (8)

5. Write the relationship between intensity probability of image and MSQE and Step out the algorithm of Llyod Max quantizer? (8)

6. Perform the convolution of following image sequence A and B.

$$A = \begin{matrix} 1 & 3 \\ 5 & 4 \end{matrix} \qquad B = 1 \quad 2 \quad 4$$

(8)

7. Write down the equation for the 2D impulse and fourier represenation of an image. Write the significance of each representation ? (8)

8. What do you understand by edge detection in image processing? Expalin the algorithm for detecting the edges in the image. (8)

9. What do you understand by perceptual image processing ? Explain the dither quantizer with the neccessary block diagram. (8)

10. Explain pattern recognition with necessary block diagram. Explain nearest mean classifier with necessary equations. (8)

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Image Processing and Pattern Recognition *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1.   (6+4)
   a)   What are sampling and quantization in image processing? Explain the image representation in the digital computer.
   b)   What are the applications of digital image processing? Explain.

2.   How can you perform the tinting in images? Write the algorithm for magnification (by replication or by interpolation) used in image processing.
                                                                         (4+6)

3.   What is histogram plot in image processing? Construct Huffman code for each gray level for the given frequency table obtained from the histogram of a 256 x 16 and 3 bits (8 level) image representation.   (2+8)

Gray level (p)	0	1	2	3	4	5	6	7
Number of occurrence of p	90	111	518	180	950	743	820	684

4.   How can you implement the Hadamard transform in image transformation? Explain with the help of example.   (10)

5.   How can you define the sharp edges in digital images? Derive the expression and digital coefficients for the laplacian 4-connected filter starting from second order differential equation.   (2+8)

6.   What is segmentation by threshold? Explain the working principle of dilation and erosion in binary images.   (4+6)

7.   Write the Adaline learning algorithm in artificial neural net. Explain with the help of suitable example   (5+5)

8.   Write a short notes on any two   (5x2)
   a.   Artificial neural network and its application in image processing
   b.   Different types of features in object recognition
   c.   Working principle of PNG compression technique
   d.   Contrast stretching and intensity level slicing in image enhancement techniques.

Exam.		Regular / Back	
Level	B.E.	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Image Processing and Pattern Recognition *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1) What is image processing? Explain the block diagram for image processing. (5+5)
2) Write the algorithms for averaging filter and median filter? What are the limitations of average filter? (4+4+2)
3) What is image coding and compression? What are the different types of redundancies in images? (4+6)
4) What is segmentation? Derive the mathematical expression and matrix for laplacian 4-connected filter starting from second order differential equation. (3+7)
5) What is thresholding in image processing? Explain different types of methods for finding the threshold value. (2+8)
6) What is dilation and erosion in image processing? Explain with suitable example. (10)
7) What is hadamard transform? Explain with suitable example. (10)
8) What is pattern recognition? Explain different recognition classification methods (4+6)

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Java Programming *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Describe the types of programming language. Explain each of their briefly.   [6]

2. Java generally refers to a combination of three things. What are they? Explain Java Virtual Machine (JVM).   [6]

3. What is Object Oriented Programming? Explain each of the following with examples.   [12]
   - Objects
   - Class
   - Super Class
   - Inheritance
   - Interface

4. What are the basic units in concurrent programming? Explain each of them.   [4]

5. What are the ways of starting a thread? Explain about Sleep and Interrupt in Threading.   [8]

6. Explain Thread Synchronization. Describe about Java monitors.   [4]

7. Explain checked and unchecked exceptions with examples.   [8]

8. Describe the following in Networking Library?   [10]
   - Socket
   - Server Socket
   - URL
   - URL Connection
   - Http URL Connection

9. Explain briefly about the features of the Java Foundation Classes.   [6]

10. Write a Simple Applet and show how it can be used in GUI.   [4]

11. What are Process and Threads?   [4]

12. Write a program such that it has   [8]
   - Encapsulation
   - Inheritance
   - Interface

***

Subject: - Java Programming *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Explain the following programming languages in brief: [6]

   a) Machine Language
   b) Assembly Language
   c) High-Level Language

2. Write a note on Object Oriented Programming highlighting an Object, Class, Super/Base Class and Inheritance.   [8]

3. With an appropriate example, show how a Base Class can be inherited from a child class and how the child can be accessed from other classes.   [6]

4. Differentiate between Abstract Class with Interface. Show how interface can be implemented in a class.   [6]

5. Why should we use package namespace in our class? With an example, explain in detail. What is API and how we can use it.   [6]

6. What is exception? Explain different types of exception with example.   [6]

7. What is swing and why is it used? Also, explain the features of Java Foundation Classes (JFC).   [8]

8. Explain Distributed Object Application. What are the advantages of Dynamic Code Loading?   [7]

9. What is Java Monitor? Explain any two kinds of thread synchronization that Java Monitors support.   [7]

10. Suppose you are working in a car manufacturing company. Write a program showing how can you manufacture different model of a car. Ref: As the basic structure of a car is same, the only difference would be looks, engine power etc.   [12]

11. What is serialization? With an appropriate example, explain object serialization in OOP.   [8]

***

Subject: - Agile Software Development Methodologies (Elective II)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. What is Agile Alliance? Explain its principles.

2. Explain how should an agile software development team look like?

3. Explain agile ways of getting feed back.

4. What is incremental design? How is it important?

5. Explain some rules that an agile developer needs to follow.

6. How does collaboration happen in agile projects?

7. Explain Extreme programming and its values.

8. Write short notes on:
   a) Continuous Integration
   b) Test Driven Development

***

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Agile Software Development Methodologies *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ __All__ questions carry equal marks.
✓ Assume suitable data if necessary.

1. Explain Agile Software Development Methodology. Compare ASDM with waterfall model.

2. What do you mean by Agile Manifesto? Explain its principles.

3. Discuss the importance of customer feedback in Agile Development.

4. What are the traits and qualities an agile developer should possess?

5. What is Test Driven Development? How does Acceptance Test help in test driven development?

6. What is refactoring? How is it done in ASDM?

7. What do you mean by Design Pattern? Explain any two of them.

8. What is XP? How are User Stories and Acceptance Tests used in XP?

9. Discuss the roles and responsibilities of an XP team.

10. Explain Unit Testing and its importance.

***

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Agile Methodologies *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. State the Agile Manifesto. How do values, principles and practices co-relate with each other? Explain in terms of Extreme Programming.

   Or

   Why do we need Agile Methodologies? Discuss its advantages over traditional approaches.

2. Explain the relationship between cost, time, scope and quality of software development. "Adding manpower late to a software project makes it later". Explain.

3. What are the limitations of Extreme Programming? When does Extreme Programming fail?

4. Discuss Test Driven Development as a Design Process. What are the major limitations of Test Driven Development?

5. Discuss the different roles and positions in an Agile Software Development environment.

6. "In Extreme programming, there is no design step, so there won't be any design." Defend against this statement with logical arguments.

   Or

   How does the planning game differ from tradition design phase? Simulate the Planning Game with user stories from a project you recently undertook

7. Explain Test Driven Development and discuss on the "Red, Green, Refactor" phases of Test Driven Development.

8. Write Short Notes on (any two):
   a. Stand Up Meetings
   b. Test Driven Development Styles
   c. Pair Programming

Subject: - Enterprise Application Design and Development
(Elective III) (CT78504)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What is an enterprise? What characterizes an enterprise application? [2+3]

2. a) What is a design pattern? What is its significance? [2+3]

   b) Describe the abstract factory pattern along with an example. [5]

3. Explain the benefits of using a multi-tiered architecture in application development. Briefly explain the functions of data, business, services and presentation layers in an application architecture. [5+5]

4. a) What is the significance of XML? Briefly explain how a DOM parser for XML works. [2+3]

   b) What is the use of XML Schema? What is the role of XSLT? [2 + 3]

5. What are the details encoded in a WSDL document? How is a RESTful web service different from a SOAP-based web service? [5+5]

6. Describe the different components and containers in Java EE architecture. Compare annotations and deployment descriptors in Java EE? [5 + 3]

7. What are message driven beans? Describe how they work in Java Messaging System. [2+5]

8. What is persistence context in Java Persistence API? How do you convert a POJO into an entity? [5+2]

9. Explain the JavaServer Faces (JSF) architecture for web application development. Describe the function of Expression Language in JSF. [5+3]

10. What is the significance of AJAX? Describe how AJAX works. [2+3]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Enterprise Application Design and Development *(Elective III) (CT78504)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. What is Java EE framework? How does it help to develop enterprise application in full scale? [1+6]

2. What is structural design patterns? Explain any two kinds of it in details. [1+3+3]

3. What is JDBC? Express your idea on JDBC framework. [1+5]

4. What is SOAP? Describe any 10 principles of SOA Architecture. [2+6]

5. What is Java EE Application Model? Explain different kinds of Java EE clients. [1+6]

6. What is Entity Bean? Explain the role of Interceptors in Java EE with neat diagram. [1+4]

7. Write briefly about any three: [3+3+3]
   a) JSTL
   b) EL
   c) JAXB
   d) JPA

8. What is servlet? Explain about JSP implicit objects. [1+4]

9. What is Web 2.0? What is JQuery? Explain at least 10 JQuery DOM manipulation methods. [2+1+3]

10. What is Ajax? Give the overview of Ajax in web application. [1+4]

11. What is 'DWR'? Explain in detail the Java Ajax Framework. [6]

12. Write short notes on: (any three) [3+3+3]
    a) <JSP: include> Vs <%Q include%>
    b) EJB3.0 Architecture
    c) Singleton Pattern
    d) Directives in JSP

***

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Enterprise Application Design and Development *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What do you understand by Software Architecture? Explain N-tier architecture with example. How is N-tier architecture different from layered architecture?   [2+3+1]

2. How are design patterns classified by GoF (Gang of four)? Explain any 2 GoF design patterns.   [3+4+4]

3. Explain JDBC architecture. What is a PreparedStatement? What are the uses of a PreparedStatement? How does a PreparedStatement prevent SQL attacks?   [3+1+3+2]

4. What do you understand by Service Oriented Architecture? Explain how it works.   [2+4]

5. How do Web Services work? Explain the structure of a SOAP message.   [4+2]

6. Explain the lifecycle of a JSP page. Explain briefly about the following implicit objects in JSP :   [4+4]
   a) Session
   b) Request

7. Write about types of Dependency Injection with sample code.   [5]

8. What is Web 2.0? Explain how Web 2.0 embraces architecture of participation.   [2+3]

9. Write briefly about any three of the following Java EE technologies: [3+3+3]
   a) JAX-RS (Java API for RESTFUL Web Services)
   b) JPA (Java Persistence API)
   c) EL (Expression Language)
   d) JSF (Java Sever Faces)
   e) Java Mail API

10. Write the difference between: [10]
   a) <jsp:include>action and <%@include > directive
   b) <jsp:include>action and <jsp:forward > action
   c) <% ! %> and <% % > in JSP
   d) CDATA and PCDATA
   e) Complex Type and simple Type in XML Schema

11. What is a Filter in Java EE? How does it work? Give an example with sample code.   [1+2+2]

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Enterprise Application Design and Development *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Explain MVC architecture with examples. Is MVC architecture same as a 3-tier architecture?   6 + 3

2. What do you mean by design pattern? Explain any 2 GoF design patterns.   2 + 8

3. Explain JDBC architecture. What is a Connection pool? Give some examples of Connection Pool.   3 + 3 + 3

4. What do you understand by Service Oriented Architecture? What are the entities of SOA?   2 + 6

5. When can we say an XML document is well-formed? Explain with examples.   8

6. Explain the lifecycle of a Servlet. Explain how an HTTP request is handled by a web server.   4 + 4

7. How do you inject dependency and where is dependency injection applicable? Explain with one example of OO programming.   6

8. How Web 2.0 is changing business model? What do you think are the key factors of Web 2.0?   4 + 4

9. What will be the effect of the following lines in JSP: 1 + 1

   a. <%!-- xx --%>

   b. <!-- xx --!>

10. Explain briefly about any two Java EE APIs.   6

11. How are Web Services discovered? Write about the key technologies involved.   6

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INSTITUTE OF ENGINEERING

Examination Control Division

2068 Baishakh

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Enterprise Application Design and Development *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. What do you understand by Software Architecture? Explain N-tier architecture with example. How is N-tier architecture different from layered architecture? [2 + 3 + 1]

2. What do you understand by Software Design Patterns? For each of these requirements identify one (or more) GoF pattern that can be use and briefly justify your choice: [2 + 6]
   You are required to enhance an existing banking software.
   The original software worked only with the SCT network now we need to make that accessible through the Visa Electron network as well. Visa Electron has provided with their API which has a different set of methods than that of the SCT network.
   - *Since both of the networks have to provide similar features, you note that the methods differ only in their names and how the parameters are passed. You need to interface to the new network with minimal changes to your business logic, if possible just a wrapper over the SCT interface.*
   - *There is a* UserDetails *object that needs to be created for each user who logs in. You note that building this object is a complicated process with 6 distinct steps - each step requiring connecting with different servers and complex business logic thereafter. The logic is different for SCT and Visa networks. You need to centralize this object building process so that it is easier to test and reuse.*
   - *Visa Electron network has a feature of caching current balance so as to minimize the need to communicate with the central server every time. But if the balance changes the cache must be updated / invalidated. Polling of the central server is not feasible. You need to implement this some other way.*

3. Explain JDBC architecture. What is a PreparedStatement? What are the uses of a PreparedStatement? How does a PreparedStatement prevent SQL attacks? [3 + 1 + 3 + 2]

4. What is XML? Write down basic rules of XML. [2 + 4]

5. How do Web Services work? Explain the structure of a SOAP message. [4 + 2]

6. What do you understand by Session? How session is managed by Servlet container? What are the advantages of JSP over Servlet? [2 + 3 + 3]

7. Write about types of Dependency Injection with sample code. [6]

8. What do you understand by Web 2.0? How do Web 2.0 applications differ from traditional web applications? [2 + 3]

9. Write briefly about any three of the following Java EE technologies: [3 + 3 + 3]
    a. JAX-RS (Java API for RESTful Web Services)
    b. JPA (Java Persistence API)
    c. EL (Expression Language)
    d. JSF (Java Sever Faces)
    e. Java Mail API

10. Write the difference between: [12]
    a. <jsp:include> action and <%@ include > directive
    b. <jsp:include> action and <jsp:forward> action
    c. <%   %> and <jsp:scriptlet> </jsp:scriptlet>
    d. <%!   %> and <%   %> in JSP
    e. complexType and simpleType in XML Schema
    f. <sequence> and <all> in XML Schema

11. What is a Filter in Java EE? How does it work? Give an example with sample code. [1 + 2 + 2]

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Exam.		**Regular / Back**	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Speech Processing *(Elective III) (CT78508)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Describe in detail the mechanism of human speech production with a neat [12] diagram by highlighting the major components for speech production.

2. Prove that ZCR can be used for frequency estimation. Also, justify that [6+6] ZCR is independent of sampling frequency. Support your mathematical explanations by giving some examples.

3. Write an equation for STFT of speech signals? How can you relate it [2+10] spectrogram and also explain about time/frequency resolution.

4. Describe in detail about LPC parameters estimation for LPC parameters [12] estimation using Covariance method.

5. Write an algorithm for Dynamic time warping. Describe how·this method [3+9] can be applied to speech recognition. Compare this algorithm with other methods of speech recognition.

6. Write short notes on: [5*4]
   a) Masking
   b) Effect of windowing for short time energy and autocorrelation.
   c) Channel vocoder.
   d) Voice excited linear predictors (VELP).
   e) Natural language Processing.

***

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Photovoltaic Technology *(Elective II) (EX76502)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain the term irradiance, solar constant, direct, diffuse and reflected radiation. Highlight the importance of insolation and peak sun in the solar application. [4+4]

2. Solar PV cell is basically a junction diode. Explain how the solar cell converts the solar radiation to the electrical power along with the characteristics curve and equivalent circuit. [8]

3. Compare the solar cells with crystalline silicon technology with the modern thin film technology. Write down the different thin film technologies currently used. [6]

4. Explain the need and types of DC-DC converter in Solar Photovoltaic system. Write down the different topologies of inverter connection . [6+2]

5. Explain the term Fill factor and MPPT used in solar PV technology. [2+2]

6. What are the issues that should be address in the grid tied solar PV system and briefly explain any one of it. Write down the need for the standard that has been developed for the grid connection of solar PV. [6+4]

7. There is a need to run a research lab in a remote area with the following equipments

S.N	Load Specification	Number	Watt	Usage(Hrs) per day	Remarks
1	Gas Analyzer	1	75	4	
2	Electronic Microscope	1	25	2	
3	Radio Communication Equipment	2	2 in standby and 30 in operation	2 in Operation and 10 in standby	
4	Electric Oven	1	150	1	
5	Bomb calorimeter	1	75	2	
6	Refrigerator	1	100	2	
7	Electric Sterilizer	1	1000	0.5	
8	Fan	6	50	7	Only on 4 summer months
9	Centrifugal Water pump	1	1 hp	4	
10	Computer (Laptop)	2	65	5	
11	Others (In aggregate)	Consuming Total energy of 500 kwhr and total power rating of 270 W			

Calculate the sizes of array, battery bank, inverter and charge regulator. Estimate the cost of your solar PV system. [20]

8. Briefly explain the environmental and health issues concerned with solar Photovoltaic electric system. Highlight the potential use of PV in the socioeconomic development of Nepal. [3+5]

9. Write Short notes on: (Any two) [4+4]

   A. Batteries in Solar PV

   B. Solar UPS

   C. Instruments in measuring Solar irradiation

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Exam.		Regular / Back ●	
Level.	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Satellite Communication *(EG786EX) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt _All_ questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Why satellite spacing is required in SATCOM? How number of satellite can be increased in GEO orbit obeying CCIR recommendation? Give examples.   [2+5]

2. Define Scintillation. Give reasonable suggestion to reduce the effect of Ionosphere and Troposphere in SATCOM.   [2+4]

3. Describe a typical earth station using FDM/FM/FDMA with a neat diagram.   [7]

4. What are features of Maritime Satellite Communication? With a neat diagram, describe frequency band used in INMARSAT.   [3+3]

5. What do you mean by DTH system? Describe Transmitting section of a DTH system in detail with a neat diagram.   [1+6]

6. Why we need a LNA? Compare the characteristics of different type of LNA used in Earth station.   [1+5]

7. How we can guarantee the satellite is visible from earth station. Justify mathematically.   [4]

8. A satellite is in a 520-km high circular orbit. Determine i) orbital angular velocity in rad/sec ii) orbital period in minutes iii) orbital velocity in m/s. assume mean earth radius 6378.137 km and keppler's constant 3.986004418×10^5 km^3/s^2 [6]

9. Calculate the slant range of non-GEO satellite 12000 km above earth surface located at 19°E longitude from earth station at 23.5°N latitude and 5°W longitude. Also find the elevation angle and suggest suitable frequency band to operate it.   [3+4]

10. A GEO stationary satellite having saturated transponder output is 90 watt, 30 dB antenna gain and 1dB output backoff is 39500 km from the earth station having receiving facilities as C/N equals 18.9 dB, antenna efficiency 75%, system noise temperature 240°k, channel bandwidth 45 MHz. What would be the diameter of ES antenna to provide proper communication from satellite operated at 13 GHz. Consider -2dB contour loss of satellite transmitting antenna and 0.9 dB other miscellaneous loss.   [12]

11. Write short notes on(any three)   [4*3]
    a. Life of Satellite
    b. Satellite stabilization
    c. History of Satellite Development
    d. DSI
    e. Application of VSAT/USAT

***

Exam.	Regular / Back ●		
Level .	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Satellite Communication *(EG785EX) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Why satellite spacing is required in SATCOM? How number of satellite can be increased in GEO orbit obeying CCIR recommendation? Give examples.   [2+5]
2. Define Scintillation. Give reasonable suggestion to reduce the effect of Ionosphere and Troposphere in SATCOM.   [2+4]
3. Describe a typical earth station using FDM/FM/FDMA with a neat diagram.   [7]

4. What are features of Maritime Satellite Communication? With a neat diagram, describe frequency band used in INMARSAT.   [3+3]
5. What do you mean by DTH system? Describe Transmitting section of a DTH system in detail with a neat diagram.   [1+6]
6. Why we need a LNA? Compare the characteristics of different type of LNA used in Earth station.   [1+5]
7. How we can guarantee the satellite is visible from earth station. Justify mathematically.   [4]
8. A satellite is in a 520-km high circular orbit. Determine i) orbital angular velocity in rad/sec ii)orbital period in minutes iii)orbital velocity in m/s. assume mean earth radius 6378.137 km and keppler's constant 3.986004418×10^5 km^3/s^2 [6]
9. Calculate the slant range of non-GEO satellite 12000 km above earth surface located at 19°E longitude from earth station at 23.5°N latitude and 5°W longitude. Also find the elevation angle and suggest suitable frequency band to operate it.   [3+4]
10. A GEO stationary satellite having saturated transponder output is 90 watt, 30 dB antenna gain and 1dB output backoff is 39500 km from the earth station having receiving facilities as C/N equals 18.9 dB, antenna efficiency 75%, system noise temperature 240°k, channel bandwidth 45 MHz. What would be the diameter of ES antenna to provide proper communication from satellite operated at 13 GHz. Consider -2dB contour loss of satellite transmitting antenna and 0.9 dB other miscellaneous loss.   [12]

11. Write short notes on(any three)   [4*3]
    a. Life of Satellite
    b. Satellite stabilization
    c. History of Satellite Development
    d. DSI
    e. Application of VSAT/USAT

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Satellite Communications (Elective I)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Discuss the characteristic of GEO satellite and compare its performance with other satellite? [4]

2. Is satellite spacing required in SATCOM? How number of satellites can be increased in same orbit? [2+4]

3. Why we need Digital SATCOM? Mention SCPC can be utilized in different manner for better performance of SATCOM. [7]

4. Describe a typical earth station using FDM/FM/FDMA with a neat diagram. [8]

5. What do you mean by DTH system? Describe Receiving section of a DTH system in detail with a neat diagram. [2+6]

6. A satellite is in a 440-km high circular orbit. Determine i) orbital angular velocity in rad/sec ii)orbital period in minutes iii)orbital velocity in m/s. assume mean earth radius 6378.137 km and keppler's constant 3.986004418×10^5 km^3/s^2 [6]

7. Describe different type of antennas used in SATCOM. Compare the performance of type of automatic-antenna tracking techniques. [3+7]

8. A GEO stationary satellite located at 2°W longitude with C/N equals 29 dB communicate with earth station co-ordinate 12.7°E longitude and 36.8°S latitude having ES facilities as receiving antenna diameter 7m,antenna efficiency 88%, system noise temperature 500°k as well as it is assumed various atmospheric loss is 20dB. Satellite antenna gain is 33 dB with channel bandwidth of 44MHz. Calculate the ES transmitter power required to make up-link communication operated at 14 GHz [16]

9. Write short notes on(any three) [5x3]
   a. Frequency band in SATCOM
   b. LNA
   c. Stabilization in satellite
   d. Application of VSAT/USAT
   e. INMARSAT

***

Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Satellite Communication *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Why Telemetry, Tracking and Command is used in SATCOM? Describe in detail with its types. [2+6]

2. Describe different type of interferences between satellite systems. [8]

3. A Quasi-GEO satellite is in a circular equatorial orbit close to geosynchronous orbit and its orbital period is of 23 hr 54 minute. Calculate i) the radius of the orbit ii) rate of the drift around the equator of subsatellite point in degrees per day iii) An observer on the earth sees that the satellite is drifting across the sky. Is the satellite moving toward the East or toward the West? [7]

4. An earth station antenna has a diameter of 30 m, has an overall efficiency 70%, and is used to receive at 6 GHz. At this frequency, the system noise temperature is 69°K when the antenna points at the satellite at an elevation angle of 45°. What is the earth station G/T ratio under these conditions? If heavy rain causes the sky temperature to increase so that the system noise temperature rises to 88°K, what is new G/T value? [7]

5. A Geo-Stationary satellite located at 115°E longitude. If the earth station A (ESA)and earth station B (ESB) having 67°N, 99.6°E and 25.6°S, 125.6°E coordinate respectively wants to access the given satellite. What would be the look angles for the earth stations to the satellite? [7]

6. A satellite located at 174.8°E longitude. The ES located at coordinate 66.8°E and 25.4°N having ES facilities as diameter of receiving antenna is 9.4m, antenna efficiency 70%, system noise temperature is considered 295°K. What will be the value of EIRP of ES to establish the uplink data communication for 12 GHz signal if transmitter power is 60 watt and waveguide loss is 3.5 dB? [12]

7. Discuss different type of facilities required at earth station. Briefly classify the type of earth station. [4+4]

8. What we need stabilization in SATCOM? Compare the performance of different kind of stabilization. [2+6]

9. Write short notes on (any three) [3x5]
   a) Water cooling circuit of HPA
   b) FDM-FM-FDMA
   c) Feature & configuration of INMARSAT
   d) INTELSAT SCPC
   e) Properties of GEO orbit

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Satellite Communications *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain the brief history of the development of the satellite communications? Discuss on the merits and demerits of GEO satellite communications system. [4 + 6]

2. Explain why the up-converter and down-converter are the most essential to have in an Earth station (ES). Discuss on working principle of an ES system with neat block diagram. [4 + 6]

3. A geostationary satellite located at 16.0^0 W longitude. What would be the distance between the given satellite and the Earth station and Determine the look angles for the Earth station having 48.6^0S latitude and 12.4^0 E longitude? [4 + 10]

4. What is the main role of transponder in satellite? Describe the operation of C-band single conversion (Bent-pipe) type satellite transponder with neat diagram. [4 ÷ 7]

5. Assume that an INTELSAT satellite located at 176.0^0 E longitudes with the saturated EIRP equals 48 dBW as per given footprint to the Earth station (ES). The ES's coordinates are 166.4^0 E longitude and 26.8^0 N latitude having ES facilities as diameter of receiving antenna is 9.2 m; antenna efficiency, 72%; system noise temperature is considered 310^0 K as well as if it is considered various atmospheric losses is 24 dB. What would be the value of satellite input backoff (BO_i)? If input backoff is 3 dB greater than output backoff (BO_o). Whereas carrier power-to-noise density power ratio of ES is 78.2 dBHz to establish the downlink data communication for C–band.
[Boltmann's Constant, k = 1.381×10^{-23} J/^{0}K] [13]

6. Find out the elevation angle (El) following below: [10]
$$El = Tan^{-1}[(6.611 - Cos\, \varphi) / \sqrt{(1 - Cos^2\, \varphi)}] - \varphi$$
    Where,
$$\varphi = Cos^{-1}[Cos (L_{diff}) Cos (l_{diff})]$$
        L = Longitude
        L = Latitude

7. Write short notes (Any THREE): [4 x 3]
    a) TWTA
    b) Faraday rotation
    c) Satellite's life
    d) TDMA frame
    e) Satellite frequency spectrum

Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Satellite Communications *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain that the satellite communications is one of the superior type communications in the world? List out the merits of non-GEO satellite communications and applications of this type of satellites. [4 + 4 + 3]

2. A satellite is orbiting on the circular orbit of 650 Km above the Earth surface and having 370 Kg while it is in its orbit. What would be the orbital period and the weight while on the Earth surface? And find out the change in velocity if the altitude of the satellite decreases to 550 Km. While the mass of the Earth (M_E) = 5.975 x 10^{24} Kg and the gravity constant (G) = 6.67 x 10^{-11} Nm^2/Kg^2. [5+5+5]

3. What is antenna tracking? How many their kinds? Describe the working principle of simultaneous lobing tracking system with necessary diagrams. [2–1+6]

4. Why the satellite transponder is also called bent pipe? Sketch the simplified double conversion transponder for 14/12 GHz band and explain its operation. [3 – 6]

5. Prove the following elevation angle (El) equation: [10]

$$Tan (El - \varphi) = [(6.611 - Cos\ \varphi)/ Sin\ \varphi]$$

Where,

$\varphi = Cos^{-1} [Cos (L_{SAT} - L_{ES}) Cos(l_{ES})]$
L_{SAT} = longitude of satellite
L_{ES} = longitude of Earth station
l_{ES} = latitude of Earth station

6. A GEO satellite located at 64^0 E longitudes with the saturated EIRP equals 44 dBW as per given footprint to the Earth station (ES) which is located at 82.6^0 E longitude and 26.8^0 N latitude having ES facilities as diameter of receiving antenna is 8.5 m: antenna efficiency, 75%: system noise temperature is considered 320^0 K as well as if it is assumed various atmospheric losses is 24dB. What would be the value of required power flux density (PFD $_{Req}$) for the satellite input? If input backoff (BO$_i$) is generally 3 dB greater than output backoff (BO$_o$). Whereas the saturated power flux density (PFD) of satellite is − 84.32 dBw m^2 given and the carrier power-to-noise density power ratio of ES is 74.8 dBHz for downlink data communication for C-band. (Boltmann's Constant, k = 1.381 X 10^{-23} J/^{0}K) [14]

7. Write shorts notes (Any THREE): [3 x 4]
   i) TWTA
   ii) Aperture antenna
   iii) Ionospheric scintillation
   iv) Digital speech interpolation
   v) Maritime satellite communications

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INSTITUTE OF ENGINEERING

Examination Control Division

2064 Poush

Exam.		Regular/Back	
Level	BE	**Full Marks**	80
Programme	BEX, BCT	**Pass Marks**	32
Year / Part	IV / II	**Time**	3 hrs.

Subject: - Satellite Communications *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *__All__* questions.
✓ The figures in the margin indicate *__Full Marks__*.
✓ Assume suitable data if necessary.

1. Explain that the satellite communications is one of the superior type communications in the world? List out the merits of non-GEO satellite communications and applications of this type of satellites. [4 + 4 + 3]

2. A satellite is orbiting on the circular orbit of 650 Km above the Earth surface and having 370 Kg while it is in its orbit. What would be the orbital period and the weight while on the Earth surface? And find out the change in velocity if the altitude of the satellite decreases to 550 Km. While the mass of the Earth (M_E) = 5.975 x 10^{24} Kg and the gravity constant (G) = 6.67 x 10^{-11} Nm^2/Kg^2. [5+5+5]

3. What is antenna tracking? How many their kinds? Describe the working principle of simultaneous lobing tracking system with necessary diagrams. [2+1+6]

4. Why the satellite transponder is also called bent pipe? Sketch the simplified double conversion transponder for 14/12 GHz band and explain its operation. [3 + 6]

5. Prove the following elevation angle (El) equation: [10]
$$Tan (El + \varphi) = [(6.611 – Cos\ \varphi)/ Sin\ \varphi]$$
   Where,
   φ = Cos^{-1} [Cos $(L_{SAT} –L_{ES})$ Cos(l_{ES})]
   L_{SAT} = longitude of satellite
   L_{ES} = longitude of Earth station
   l_{ES} = latitude of Earth station

6. A GEO satellite located at 64^0 E longitudes with the saturated EIRP equals 44 dBW as per given footprint to the Earth station (ES) which is located at 82.6^0 E longitude and 26.8^0 N latitude having ES facilities as diameter of receiving antenna is 8.5 m; antenna efficiency, 75%; system noise temperature is considered 320^0 K as well as if it is assumed various atmospheric losses is 24dB. What would be the value of required power flux density (PFD $_{Reqd'}$) for the satellite input? If input backoff (BO_i) is generally 3 dB greater than output backoff (BO_o). Whereas the saturated power flux density (PFD) of satellite is – 84.32 dBw/m^2 given and the carrier power-to-noise density power ratio of ES is 74.8 dBHz for downlink data communication for C-band. (Boltmann's Constant, k = 1.381 x 10^{-23} $J/^0K$) [14]

7. Write shorts notes (Any THREE): [3 x 4]
   i) TWTA
   ii) Aperture antenna
   iii) Ionospheric scintillation
   iv) Digital speech interpolation
   v) Maritime satellite communications

Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Satellite Communications (Elective)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What is multiple access? How does TDMA work? Explain clearly with necessary diagrams and list out the advent of TDMA system. [2 + 3 + 3]

2. Geostationary satellite "Thaicom 3" located at 78.5^0 E longitude circular orbit operating in both C and Ku band. What would be the orbital period of it and look angles for the Earth station (ES) which is located at 88.6^0 E longitude and 26.4^0 N latitude. While the mass of the Earth $(M_E) = 5.975 \times 10^{24}$ Kg and the gravity constant $(G) = 6.67 \times 10^{-11}$ Nm^2/Kg^2. [4 + 8]

3. What is INTELSAT system and how does it form? Define the main characteristics of satellite communication system and list at least eight applications of satellite communications. [3 + 4 + 4]

4. A geostationary satellite located at 87.5^0 E longitude operating at extended C-band of 6775-6995 MHz uplink frequency and 4530-4770 MHz downlink frequency. As given satellite transponder parameter details:
    i) Saturated EIRP within EOC equals 36 dBW
    ii) Figure of merit (G/T) = -5dB/^{0}K
    iii) Saturated power flux density (PFD) = -82 dBw/m^2
    iv) Input backoff (BOi) = Output backoff (BOo) + 3 dB
    v) C/N_0 margin = 3 dB

    An earth station (ES) having coordinates of 80.6^0 E and 28.6^0 N that located within satellite's footprint EOC. The ES communication facilities as antenna diameter (Ø) is 2.4 m with 52 % antenna efficiency, system noise temperature (T) equals 280^0K and waveguide loss ($L_{w/g}$) is 1.2 dB considered. Find out the required power flux density ($PFD_{Req'd}$) for 2048 Kbps data transmission that can satisfy the downlink satellite communication for the given ES? If the bit error rate (BER) 10^{-6} to 10^{-7} for 2048 Kbps is assumed. [16]

5. Find the following equation of slant range (R) [10]

$$R = \sqrt{(1 + 0.42(1 - \cos\Phi)}.h$$

    Where,
    h is altitude of GEO satellite
    cos Φ is the product of cos (longitude diff.) and cos (latitude diff).

6. Which types of antennas being used in satellite communications? Define aperture antenna parameters with required sketches and formulas. [4 + 7]

7. Define the following terms (Any THREE): [3 × 4]
    a) Albedo
    b) PDMA
    c) Sun Interference
    d) Poincare's Sphere
    e) Maritime SATCOM

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Remote Sensing *(Elective III) (CT78501)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ **Necessary figure is attached herewith.**
✓ Assume suitable data if necessary.

1. Define a remote sensing. Describe the general remote sensing process with neat and well labeled diagram.   3+7

2. Explain briefly about how ultraviolet, visible, Infrared and microwave region are used for remote sensing process.   7

3. Explain different mechanisms of interaction of radiation from energy source with the atmosphere in remote sensing.   8

4. Describe the basics of airborne and space borne sensing with examples.   5

5. What is a RADAR? Explain its applications. Derive maximum radar range equation.   2+3+5

6. Describe any one remote sensing application by highlighting its applications, merits and sensing technology.   10

7. What is a Geographic Information System? Explain its benefits.   2+3

8. Describe the major representing characteristics of remote sensing images, and the general criterion of the image interpretation. Observe the attached image (Figure 1) and discuss it based on sensing principles and the elements of image interpretation.   3+3+4

9. Write short notes on: 3x5=15
   a. Radiation – Target Interaction
   b. Geo-stationary orbit
   c. Remote sensing of Himalayan region

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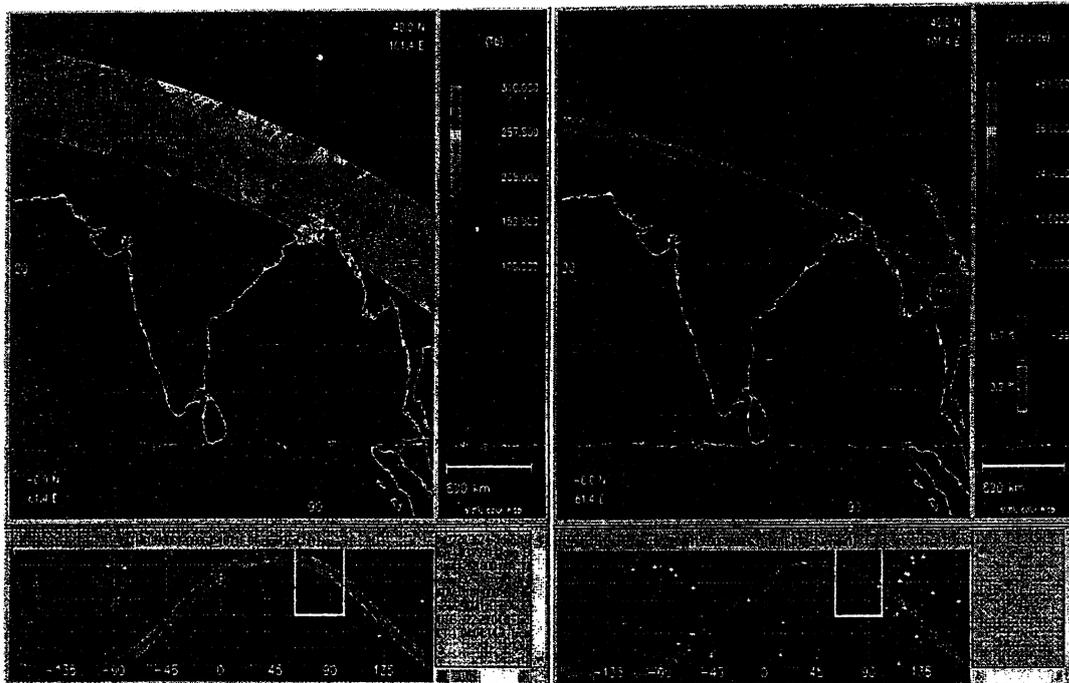
Figure 1. (a) (Left) (Bottom panel) An image projecting the orbital coverage over the globe by a passive sensor (operating at microwave-band) onboard TRMM satellite. (Top panel) Zoomed version of the image indicated by the square at the bottom panel. (b). (Right) same as (a) but for visible band.

INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Remote Sensing *(Elective III) (CT78501)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ **Necessary figure is attached herewith.**
✓ Assume suitable data if necessary.

1. Define remote sensing and describe its advantages and classes in different aspects. [3+3+4]

2. Describe in brief about the electromagnetic spectrums that are used for remote sensing process. [7]

3. Explain in detail about the mechanisms of interaction of radiation from energy source with the atmosphere in remote sensing. [8]

4. Describe the basics of passive and active remote sensing with examples. Explain briefly about visible and infrared technique of passive remote sensing. [5+5]

5. Derive an expression for maximum range of a radar system suitable for a point target. [5]

6. With a suitable example describe one of remote sensing applications and highlight its technological and application merits. [10]

7. What is a Geographic Information System? Briefly explain its benefits. [2+3]

8. Describe the major representing characteristics of remote sensing images, and the general criterion of the image interpretation. Observe the attached image and discuss it. [3+3+4]

9. Write short notes on: [3x5]
   a. Radiation – Target Interaction
   b. Geo-stationary orbit
   c. Remote sensing of Himalayan landscape: scopes and limitations

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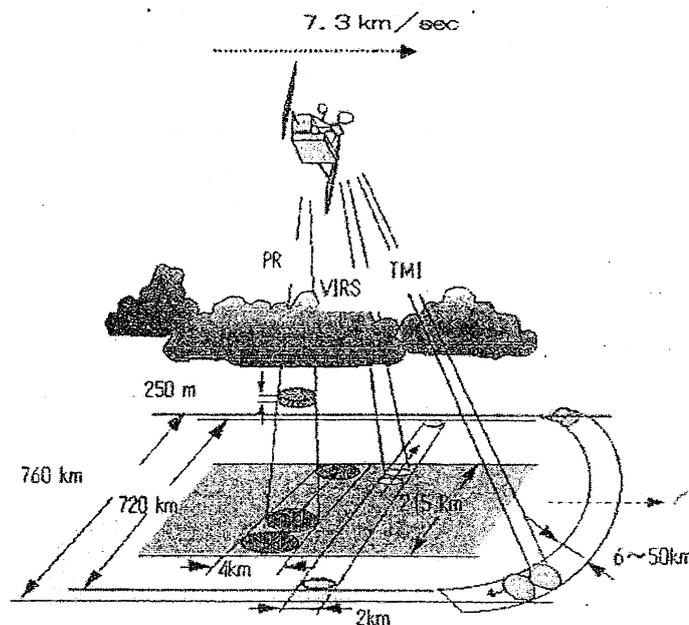
Figure 1. A illustration showing an observation geometry of a set of sensors (PR: precipitation radar, TMI: TRMM microwave imager and VIRS: visible and infrared imager) onboard a satellite called Tropical Rainfall Measuring Mission (TRMM). The satellite revolves along a non-sunsynchronous orbit at the height of 350 km above the Earth surface. The inclination angle and the orbital period are 35° and 90 minutes, respectively.

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Radar Technology (EG785EX) (Elective II)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) Explain the working principle of continuous wave radar with the help of a block diagram. Find the value of radiation factors if G_p = 70 dB and G_D =90 dB. [5+1]

   b) With the help of a block diagram, explain the working principle of MTI Radar with power oscillator. Calculate the relative velocity of an aircraft and the frequency of received eco for the radar transmitting frequency of 1000 MHz. Given θ = 60°, v = 300m/s. [8+2]

2. a) What do you understand by parabolic reflector antenna? Explain the detection of moving target in MTI radar by using 'A' scope. [2+4]

   b) What is the difference between tracking radar and search radar? Explain the functioning of a delay-line canceler with the help of a block diagram. Calculate the PRT of the radar having transmitted frequency of 8 GHz and the blind speed of an aircraft is 150m/s. Given, n = 8. [2+6+2]

3. a) What are the types of radar modulator? Explain the functioning of magnetron with the help of a diagram. Calculate the range of tracking radar when time taken by signal is 60μs. [2+4+1]

   b) What do you understand by receiver noise? Explain the working principle of Klystron amplifier with the help of a diagram. Calculate the bandwidth of the radar receiver generating thermal noise power of $8*10^{-18}$W at a temperature of 290°K. [2+6+1]

4. a) Draw the radiation pattern of the parabolic reflector antenna. Name the types of duplexers used in Radar. Explain the functioning of balanced mixer with the help of a diagram. [1+1+6]

   b) What do you understand by blind speed? Explain the basic types of radar CRT display. Calculate the duty cycle and transmitted peak power of the surveillance radar having PRF of 600 Hz, pulse width 0.8 μs and average power of 2kW. [2+3+3]

5. a) What is the difference between the primary and secondary radar. Explain the role of AFC in radar receiver with the help of a simple block diagram. Calculate the range from secondary surveillance radar to aircraft when time taken by pulse is 80μs. [1+4+1]

   b) What are the types of Air surveillance radar? Explain the working principle of ASR and SSR with the help of block diagram. [2+8]

6. Write short notes on: (any four) [4×4]

   a) PRF and PRT
   b) Radar resolution
   c) Radar application
   d) Cassegrain antenna
   e) Doppler effect

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Radar Technology *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) What is the difference between PRF and PRT? Derive the simple radar range equation and also give the physical significances of that equation.   [2+6+2]

   b) Why do we need a duplexer? Calculate the relative velocity of the aircraft and the frequency of the received echo for the radar is transmitting at 8.9 GHz. Given, $\theta = 30°$, $V = 200$ m/s.   [2+2+2]

2. a) What do you mean by blind speed? Explain the working principle of a CW radar with the help of a block diagram and also list out some radar applications.   [2+5+2]

   b) What is the basic purpose of delay-line cancelers? Explain the 'butterfly' effect and also list out some CW radar applications. Calculate the radar range when the time taken by the pulse to travel to the target and return is 30μs.   [1+3+1+2]

3. a) What is MTI radar? Explain the working principle of MOPA with the help of a block diagram.   [1+8]

   b) Explain the working principle of a line type modulator with the help of a schematic diagram. Find the blind speed of an aircraft for the radar is transmitting at 8.2 GHz. Given, PRF = 5000 Hz, n = 8.   [5+2]

4. a) What is tracking radar? Explain the functioning of a balanced mixer with the help of a diagram.   [1+5]

   b) What do you understand by directive gain and power gain of the antenna? Explain the working principle of branch type duplexer with the help a diagram. Calculate the distance from SSR to the A/C, when one way time taken by pulse to travel to the A/C is 60μs.   [2+6+2]

5. a) What are the basic types of CRT displays? Explain working principle of Klystron amplifier with the help of a diagram.   [2+6]

   b) What are the types of ATC radars? Explain the working principle of ASR and SSR with the help of diagrams.   [2+6]

6. Write short notes on any four of the following: [4×4]

   a) Receiver Noise
   b) Fan Beam and Pencil Beam
   c) Magnetron
   d) AFC
   e) Parabolic Reflector Antenna

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TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2064 Jestha

Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Radar Technology *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ The figures in the margin indicate **Full Marks.**
✓ Assume suitable data if necessary.

1. a) What is the difference between PRF and PRT? Derive the simple radar range equation and also give the physical significances of that equation. [2+6+2]

   b) Why do we need a duplexer? Calculate the relative velocity of the aircraft and the frequency of the received echo for the radar is transmitting at 8.9 GHz. Given, $\theta = 30°$, $V = 200$ m/s. [2+2+2]

2. a) What do you mean by blind speed? Explain the working principle of a CW radar with the help of a block diagram and also list out some radar applications. [2+5+2]

   b) What is the basic purpose of delay-line cancelers? Explain the 'butterfly' effect and also list out some CW radar applications. Calculate the radar range when the time taken by the pulse to travel to the target and return is 30μs. [1+3+1+2]

3. a) What is MTI radar? Explain the working principle of MOPA with the help of a block diagram. [1+8]

   b) Explain the working principle of a line type modulator with the help of a schematic diagram. Find the blind speed of an aircraft for the radar is transmitting at 8.2 GHz. Given, PRF = 5000 Hz, n = 8. [5+2]

4. a) What is tracking radar? Explain the functioning of a balanced mixer with the help of a diagram. [1+5]

   b) What do you understand by directive gain and power gain of the antenna? Explain the working principle of branch type duplexer with the help a diagram. Calculate the distance from SSR to the A/C, when one way time taken by pulse to travel to the A/C is 60μs. [2+6+2]

5. a) What are the basic types of CRT displays? Explain working principle of Klystron amplifier with the help of a diagram. [2+6]

   b) What are the types of ATC radars? Explain the working principle of ASR and SSR with the help of diagrams. [2+6]

6. Write short notes on any four of the following: [4×4]

   a) Receiver Noise
   b) Fan Beam and Pencil Beam
   c) Magnetron
   d) AFC
   e) Parabolic Reflector Antenna

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Subject: - Radar Technology *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) What is a duplexer? Derive the fundamental radar range equation and also give the physical significances of that equation. [1+6+2]

   b) Explain the functioning of a delay-line cancelers with the help of a block diagram. Calculate the radar range when the time taken by the signal to travel to the aircraft and return is 60 μs. [5+2]

2. a) What is sidelobe radiation? Explain the working principle of MOPA with the help of a block diagram. [1+8]

   b) What is CW radar? List out some radar and CW radar application. Calculate the relative velocity of the aircraft and frequency of the received echo for the radar is transmitting at 10 GHz. Given, θ = 60°, V = 400 m/s. [1+3+3]

3. a) What is the difference between a tracking radar and search radar? Explain the working principle of line type modulator with the help of a schematic diagram. [1+6]

   b) What are the types of modulator? Explain the functioning of balance mixer with the help of a diagram. Find the blind speed of an aircraft for the radar is transmitting at 8 GHz. Given, PRF = 8000 Hz, n = 8. [2+4+3]

4. a) What do you understand by Cassegrain antenna? Explain the functioning of magnetron with the help of a diagram. [2+4]

   b) What do you understand by receiver noise? Explain the working principle of Klystron amplifier with the help of a diagram. Calculate the distance from SSR to A/C when one way time taken by pulse to travel to the A/C is 50 μs. [2+6+2]

5. a) What do you understand by intensity-modulated CRT display? Explain the working principle of a branch type duplexer with the help of a diagram. [2+5]

   b) What are the differences between ASR and ARSR? Explain the working principle of ASR and SSR with the help of block diagrams. [3+6]

6. Write short notes on any four of the followings. [4×4]

   a) 'Butterfly' Effect
   b) Blind Speed
   c) Antenna Gain
   d) PRF and PRT
   e) Doppler Effect

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45G   TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Bhadra

Exam.		Regular	
Level	BE	**Full Marks**	80
Programme	BEX	**Pass Marks**	32
Year / Part	IV / II	**Time**	3 hrs.

Subject: - Broadcast Engineering *(Elective II) (EX76503)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. a) What is a sound? What are its different characteristics? List and briefly explain them.

    b) State the speed, frequency and wavelength relation in propagation of sound. What do you understand by Spectrum level? State the unit.

2. a) Draw the block diagram of a typical Radio Production studio. And explain the equipments used for the purpose.

    b) What is a remote broadcasting? List and explain briefly different Contribution links normally used for Radio and TV Broadcasting.

3. a) What are sub carriers? Explain the significance of these subcarriers in FM and TV broadcasting?

    b) Draw a neat block diagram of the transmitter site facilities used in TV broadcasting and discuss briefly each block.

4. a) Draw a block diagram of Cable TV distribution system. Label the signal level required at different points on the distribution chain while carrying the signal up to the subscriber's premises.

    b) What are different Cable TV source signals used? Write briefly about the processing of such signals and frequency bands allocated for Cable TV.

5. a) Draw the block diagram of generation of a DAB signal at transmitter and briefly explain it.

    b) What is a scanning? Briefly describe how the scanning occurs in TV cameras and also define Luminance, Chrominance, horizontal and vertical blanking intervales.

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Exam.	Regular / Back •		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Broadcast Engineering *(EG785EX) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt any **Five** questions.*
✓ ***All** questions carry equal marks.*
✓ *Assume suitable data if necessary.*

1. a) What is sound? List and briefly explain different characteristics of sound.

   b) State the speed, frequency and wavelength relation in propagation of sound. What do you understand by Spectrum level? Write the formula for it with the unit for each symbol used.

2. a) Write the block diagram of a typical TV camera and illustrate how color video signal is formed in it?

   b) List the difference between NTSC, PAL and SECAM color TV systems deployed in Analog TV transmission.

3. a) Draw the neat block diagram of a TV Broadcast Air Chain. Describe each component in the chain.

   b) Describe different Tape formats and Tape machines that are used in the Radio and TV industry.

4. a) What are sub carriers? Why are they used in FM and TV broadcasting?

   b) Discuss briefly about the transmitter site facilities used in Radio broadcasting with a neat block diagram.

5. a) Draw a neat block diagram of a Cable TV distribution systems and describe briefly labeling the required signal levels at each point in the distribution chain.

   b) What are ground wave, sky wave and space wave propagation? Mention the significance of each in Radio / TV transmission.

6. a) Draw the block diagram of generation of a DVB signal at transmitter and its demodulation at the receiver side. And briefly explain it.

   b) What is digital audio? What are the fundamental concepts that define digital audio?

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Broadcast Engineering *(Elective I) (EG735EX)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt any **Five** questions.*
✓ *The figures in the margin indicate **Full Marks**.*
✓ Assume suitable data if necessary. •

1. a) What do you understand by sound pressure level? Discuss the different properties of sound as relevant to Broadcasting. [2+6]

   b) Derive the Wavelength, velocity and frequency of sound with their units. Also define the sound spectrum level with mathematical formula. [4+4]

2. a) Draw a nice block diagram of TV production studio and elaborate the different equipments used for the purpose. [4+4]

   b) What do you mean by Digital Audio and Video? List and briefly discuss the fundamental characteristics that define Digital Audio and Video. [2+6]

3. a) Illustrate the Radio transmission facility with a clear block diagram. [4+4]

   b) List the different frequency bands allocated for AM, FM and TV broadcasting. [8]

4. a) Draw a neat block diagram of cable Headend system and explain the importance of each block in the Headend. [4+4]

   b) What are the different Digital TV broadcasting standards? Discuss the features of DVB system with a neat figure. [2+6]

5. a) Define ground wave, sky wave and space wave. Mention their importance in Radio Broadcasting with associated propagation mechanism. [4+4]

   b) What do you understand by Remote Broadcasting? Describe the equipment used in Radio Remote production. [2+6]

6. Write short notes on: (any four) [4×4]

   a) HDTV (High Definition Television)
   b) Composite and component video
   c) Tape formats in Radio Broadcasting
   d) Online Radio Station
   e) Cable Television

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Broadcast Engineering (Elective I)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. a. What is sound? What are its different characteristics? List and briefly explain them.

   b. State the speed, frequency and wavelength relation in propagation of sound. What do you understand by Spectrum level? State the unit.

2. a. Draw the block diagram of a typical TV Production studio. And explain the equipments used for the purpose.

   b. What are different tape formats used in Radio broadcasting industry and TV industry? Describe in brief.

3. a. What do you understand by FM transmission? Briefly mention about FM emission masks and frequency spectrum used.

   b. Discuss briefly about the transmitter site facilities used in Radio broadcasting with a neat block diagram.

4. a. Draw a neat block diagram of a Head End Installation at a Cable station. State the significance of each equipment in the Head End system.

   b. What are different Cable TV source signals used. Write briefly about the processing of such signals and frequency bands allocated for Cable TV ?

5. a. Draw the block diagram of generation of a DVB signal at transmitter and briefly explain it.

   b. What is digital audio? What are the fundamental concepts that define digital audio?

6. Write Short notes on (any Four):
   a. HDTV
   b. Digital Radio Broadcasting Standards
   c. STL links for Radio
   d. Online Radio Station
   e. Component and Composite Video signals

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Broadcast Engineering *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. a. What is sound? What are its different characteristics? List and briefly explain them.

   b. State the speed, frequency and wavelength relation in propagation of sound. What do you understand by Spectrum level? State the unit.

2. a. Draw the block diagram of a typical TV Production studio. And explain the equipments used for the purpose.

   b. What are different tape formats used in Radio broadcasting industry and TV industry? Describe in brief.

3. a. What do you understand by FM transmission? Briefly mention about FM emission masks and frequency spectrum used.

   b. Discuss briefly about the transmitter site facilities used in Radio broadcasting with a neat block diagram.

4. a. Draw a neat block diagram of a Head End Installation at a Cable station. State the significance of each equipment in the Head End system.

   b. What are different Cable TV source signals used. Write briefly about the processing of such signals and frequency bands allocated for Cable TV ?

5. a. Draw the block diagram of generation of a DVB signal at transmitter and briefly explain it.

   b. What is digital audio? What are the fundamental concepts that define digital audio?

6. Write Short notes on (**any Four**):
   a. HDTV
   b. Digital Radio Broadcasting Standards
   c. STL links for Radio
   d. Online Radio Station
   e. Component and Composite Video signals

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Broadcast Engineering *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any *Five* questions.
✓ *All* questions carry equal marks.
✓ Assume suitable data if necessary.

1. a. List the difference between NTSC, PAL and SECAM colour TV systems deployed in Analogue TV transmission.

   b. Define and explain reflection, refraction, diffraction, diffusion and superposition of sound waves with simple sketch.

2. a. Draw the neat block diagram of a TV Broadcast Air Chain. Describe each component in the chain.

   b. Describe different Tape formats and Tape machines that are used in the Radio and TV industry.

3. a. What are sub carriers? Explain the significance of these subcarriers in FM and TV broadcasting?

   b. Draw a neat block diagram of the transmitter site facilities used in TV broadcasting and Discuss briefly each block.

4. a. Draw a neat block diagram of a Cable Headend systems and explain in detail. Also mention briefly about the frequency bands used in Analogue Cable Television.

   b. What are different Cable TV source signals used? With a neat schematic, write how the signal flow is carried while distributing it to the cable subscribers from the Headend?

5. a. Draw the block diagram of generation of a DVB signal at transmitter and its demodulation at the receiver side. And briefly explain it.

   b. What are ground wave, sky wave and space wave propagation? Mention the significance of each in Radio/ TV transmission.

6. Write Short notes on (**any Four**):
    a. HDTV and SDTV Video
    b. IPTV
    c. Contribution links for Radio
    d. Online Radio Station
    e. Progressive and Interlaced Scanning

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Broadcast Engineering *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt any **Five** questions.*
✓ *The figures in the margin indicate **Full Marks**.*
✓ *Assume suitable data if necessary.*

1. a) Define sound and its fundamental characteristics. Discuss the properties of sound with neat figure. [2+6]

   b) What are the different Tape formats used in Television Broadcasting field? Discuss briefly. [4+4]

2. a) Describe the function of each equipment used in Television Broadcast Air Chain, Support your answer with a neat figure. [4+4]

   b) What do you mean by FM transmission? Briefly describe the Emission and mask level for FM with a figure. [2+6]

3. a) List the different equipments used in Remote broadcasting for Television. What are the salient features of these equipment used in the field? [4+4]

   b) Draw a block diagram of cable television distribution system and briefly describe the signal flow through the chain. [4+4]

4. a) What are the different Digital Radio Broadcasting standards used worldwide? Discuss the feature of DAB system with a neat figure. [4+4]

   b) Draw a block diagram of the color camera used in television picture capturing. Why do you think scanning is necessary for displaying TV picture in the receiver? [4+4]

5. a) What is the difference between NTSC, PAL and SECAM television system? Support your answer with comparative chart. [8]

   b) List and discuss the propagation system used for MW, SW and FM radio broadcasting. [4+4]

6. Write short notes on: (any four) [4×4]

   a) Standard definition TV (SDTV)
   b) Sampling rates for Digital Audio
   c) Sound Acoustics
   d) IPTV
   e) Cable Headend

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INSTITUTE OF ENGINEERING
Examination Control Division
2067 Ashadh

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Broadcast Engineering *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a. What is scanning? Briefly describe how the scanning occurs in TV cameras? [2+6]

   b. Define Luminance, Chrominance, Horizontal blanking interval & Vertical blanking interval. [4*2]

2. a. List the differences between NTSC, PAL and SECAM colour TV systems. [8]

   b. What is digital video? What are the characteristics that define different video formats? [2+6]

3. a. What is a studio? What are the salient features of a studio? [2+6]

   b. Draw the block diagram of a TV Broadcast Air Chain and briefly explain the chain. [4+4]

4. a. What do you understand by FM transmission? Briefly mention about FM emission masks and frequency spectrum used. [4+4]

   b. Discuss briefly about the transmitter site facilities used in Radio broadcasting with a neat block diagram. [8]

5. a. Draw a neat block diagram of a Head End Installation at a cable station. [8]

   b. Draw the block diagram of generation of a DAB signal at transmitter and briefly explain it. [4+4]

6. Write Short Notes on any Four. [4*4]
   a. SMPTE 292M
   b. Digital Radio Broadcasting Systems
   c. Tape formats in TV Studio
   d. Propagation in AM Radio
   e. DTH System

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Broadcast Engineering *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt any **Five** questions.*
✓ *All questions carry equal marks.*
✓ *Assume suitable data if necessary.*

1. a) What is sound? What are its different characteristics? List and briefly explain them. Explain how do you measure sound level?

   b) Define Refraction, Reflection, Diffraction, Diffusion and superposition of sound waves with sketch?

2. a) What is a radio production mixer? Write different equipments connected to it with a neat block diagram.

   b) Describe different contribution links for radio programs.

3. a) What are the different tape formats used in radio and TV broadcasting industry?

   b) Write short notes on:

   i) Radio and TV news gathering
   ii) TV remote production

4. a) What are different cable TV source signals used and write how the signal processing is done for each source? Draw the block diagram to support your answer.

   b) Name the different types of propagation used in AM radio, FM radio and TV signal transmission and briefly explain.

5. a) What do you understand by FM transmission? Briefly mention about FM emission masks and frequency spectrum used.

   b) What are subcarriers? Why are they used in FM and TV broadcasting?

6. a) Draw the block diagram of generation of a DAB signal at transmitter and its demodulation at the receiver side. And briefly explain it

   b) Write short notes on:

   i) HDTV
   ii) IPTV

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Exam.	**Regular / Back**		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Optical Fiber Communication *(Elective II) (EX76501)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. (a) A multimode step index fiber with a core diameter of 80 μm and a relative index difference **(2+2)** of 1.5% is operating at a wavelength of 0.85 μm. If the core refractive index is 1.48. Determine
    i) The normalized frequency for the fiber
    ii) The number of guided modes

   (b) With respect to attenuation window curve explain the nature of attenuation for different **(5)** operating wavelength in optical communication?

2. Describe the operation of EDFA (Erbium Doped Fiber Amplifier) and explain the **(8)** significance of metastable level. What are the advantages and disadvantages of EDFA?

3. Derive the wave equation and its solution for a slab waveguide having dielectric slab of **(8)** refractive index n_1 embedded in a material having refractive index, n_2. Show it's signification with respect to normalized frequency, V.

4. What are the different types of misalignment losses associated with optical fiber joints? What **(4+3)** are the causes of insertion loss?

5. When an input to the optical fiber communication system with step index fiber is an impulse **(6)** response, explain how bandwidth of the system is affected by dispersion and how it can be minimized.

6. The 10–90% rise times for possible components to be used in a D–IM analog optical fiber **(5)** link are specified below:

    > Source (LED) =10 ns ; Fiber cable: intermodal =9 ns km−1 ; Chromatic=
    > 2 ns km−1 ; Detector (APD)= 3 ns. The desired link length without
    > repeaters is 5 km and the required optical bandwidth is 6 MHz.

    Determine whether above combination of components gives an adequate temporal response.

7. What are the performance & compatibility requirement for an optical detector? Explain the **(3+4)** basic operation principle of a p-n photodiode.

8. An optical fiber system is to operate at 622 Mbps over a distance of 65 km without repeaters. **(8)** Fiber with a loss of 0.23 dB/km and a dispersion of 5.5 ps/km is available in maximum lengths of 1 km. The fusion splice loss is 0.035dB/splice and repair power margin is 5 dB. If the receiver sensitivity is -28 dBm and the transmitter output power is +1dBm, determine the maximum allowable attenuation which can be tolerated during installation. If a system upgrade to operation at 1.2 Gbits/ sec is required, is the fiber link acceptable?

9. Explain the mechanism for the operation of LASER. What is the responsivity of an optical **(5+2)** detector?

10. Write short notes on **any three** **(3*5)**
    a) Phase velocity and Group velocity
    b) Direct intensity Modulation
    c) Goos-Haenchen effect
    d) SONET

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35F   TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2071 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Optical Fiber Communication *(Elective II) (EX76501)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **_All_** questions.
✓ The figures in the margin indicate **_Full Marks_**.
✓ Assume suitable data if necessary.

1 a. Explain different components of optical fiber communication system with block diagram and list the advantages of optical fiber communication. **2+2**

   b. What is Bending loss? Explain with mathematical expression how bending loss can be reduced. **2+2**

2 a. Explain evanescent field. For a TE mode wave propagation, derive the wave equation for a Dielectric slab waveguide of infinite depth consisting of a slab of dielectric material of width 'd' of refractive index, η_1 embedded in a material having refractive index, η_2 **3+6**

   b. A step index multimode fiber with a numerical aperture of 0.2 supports approximately 1000 modes at 850nm wavelength. **2**
   i. What is the diameter of its core.
   ii. How many modes do the fiber supports at 1550nm?

3 a. Explain how numerical aperture of fiber affects the system bandwidth when an impulse input is fed into the step index fiber with necessary derivation. **6**

   b. Point out the limitations of ray theory. Compare meridional rays and skew rays. **2+2**

4 a. With neat block diagram explain subcarrier intensity modulation. **4**

   b. A 32*32 port multimode fiber transmissive star coupler has 1 mW of optical power launched into a single input port. The average measured optical power at each output port is 14 µW. Calculate the total loss incurred by the star coupler and the average insertion loss through the device. **3**

5 a. Explain quantum well concept used in LASER. **4**

   b. A Fiber Bragg Grating (FBG) is developed within a fiber core which has an effective refractive index of 1.46. Find the grating period for it to reflect an optical signal with a wavelength of 1.55 µm. **2**

6 a. Explain the fusion splicing procedure. What are the problems associated with fusion splicing? **3+2**

   b. An optical fiber has a core refractive index of 1.5. Two lengths of the fiber with smooth and perpendicular (to the core axes) end faces are butted together. Assuming the fiber axes are perfectly aligned, calculate the optical loss in dB at the joint (due to Fresnel reflection) when there is a small air gap between the fiber end faces. **3**

7 a. What is the significance of the power margin in a link budget analysis? 2+5
Consider a LED source of emitted power 1 mW. Let the detector be a p-i-n diode with receiver sensitivity of -30 dBm. The fiber being used is available in lengths of 2 km and attenuation of 2 dB/ km at an operating wavelength of 850nm. The source coupling loss is 3dB, detector coupling loss is 1 dB, system margin is 5dB and splice loss is 0.2 dB per splice. Calculate the maximum permissible link length.

b. Explain with block diagram the optical amplification approach. What are the advantages of 3+2 integrated optics over electronic circuits?

8 a. Explain the optical detection principle of p-n photodiode. 4

b. A p–n photodiode has a quantum efficiency of 50% at a wavelength of 0.9 μm. Calculate: 3
(a) its responsivity at 0.9 μm;
(b) the received optical power if the mean photocurrent is 10^{-6} A;
(c) the corresponding number of received photons at this wavelength.

9 a. Three clients traffic: STM-64 from SDH equipment, 10 Gbps from router and 1Gbps from 7 L3 Switch needs to be carried from Kathmandu to Biratnagar. Only one pair of optical fiber is available between these cities. Explain how the traffic can be carried in the given scenario using DWDM technology with necessary block diagram. Assume the channel value having channel spacing of 100 GHz.

b. What are the different components of passive optical fiber network (PON)? Explain with 4 detail architecture.

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Optical Fiber Communication *(Elective II) (EX76501)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. (a) A multimode step index fiber with a core diameter of 80 μm and a relative index difference **(2+2)**
   of 1.5% is operating at a wavelength of 0.85 μm. If the core refractive index is 1.48.
   Determine
        i) The normalized frequency for the fiber
        ii) The number of guided modes

   (b) With respect to attenuation window curve explain the nature of attenuation for different **(5)**
   operating wavelength in optical communication?

2. Describe the operation of EDFA (Erbium Doped Fiber Amplifier) and explain the **(8)**
   significance of metastable level. What are the advantages and disadvantages of EDFA?

3. Derive the wave equation and its solution for a slab waveguide having dielectric slab of **(8)**
   refractive index n_1 embedded in a material having refractive index, n_2. Show it's signification
   with respect to normalized frequency, V.

4. What are the different types of misalignment losses associated with optical fiber joints? What **(4+3)**
   are the causes of insertion loss?

5. When an input to the optical fiber communication system with step index fiber is an impulse **(6)**
   response, explain how bandwidth of the system is affected by dispersion and how it can be
   minimized.

6. The 10–90% rise times for possible components to be used in a D–IM analog optical fiber **(5)**
   link are specified below:
            Source (LED) =10 ns ; Fiber cable: intermodal =9 ns km−1 ; Chromatic=
            2 ns km−1 ; Detector (APD)= 3 ns. The desired link length without
            repeaters is 5 km and the required optical bandwidth is 6 MHz.
   Determine whether above combination of components gives an adequate temporal response.

7. What are the performance & compatibility requirement for an optical detector? Explain the **(3+4)**
   basic operation principle of a p-n photodiode.

8. An optical fiber system is to operate at 622 Mbps over a distance of 65 km without repeaters. **(8)**
   Fiber with a loss of 0.23 dB/km and a dispersion of 5.5 ps/km is available in maximum
   lengths of 1 km. The fusion splice loss is 0.035dB/splice and repair power margin is 5 dB. If
   the receiver sensitivity is -28 dBm and the transmitter output power is +1dBm, determine the
   maximum allowable attenuation which can be tolerated during installation. If a system
   upgrade to operation at 1.2 Gbits/ sec is required, is the fiber link acceptable?

9. Explain the mechanism for the operation of LASER. What is the responsivity of an optical **(5+2)**
   detector?

10. Write short notes on **any three** **(3*5)**
         a) Phase velocity and Group velocity
         b) Direct intensity Modulation
         c) Goos-Haenchen effect
         d) SONET

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36C   TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division.

2069 Bhadra

Exam.		Regular / Back ●	
Level	BE	Full Marks	80
Programme	BEX,	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Optical Fiber Communication *(EG785EX) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt any **Six** questions.*
✓ *The figures in the margin indicate **Full Marks**.*
✓ *Assume suitable data if necessary.*

1. a) Explain different approaches of signal propagation in optical fiber. [6]

   b) Consider a fiber with a 25 μm core radius, a core index $\eta = 1.48$ and $\Delta = 0.01$ [2+2]

      i) If $\lambda = 1320$nm, what is the value of V and how many modes propagate in fiber?
      ii) What percent of the optical power flows in the cladding?

2. a) Describe the major signal distortion mechanism and its type in optical fiber communication. Explain with necessary derivation how dispersion affects the information capacity of the optical fiber. [4+5]

   b) A LED operating at 850nm has a spectral width of 45nm. What is the pulse spreading in ns/km due to material dispersion? What is the pulse spreading when a laser diode having a 2-nm spectral width is used? Given dispersion coefficient = 80 ps/nm.km. [4]

3. a) Why do we need optical joints? Describe various fiber joint technique and different losses associated with fiber joints. [2+3+3]

   b) An optical fiber has a core refractive index of 1.5 two length of the fiber with smooth and perpendicular (to the core axes) end faces are butted together. Assuming the fiber axes are perfectly aligned, calculate the optical loss in dB at the joint to Fresnel reflection when there is a small air gap between the fiber end faces. [5]

4. a) Define Lasing action. Explaining the quantum well lasing concept, describe the operating principle of vertical cavity surface emitting lasers (VCSEL). [4+5]

   b) Explain the photo detection principle. What are the performance and compatibility requirements for an optical detector? [3+3]

5. a) Explain the process of avalanche multiplication in avalanche photo diode. [5]

   b) The quantum efficiency of particular silicon APD is 80% for the detection of radiation at a wavelength of 0.9μm. When the incident optical power is 0.5μW, the output current from the device after avalanche gain is 11μA. Determine the multiplication factor of the photodiode under these conditions. [4]

6. a) Write short notes on WDM and SONET [4+4]

   b) A 622 Mbps optical transmission system is to operate at a wavelength of 1550nm over a distance of 80km. Apart from the transmitter and receiver, the optical link contains an optical amplifier with 7 dB gain at 45 km of the link. The transmitter available has a minimum coupled output power of +3dBm, while the receiver has a worst case sensitivity of -27dBm. Two types of fiber with different specifications are available as shown in table below. Four connectors are to be used in the system with a loss of 0.15 dB each, while the splice loss for both fiber types is 0.05dB maximum. Calculate the dispersion penalty associated with the use of each fiber. Prepare a power budget for each system and decide which fiber type should be used and why? [12]

Fiber Type	Total Dispersion	Attenuation	Maximum distance between splices
X	5 ps/km	0.3 dB/ km	0.7 km
Y	7 ps/km	0.4 dB/ km	0.6 km

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36C TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Bhadra

Exam.	Regular / Back ●		
Level	BE	Full Marks	80
Programme	BEX,	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Optical Fiber Communication *(EG785EX) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Six** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) Explain different approaches of signal propagation in optical fiber. [6]

   b) Consider a fiber with a 25 μm core radius, a core index $\eta = 1.48$ and $\Delta = 0.01$ [2+2]

      i) If $\lambda = 1320$nm, what is the value of V and how many modes propagate in fiber?
      ii) What percent of the optical power flows in the cladding?

2. a) Describe the major signal distortion mechanism and its type in optical fiber communication. Explain with necessary derivation how dispersion affects the information capacity of the optical fiber. [4+5]

   b) A LED operating at 850nm has a spectral width of 45nm. What is the pulse spreading in ns/km due to material dispersion? What is the pulse spreading when a laser diode having a 2-nm spectral width is used? Given dispersion coefficient = 80 ps/nm.km. [4]

3. a) Why do we need optical joints? Describe various fiber joint technique and different losses associated with fiber joints. [2+3+3]

   b) An optical fiber has a core refractive index of 1.5 two length of the fiber with smooth and perpendicular (to the core axes) end faces are butted together. Assuming the fiber axes are perfectly aligned, calculate the optical loss in dB at the joint to Fresnel reflection when there is a small air gap between the fiber end faces. [5]

4. a) Define Lasing action. Explaining the quantum well lasing concept, describe the operating principle of vertical cavity surface emitting lasers (VCSEL). [4+5]

   b) Explain the photo detection principle. What are the performance and compatibility requirements for an optical detector? [3+3]

5. a) Explain the process of avalanche multiplication in avalanche photo diode. [5]

   b) The quantum efficiency of particular silicon APD is 80% for the detection of radiation at a wavelength of 0.9μm. When the incident optical power is 0.5μW, the output current from the device after avalanche gain is 11μA. Determine the multiplication factor of the photodiode under these conditions. [4]

6. a) Write short notes on WDM and SONET [4+4]

   b) A 622 Mbps optical transmission system is to operate at a wavelength of 1550nm over a distance of 80km. Apart from the transmitter and receiver, the optical link contains an optical amplifier with 7 dB gain at 45 km of the link. The transmitter available has a minimum coupled output power of +3dBm, while the receiver has a worst case sensitivity of -27dBm. Two types of fiber with different specifications are available as shown in table below. Four connectors are to be used in the system with a loss of 0.15 dB each, while the splice loss for both fiber types is 0.05dB maximum. Calculate the dispersion penalty associated with the use of each fiber. Prepare a power budget for each system and decide which fiber type should be used and why? [12]

Fiber Type	Total Dispersion	Attenuation	Maximum distance between splices
X	5 ps/km	0.3 dB/ km	0.7 km
Y	7 ps/km	0.4 dB/ km	0.6 km

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Subject: - Optical Fiber Communication *(Elective I)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. a) Explain about different types of optical fiber according to refractive and index profile? Why multimode step index fiber is rarely used. [6+2]

   b) Estimate the maximum core diameter for an optical fiber with $\Delta=1.6\%$ and $n1=1.48$ and so that it may be suitable for signal mode operation. Also calculate critical angle at core cladding interface. [Given: $\lambda=0.85\mu m$] [4+4]

2. a) Find the cutoff wavelength for a step index fiber to exhibits single mode operation. When the core refractive index and radius are 1.46 and $4.4\mu m$ respectively, with the relative index difference being 0.25%? [8]

   b) An optical signal gets reduced in strength and gets spread while propagating through the optical fiber. What are these effects called and what are different mechanisms for creating these effects? Explain them clearly. [7]

3. a) A multimode step index fiber with a core refractive index of 1.5, a relative refractive index difference of 3% and an operating wavelength of $0.82\mu m$. Estimate the critical radius of curvature at which large bending losses occur. [6]

   b) What is wavelength division multiplexing? Why is it needed in Optical fiber Communication? [7]

4. a) Define splicing and briefly explain various techniques of splicing. [8]

   b) Explain the principle of operation of a optical fiber coupler. What are its types? [7]

5. a) What are the common properties of photodiodes? Explain the operating principle of avalanche photodiodes. [8]

   b) Explain fiber drawing process in optical fiber. [6]

6. Explain SONET in optical fiber. List out the benefits of SDH system. [4+3]

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

INSTITUTE OF ENGINEERING

Examination Control Division

2066 Magh

Subject: - Optical Fiber Communication (Elective II)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

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1. a) Describe structure and types of optical fiber. Discuss optical communication window. [4]
    b) A graded index fiber has fiber core with parabolic refractive index profile with diameter of 50 μm, numerical aperture 0.2. Estimate the total number of guided modes at operating wavelength of 1 μm. [8]

2. a) Explain different mechanism of attenuation in fibers. How can we minimize them? [6+2]
    b) A certain optical fiber has an attenuation of 0.5dB/km at 1300 nm and 0.3dB/km at 1550 nm. Suppose the following two optical signals are launched simultaneously into the fiber: an optical power of 150 μW at 1300 nm and an optical power of 100 μW at 1550 nm. What are the power levels in μW of these two signals at 12 km from the optical source? [4]

3. a) Discuss requirements and types of fiber materials. Explain with neat diagram fiber drawing technique? [4+4]
    b) Discuss the effects dispersion in optical fiber. Compare modal and chromatic dispersion. [4]

4. a) Describe methods of splicing in fiber. What is Fresnel loss? [6+2]
    b) Calculate the intrinsic connection losses for two single mode fiber from Samsung Fiber Company caused by MFD mismatched. The fiber as given from the data sheet has MFD 9.2±0.4 nm at 1550 nm. [4]

5. a) What are optical coupler and switches. Describe with neat diagram Fused Biconical Taper Technique (FBT). [4+4]
    b) Describe photo detection principle using Avalanche Photo Diode (APD). [4]

6. a) Discuss different factor affecting power budget analysis of optic link. [4]
    b) A local data link to be installed has the following requirement and characteristics.
       i. Maximum bit rate: 60 Mbps; Line Code: RZ format
       ii. Fiber type: 62.5/125 μm; Installation length: 2 km
       iii. Operating λ: 1300 nm; Rise time of light wave equipment :4ns
       iv. Laser diode spectral width :2nm
    Will this fiber support the required bit rate? The fiber has Modal bandwidth of 180MHz.km and chromatic dispersion of 2.5ns/nm km. [8]

7. Write short notes on (Any Two) [4x2]
    a) Axial Vapour Deposition Method
    b) VCSEL
    c) PIN
    d) Numerical Aperture

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Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Optical Fiber Communication *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) Explain some benefits of optical fiber communication. Why are the telecom operators migrating from copper based access networks to fiber based access networks?   [3+4]

   b) Calculate the numerical aperture of a step-index fiber having indices of 1.49 and 1.47. What is the maximum solid acceptance angle for this fiber if the external medium is air, with n=1.00?   [5]

2. a) Describe some factors that limit the repeater less transmission distance of the optical fiber link.   [5]

   b) A multimode fiber has a core refractive index of 1.48, a relative refractive index difference of 2.5% and an operating wavelength is 0.85μm. Estimate the critical radius of curvature at which large bending losses occurs.   [5]

3. a) What is modal dispersion? Explain about the reduction of information capacity of the fiber in the presence of dispersion of pulse with in the optical fiber. [3+3]

   b) A local data link to be installed has the following requirement and characteristics.
      - Maximum bit rate: 60 Mbps; Line Code: NRZ format
      - Fiber type: 62.5/125 μm; Installation length: 2 km
      - Operating wavelength: 1300 nm; Rise time of light wave equipment :4ns
      - Laser diode spectral width :2nm

   Will this fiber support the required bit rate or not? The fiber has Modal bandwidth of 180MHz.km and chromatic dispersion of 2.5ns/nm.km   [7]

4. a) What are optical sources? Describer one of the most commonly used optical source in the telecommunication networks.   [1+4]

b) An optical fibre system is to operate at 622 MBits/sec over a distance of 65 km without repeaters. Fibre with a loss of 0.25 dB/km and a dispersion of 5.5 ps/km is available in maximum lengths of 1 km. The connector loss is 0.8 dB and repair power margin is 5 dB. If the receiver sensitivity is -28 dBm and the transmitter output power is +1 dBm determine the maximum allowable attenuation per fusion splice, which can be tolerated during installation. [7]

5. a) Describe the necessity of joints in optical fibers. Point out some joint losses that prevail in the imperfect fiber joints. [2+5]
    b) In a mechanical joint of fibers, calculate the Fresnel reflection loss with air in gap if end separation is 1.4 μm and wavelength 1550 nm. The fiber core has the refractive index of 1.5. [5]

6. a) Describe photo detection principle in Avalanche photo diode. Compare its receiver sensitivity with PiN photo detector. [4+2]
    b) An APD has a quantum efficiency of 40% at 850 nm. When illuminated with radiation of this wavelength it produces an output photocurrent of 10 μA after avalanche gain of 450. How many photon per second does this correspond to? [5]

7. Write short notes on (**Any Two**) [5×2]
    i.   Mode Field Diameter
    ii. Fresnel Reflection loss in the fiber
    iii. WDM networks

Subject: - Optical Fiber Communication (Elective)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) Explain some benefits of optical fiber communication. Why are the telecom operators migrating from copper based access networks to fiber based access networks? [3+4]
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           i.   Mode Field Diameter
           ii.   Fresnel Reflection loss in the fiber
           iii. WDM networks

Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Optical Fiber Communication (Elective)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) Describe the advantages of Optical Fiber Communication system. Illustrate some factors that degrade the signal quality in optical fiber communication.   [8](3+5)
   b) A step-index fiber has a 25-μm core radius, a core index of 1.47, and a cladding index of 1.45. For each of the wavelengths 1320 nm, and 1550 nm, what are the normalized frequency parameter V, and the percentage of the optical power flowing in the cladding? [5]

2. a) What materials are used to manufacture the optical fibers? Describe Manufacturing process of optical fiber.   [2+6]
   b) A continuous 15 km-long optical fiber link has a loss of 1.2 dB/km. (a) What is the minimum optical power level that must be launched into the fiber to maintain an optical power level of 0.32 μW at the receiving end? (b) What is the required input power if the fiber has a loss of 2.3 dB/km?   [5]

3. a) What is stimulated emission radiation? Describe the working principle of Distributed Feedback Laser Diode. Why do the telecom companies use this source?   [2+5+1]
   b) How many longitudinal modes can a Fabry-Perot laser diode generate if the length of its resonator is 0.3mm and operating frequency is 1550 nm? The width of the gain curve is 10 nm.   [5]

4. a) What are photo detectors? Describe photo detection principle using Avalanche Photo Diode.   [2+6]
   b) For two mechanically spliced fibers, calculate the Fresnel reflection loss with air in gap if end separation is 1.5 μm and wavelength 1550 nm. The fiber core has the refractive index of 1.47.   [5]

5. Define Dispersion penalty in the optical fiber communication. A 622 Mb/s optical transmission system is to operate at a wavelength of 1550 nm over an unrepeatered distance of 45 km. The transmitter available has a minimum fibre coupled output power of +3 dBm, while the receiver has a worst case sensitivity of -29 dBm. Two types of fibre are available with different specifications as shown in Table 1 below. Two connectors are used in the system. The average distance between fusion splices is 500 m. The connector and fusion splice losses are shown in Table 2.
   Calculate the dispersion penalty associated with the use of each fibre. By preparing a **two standard deviation** statistical power budget using each fibre type in turn decide whether fibre type A or B should be used and why. State clearly any assumptions made.   [2+16]

Fibre type	Total dispersion	Attenuation	Attenuation Standard Deviation
A	7 ps/km	0.36 dB/km	0.05 dB/km
B	9.5 ps/km	0.33 dB/km	0.04 dB/km

Table 1

Joint Type	Average attenuation	Attenuation Standard deviation
Fusion splice	0.03 dB	0.012 dB
Connector	0.25 dB	0.04 dB

Table 2

6. Write short notes on (**Any Two**)   [2×5]
      a) Optical Fiber Network Topology
      b) WDM
      c) ATM

Exam.		Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Optical Fiber Communication (Elective)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt All questions.
✓ The figures in the margin indicate Full Marks.
✓ Assume suitable data if necessary.

1. a) Describe the major causes of attenuation in optical fiber. Illustrate the transparent windows in optical fiber with major peak transparent wavelength in fiber. [6+2]

   b) Determine the cutoff wavelength for a step index fiber to exhibit single mode operation when the core refractive index and radius are 1.46 and 4.5 µm, respectively with the relative refractive index difference being 0.25%. [5]

2. a) Define dispersion of optical signal in fiber. Compare and contrast between modal and chromatic dispersion of signal in optical fiber. [3+5]

   b) A multimode fiber has a core refractive index of 1.48, a relative refractive index difference of 2.5% and an operating wavelength is 0.85µm.Estimate the critical radius of curvature at which large bending losses occurs. [5]

3. a) What are the single mode lasers and multimode lasers? Describe the operating principle of vertical cavity surface emitting lasers (VCSEL). Point out its advantages. [2+5+1]

   b) When 3×10^{11} photon reach with a wavelength of 0.85 µm are incident on a photodiode, on average 1.4×10^{11} electrons are collected at the terminals of the device. Determine the quantum efficiency and the responsivity of the photodiode at this wavelength. [5]

4. a) What is responsivity of optical detector? Describe the photo detection principles using PiN photo diode. [2+6]

   b) What power will be radiated by an LED in µW and dBm if its quantum efficiency is 3% and peak wavelength is 850nm? Assume forward current I= 40mA. [5]

5. Point out the dispersion penalty calculation in Power budget analysis. A 622 Mb/s optical transmission system is to operate at a wavelength of 1550 nm over an unrepeatered distance of 45 km. The transmitter available has a minimum coupled output power of +2 dBm, while the receiver has a worst case sensitivity of -28 dBm.

Two types of fibre with different specifications are available as shown in **Table 1** below. Two connectors are to be used in the system with a loss of 0.4 dB each, while the splice loss for both fibre types is 0.05 dB maximum. Calculate the dispersion penalty associated with the use of each fibre. Prepare a power budget for each system and decide which fibre type should be used and why. [2+16]

Table 1

Fibre type	Total dispersion	Attenuation	Maximum distance between splices
A	12 ps/km	0.25 dB/km	800 metres
B	10 ps/km	0.35 dB/km	600 metres

6. Write short notes on (**Any Two**) [2×5]

        a) Optical fiber joints

        b) Optical fiber based access networks

        c) SDH

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Exam.		Regular / Back ●	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Avionics *(EG785EX) (Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. a) Why VOR is preferred by the pilots over NDB for getting the azimuth information?

   b) What are the uses of HF and VHF communication in Aviation?

2. a) With the help of a block diagram explain the working principle of Primary Radar.

   b) Explain briefly how aircrafts extracts the distance information with the help of Distance Measuring Equipment (DME)?

3. a) What is Instrument Landing System (ILS) and what are its different Categories?

   b) In your opinion what are the advantages of Secondary Radar (SSR) over Primary Radar (ASR)?

4. a) What is GNSS? Explain briefly.

   b) Why top loading of the antennas are necessary in case of NDB?

5. a) With a figure explain the difference between Magnetic Heading, Relative bearing and magnetic bearing.

   b) Explain briefly the difference between a conventional VOR and Doppler VOR.
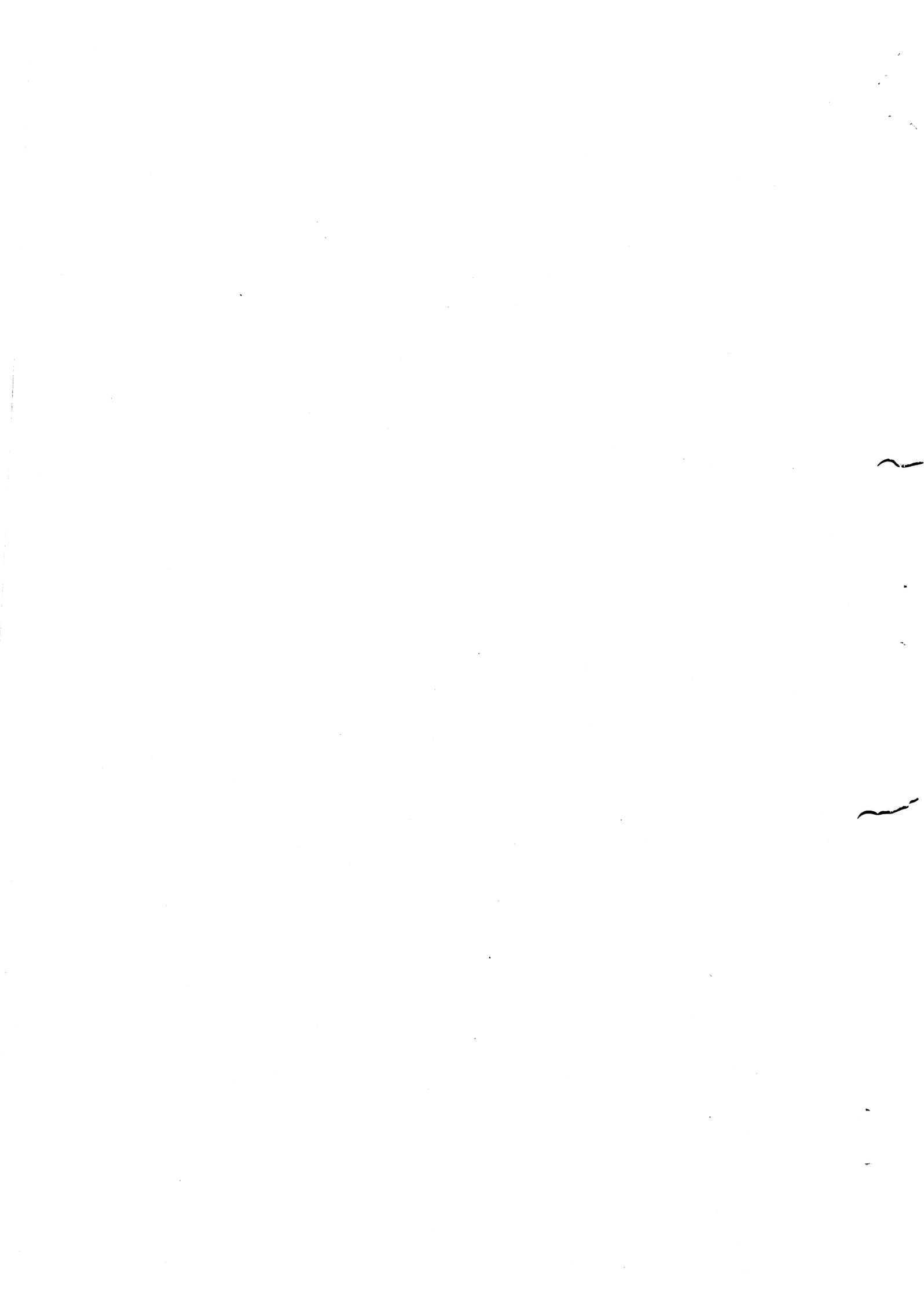
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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Avionics (Elective I)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. Explain the role of "Ground Radials" in NDB antenna system.

2. The accuracy of a DVOR is far better than that of a CVOR. What are the major contributing factors in a DVOR for its better performance?

3. What is the "Gaussian Pulse"? Why such a pulse is exclusively used in DME as the modulating signal for generating interrogation and Reply RF pulses?

4. Why is the DME immune to short-distance echoes? How are they effectively eliminated by the DME receiver?

5. Define the "Capture Effect"? How is this principle utilized while installing a Glide Path at an airport with obstructions on the foreground?

6. Explain the reason why the transmitter power in the Secondary Surveillance Radar (SSR) is far lower compared to Primary Surveillance Rader (PSR)? What are Modes A and C in SSR?

7. Describe the principle of operation of the Goble Positioning System (GPS) and the technique used by the Aircraft for getting accurate measurements.
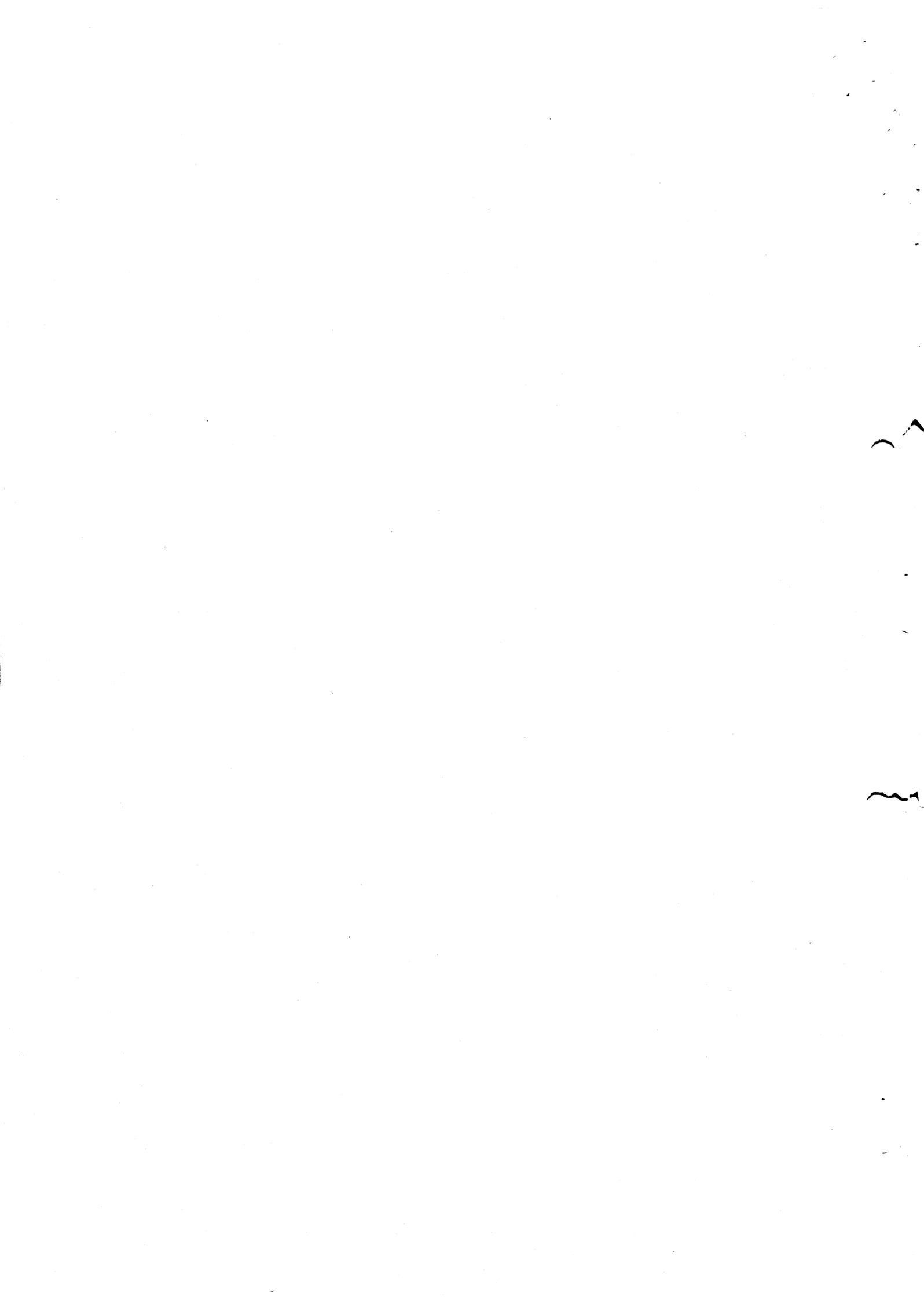
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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Avionics *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. Explain why Non Directional Beacon (NDB) transmitting antennas are so large compared to those for VHF/UHF bands, yet they are so very inefficient? What is the role of tuning coil and ground radials in MW/LW antennas?

2. How 30Hz Reference and Variable Signals are generated in a Conventional VOR (CVOR)? Why DVOR is preferred more than CVOR, give your reasoning.

3. While selecting number of antennas for the outer-ring in a DVOR, manufacturers mostly chose 45 to 52 "Alford Loop" type antenna only. Describe what has necessitated to the above.

4. What are the "Lock" and "Track" modes in a DME? A DME ground transponder with a capacity of 2700 pulse pairs per second (pps) can handle up to 100 aircraft simultaneously. Explain how it is possible.

5. Using vector diagram prove that DDM in a Localizer at any point other than the centreline of the runway will be more than Zero.

6. ICAO has recommended its member countries to replace the Primary Radars as much as practicable with Secondary Surveillance Radar. Do you think it would be a wise decision to stop operation of Primary Radar completely? Give your reasoning.

7. What is the Global Navigation Satellite System (GNSS)? While using GNSS as a Landing Aid (in place of an ILS), Local Area Augmentation System (LAAS) is generally used, why?

Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Avionics *(Elective II)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Describe the types of antenna used in NDB. Discuss in detail about factor affecting NDB antenna with suitable examples. [6+8]

2. What are the major advantages of DVOR over CVOR? Discuss the principal of operation of DVOR with suitable diagrams. [6+8]

3. Discuss the importance of squitter pulses in DME. Describe different type of errors and echo in DME and how its effect can be minimized? [5+7]

4. What are the new identified systems by FANS committee to overcome limitation of existing navigation equipment? How does GPS work? [5+7]

5. Derive the equation for RADAR range. Why transmitted power is different for same coverage in ASR and SSR? [7+7]

6. Modulation index vary when aircraft moves away from the center line or angle of approach. Discuss with necessary diagrams [14]

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Rader -16

Exam.		Back	
Level	BE	**Full Marks**	80
Programme	BEX	**Pass Marks**	32
Year / Part	IV / II	**Time**	3 hrs.

Subject: - Avionics *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt any **Five** questions.
✓ **All** questions carry equal marks.
✓ Assume suitable data if necessary.

1. Define the properties of the "Loop Antenna" and its importance in direction finding in NDB. How 180° ambiguity of the Loop Antenna is resolved in Automatic Direction Finder (ADF) Receiver of the Aircraft?

2. What is Doppler Effect? Explain how this principal is being used in creation of 30Hz variable signal in the air. What will happen if the diameter of the ring of antennas is increased or decreased from its nominal 5λ size?

3. What are the Locking and Searching modes in a DME? A DME ground station works on "first come first served" basis. Explain how each individual aircraft recognizes that particular replies only belong to it.

4. If the foreground area at an airport is hilly and sloping upwards, can we install an ILS at this airport? If yes, then which type of ILS would be more appropriate and why?

5. Describe the basic principal of operation of a Secondary Surveillance Radar. What are the various modes of operation of SSR? How Side Lobe Suppression (SLS) is achieved in a Secondary Radar?

6. Describe the basic concepts of satellite based Communication, Navigation and Surveillance.
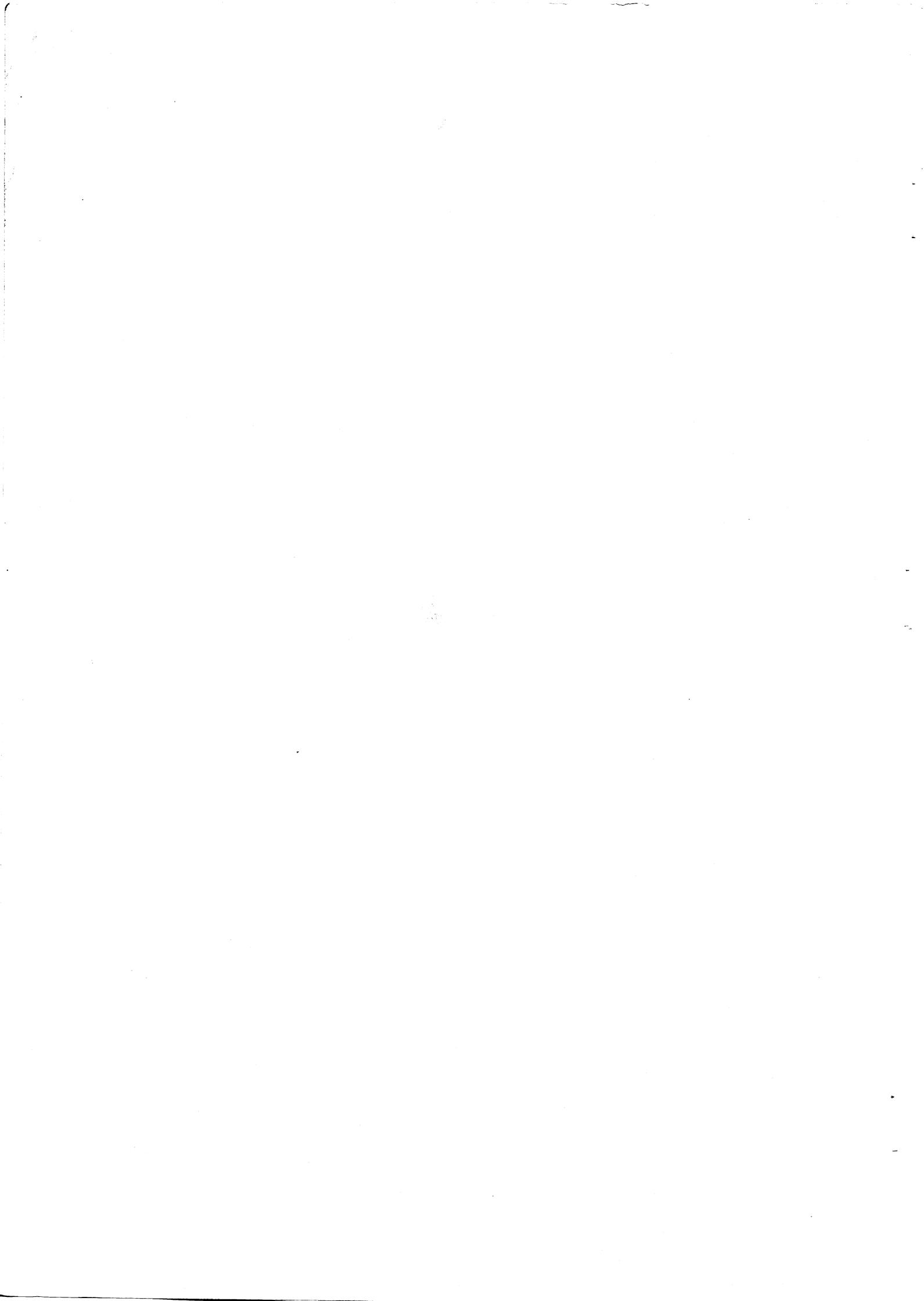
Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Avionics *(Elective)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
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1. Describe briefly to the following: [20]

   (a) Use of Capture Effect in ILS
   (b) Geostationary Orbit of a Satellite
   (c) Slot Antenna and its properties
   (d) TCAS

2. Why "Top Loading" is common in LW/MW transmitting antenna?   [15]
   Describe the effects of top loading in overall performance of the
   NDB transmission.

3. Describe various methods being used for switching the sideband signals in a   [15]
   Doppler VOR? Why is the single sideband switching not preferred?

4. Analyze various factors affecting Minimum and Maximum range and   [15]
   display in a Primary Radar.

5. Why "Receiver Dead Time" is required in a DME Transponder? Describe   [15]
   in detail its importance in DME Ground Station Performance.

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Aeronautical Communication *(Elective I) (EX72504)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt *All* questions.
✓ *All* questions carry equal marks.
✓ Assume suitable data if necessary.

1. Describe the different type of Communication systems used for ground to ground and Air to ground communication in aviation based air traffic management. [8]

2. Describe different organizations involved in aviation field. Mention role of ICAO in civil aviation. [4+4]

3. Explain briefly how Air Traffic Control takes place in an international airport. [8]

4. With a suitable block diagram explain the working principle of a Primary Surveillance Radar. [8]

5. Why pilot does not prefer NDB as a primary navigational aid? Explain briefly. [8]

6. In your opinion what are the advantages of Secondary Radar (SSR) over Primary Radar (ASR)? [8]

7. Describe briefly how pilots find directional information using a DVOR. - [8]

8. What should be the minimum receiver sensitivity of primary radar system to detect a target at 60 NM from station while power meter shows 1.6 KW at operating frequency 2.7GHz. It is assumed antenna gain of radar is 48dB with waveguide loss of 6 dB? Standard Echoing area $= 15 \text{ m}^2$. [8]

9. What are the major advantages of DVOR over CVOR? Discuss the principal of operation of DVOR with suitable diagrams. [3+5]

10. Modulation index vary when aircraft moves away from the center line of runway or angle of approach. Discuss with necessary diagrams for Localizer or Glide slope of ILS. [8]

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