



**SOMAIYA**  
**VIDYAVIHAR**

## K J Somaiya Institute of Engineering and Information Technology

An Autonomous Institute permanently affiliated to University of Mumbai  
Accredited NAAC and NBA, Approved by AICTE, New Delhi

### Department of Electronics and Telecommunication Engineering

Academic Year 2021-22

Semester: VI

Year: TY

Subject: COMPUTER COMMUNICATION NETWORK \_Course Code: 1U XC604

#### Question bank

Question No.	Module 1_ ( Introduction to service model)	BT Level	CO
1	What is a token and explain its function in ring topology.	2	CO1
2	Difference between LAN MAN WAN PAN How does BUS topology work? Is it robust?	1	CO1
3	What makes a network effective and efficient?	1	CO1
4	Define Unicasting, Broadcasting, Multicasting and Anycasting	2	CO1
5	Explain Repeater, Hub, Bridge, Switch, Gateway	2	CO1
	<b>Module _2 (Physical layer )</b>		
1	What is a UTP cable?	2	CO2
2	Compare between – Coaxial cable and Optical fiber cable	1	CO2
3	What are different types of routing algorithms in the Network layer?	3	CO2
4	Compare DSL and HFC media	2	CO2
5	Explain OSI reference model	1	CO2
	<b>Module 3(Data link layer )</b>		
1	What is ALOHA? Derive the expression for the slotted and pure ALOHA.	2	CO3
2	Explain CSMA Protocols. How are collisions handled CSMA/CD	3	CO3
3	Short note on Byte stuffing and Bit stuffing	2	CO3
4	Explain Go-back-N ARQ protocol in brief. Also compare and contrast the Go-Back-N ARQ Protocol with Selective-Repeat ARQ.	3	CO3
5	Explain various types of frames in HDLC.	1	CO3



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<b>Module 4(Network layer )</b>			
1	What is subnetting? List advantages and disadvantages of the same.	2	CO4
2	Explain Dijkstra Algorithm with one example	2	CO4
3	What is Subnetting? An organization is given the block 17.12.40.0/26, which contains 64 addresses. The organization has three offices and needs to divide the addresses into three sub blocks of 32, 16, and 16 addresses using subnetting. Identify the mask for individual subnet, Also assign IP addresses to respecting subnet.	3	CO4
4	Identify the class of given IP addresses: (1) 130.1.1.1 (2) 95.20.2.1	2	CO4
5	Explain Circuit switching. Virtual-circuit switching and Datagram switching	1	CO4
<b>Module 5(Trans[port layer )</b>			
1	Describe Go back N ARQ and Selective reject ARQ .	2	CO5
2	Discuss pros and cons of DS-CDMA and FH- CDMA protocols	2	CO5
3	Explain congestion control in TCP.		CO5
4	Describe TCP header with diagram.		CO5
5	Explain Segmentation and Reassembly with respect to Transport layer		CO5
<b>Module 6 (Application layer layer )</b>			
1	List down different protocols supported at Application layer		CO6
2	Explain DNS in detail		CO6
3	What are the three sections of the domain name space on the internet? Describe the details.		CO6
4	Compare HTTP ,DNS and TELNET Application Layer Protocol.		CO6
5	Explain FTP in detail. Mention its limitation and justify how these limitations are overcome in TFTP.		CO6



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### Department of Electronics and Telecommunication Engineering

Academic Year 2021-22

Semester: \_VI

Year: TY

Subject: \_Database Management System

Course Code: 1UEXDLC6054

#### Question bank

Question No.	Module 01 (Introduction to Databases and Transactions)	BT Level	CO
1	List advantages of DBMS	U	CO1
2	What is logical data independence	U	CO1
3	Explain different types of schemas	R	CO1
4	Explain Data definition language	R	CO1
5	Explain Data manipulation language	R	CO1
6	Why does a DBMS interleave the actions of different transactions instead of executing transactions one after the o	A	CO1
7	Why would you choose a database system instead of simply storing data in operating system files? When would it make sense not to use a database system?	A	CO1
8	Explain 2-tier architecture	U	CO1
9	Explain 3-tier architecture	U	CO1
10	Explain data independence	U	CO1
11	Explain the difference between logical and physical data independence.	U	CO1
12	Which of the following plays an important role in representing information about the real world in a database? Explain briefly.  1. The data definition language.  2. The data manipulation language.  3. The buffer manager.  4. The data model.	A	CO1
13	Explain the term file system vs DBMS	U	CO1
	<b>Module 02 (Data Models)</b>		
14	Explain the term attribute	U	CO2



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15	Explain the term one to many relationship	U	CO2												
16	Explain the term many to one relationship	U	CO2												
17	Explain the term weak entity set	U	CO2												
18	Explain the term aggregation	U	CO2												
19	List and explain different types of cardinalities	R	CO2												
20	Write short note on primary key	R	CO2												
21	Write short note on foreign key	R	CO2												
22	Write short note on candidate key	R	CO2												
23	Write short note on all types of keys	R	CO2												
	<b>Module 03 (Database Design, ER-Diagram and Unified Modelling Language)</b>														
24	<b>Explain the term normalization</b>	<b>U</b>	co3												
25	<b>What is transitive dependencies</b>	<b>R</b>	co3												
26	<b>Explain types of anomalies</b>	<b>U</b>	co3												
27	<p><b>Check the below table in first normal form, if not then convert.</b></p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Roll no</th> <th>Name</th> <th>Course</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Sai</td> <td>C/C++</td> </tr> <tr> <td>2</td> <td>Harsh</td> <td>Java</td> </tr> <tr> <td>3</td> <td>Omkar</td> <td>C/DBMS</td> </tr> </tbody> </table>	Roll no	Name	Course	1	Sai	C/C++	2	Harsh	Java	3	Omkar	C/DBMS	<b>A</b>	co3
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28	In relation R(ABCD), functional dependencies are given, $FD\{AB \rightarrow CD, D \rightarrow A\}$ , What is the candidate key?	<b>A</b>	co3												
29	In relation R(ABCDEF), functional dependencies are given, $FD\{C \rightarrow F, E \rightarrow A, EC \rightarrow D, A \rightarrow B\}$ , What is the candidate key?	<b>A</b>	co3												
30	Draw UML diagram for shopping app	<b>A</b>	co3												
31	Draw UML class diagram for library management system	<b>A</b>	co3												
32	In relation R(ABCDEF), check the highest normal form, $FD\{AB \rightarrow C, C \rightarrow DE, E \rightarrow F, F \rightarrow A\}$ , What is the candidate key?	<b>A</b>	co3												



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		Module-04 (Relational Algebra and Calculus)																															
33	Explain selection operator			<b>U</b>	Co4																												
34	Explain projection operator			<b>U</b>	Co4																												
35	List different basic operators			<b>U</b>	Co4																												
36	Explain Cross product			<b>U</b>	Co4																												
37	Explain Union operator			<b>U</b>	Co4																												
38	List and explain types of joins			<b>U</b>	Co4																												
39	Find Left outer join of the following tables			<b>U</b>	Co4																												
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		Module 05 (Constraints, Views and SQL)																															
41	What is constraint			<b>U</b>	Co5																												
42	What is views in database			<b>U</b>	Co5																												



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43	Compare tables and views	<b>R</b>	Co5																								
44	Write advantages of views	<b>U</b>	Co5																								
45	What is nested subqueries	<b>U</b>	Co5																								
46	Write short note on constraint	<b>U</b>	Co5																								
47	Write short note on views	<b>U</b>	Co5																								
48	Write SQL query to display employee name who is taking maximum salary.  <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>E_Id</th> <th>E_Name</th> <th>Department</th> <th>Salary</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Jatin</td> <td>Finance</td> <td>50000</td> </tr> <tr> <td>2</td> <td>Pratham</td> <td>IT</td> <td>20000</td> </tr> <tr> <td>3</td> <td>Ram</td> <td>HR</td> <td>30000</td> </tr> <tr> <td>4</td> <td>Somesh</td> <td>IT</td> <td>15000</td> </tr> <tr> <td>5</td> <td>Siddharth</td> <td>HR</td> <td>56000</td> </tr> </tbody> </table> <p style="text-align: center;">Employee Table</p>	E_Id	E_Name	Department	Salary	1	Jatin	Finance	50000	2	Pratham	IT	20000	3	Ram	HR	30000	4	Somesh	IT	15000	5	Siddharth	HR	56000	<b>A</b>	Co5
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49	Explain how aggregate function work on null values	<b>A</b>	Co5																								
50	Calculate Nth highest salary using SQL  <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>E_Id</th> <th>Salary</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>10000</td> </tr> <tr> <td>2</td> <td>20000</td> </tr> <tr> <td>3</td> <td>30000</td> </tr> <tr> <td>4</td> <td>40000</td> </tr> <tr> <td>5</td> <td>50000</td> </tr> </tbody> </table>	E_Id	Salary	1	10000	2	20000	3	30000	4	40000	5	50000	<b>A</b>	Co5												
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51	Calculate 4th highest salary using SQL	<b>A</b>	Co5																								



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	<b>Module 06 (Transaction management and Concurrency control)</b>																													
52	<b>Define atomicity</b>	<b>R</b>	Co6																											
53	<b>Define consistency</b>	<b>R</b>	Co6																											
54	<b>Define isolation</b>	<b>R</b>	Co6																											
55	<b>Define durability</b>	<b>R</b>	Co6																											
56	<p><b>Check conflict pairs in other transactions and draw edges</b></p> <table border="1"> <thead> <tr> <th>T1</th> <th>T2</th> <th>T3</th> </tr> </thead> <tbody> <tr> <td>R(x)</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>R(y)</td> </tr> <tr> <td></td> <td></td> <td>R(x)</td> </tr> <tr> <td></td> <td>R(y)</td> <td></td> </tr> <tr> <td></td> <td>R(z)</td> <td></td> </tr> <tr> <td></td> <td></td> <td>W(y)</td> </tr> <tr> <td></td> <td>W(z)</td> <td></td> </tr> <tr> <td>R(z)</td> <td></td> <td></td> </tr> </tbody> </table>	T1	T2	T3	R(x)					R(y)			R(x)		R(y)			R(z)				W(y)		W(z)		R(z)			<b>A</b>	Co6
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		W(x)					
		W(z)					
57	<b>Write short note on shared exclusive locking protocol</b>					<b>A</b>	Co6
58	<b>Explain the drawbacks of shared exclusive locking</b>					<b>A</b>	Co6
59	<b>write short note on timestamp ordering protocol</b>					<b>A</b>	Co6
60	<b>Draw and explain transaction states</b>					<b>A</b>	Co6
61	<b>Explain properties of ACID</b>					<b>A</b>	Co6
62	<b>What is Schedule, compare serial vs parallel schedule</b>					<b>A</b>	Co6
63	<b>Explain conflict equivalent schedule</b>					<b>A</b>	Co6





**Department of Electronics and Telecommunication Engineering**

Academic Year 2021-22

Semester: VI

Year: TY

Subject: Electromagnetics and Antenna

Course Code: 1UEXC601

**Question bank**

Question No.	Module 1 (Introduction to static field)	BT Level	CO
1	Explain the followings. 1. Coulombs Law 2. Electric field Intensity 3. Gauss Law 4. Continuity equations 5. Laplace's and poisons equations 6. Biot Savart Law 7. Gauss Law for magnetic field	U	1
2	Three equal point charges of $2\mu\text{C}$ are located at $(0,0,0)$ m, $(2,0,0)$ m and $(0,2,0)$ m respectively in free space. Find out net force on $Q_4 = 5\mu\text{C}$ at $(2,2,0)$ m.	Ap	1
3	A dipole having a moment $p = 12ax - 6ay + 7az$ nC.m is located at Q $(3,4,1)$ in free space. (a) Find V at P(x, y,z) (b) Find V at P $(5,1,0)$ .	Ap	1
4	A charge is located in free space at P(a,0,0). Prepare a sketch of magnitude of force on as a function of a produced by two other charges, at $(0,1,0)$ and : (a) $4\text{C}$ at $(0,-1,0)$ ; (b) $-2\text{C}$ at $(0,-1,0)$ .	Ap	1
5	Explain the concept of potential gradient and the relation between electric field and potential.	U	1
	<b>Module 2 (Electromagnetic field and Maxwell's equation)</b>		
1	Explain boundary conditions of E and H fields for two media	U	2
2	Derive Maxwell's equations in integral and point form for static field	Ap	2
3	Define Skin Depth, and calculate it for a wave travelling in a conductor ( $\sigma = 3.5 \times 10^7$ S/m), with a frequency of 100 MHz $\epsilon_r = 1.2$ , $\mu_r = 1$ .	Ap	2

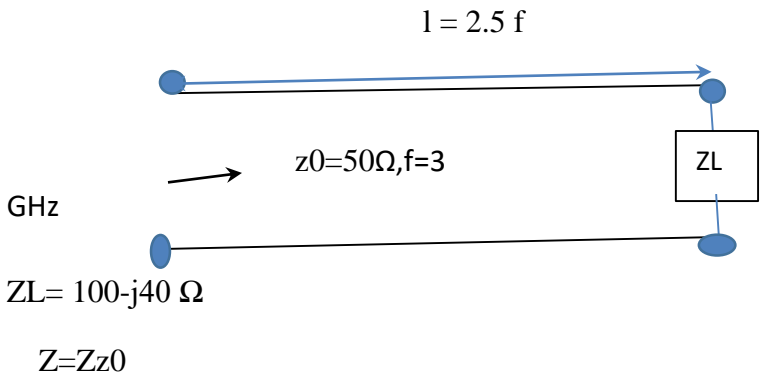


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4	Write the generalized Maxwell's Equation in point form and integral form.	U	2
5	Derive Maxwell's equations in integral & Point form for time varying fields.	U	2
6	Starting with Maxwell's equations derive the expression for the wave equation for an electromagnetic wave propagating in a perfect dielectric.	Ap	2
<b>Module 3 (Transmission Line)</b>			
1	Draw the following on the smith chart. The normalizing impedance is $50 \Omega$ . (a). $50+j75 \Omega$ , (b). $10+j0 \Omega$ (c). $0-j80 \Omega$ (d). reflection coefficient $\Gamma = 0.3 \angle 60^\circ$ . (e). constant VSWR circle for $\rho = 2.5$ (f). minimum resistance point on the constant VSWR circle for $\rho = 1.5$	Ap	3
2	A $50 \Omega$ loss less transmission line is terminated by a load impedance $Z_L = 50-j75 \Omega$ . If the incidence power is 100 mW, find the power dissipated by the load.	Ap	3
3	Two lossy lines are to be joined by end to end. The first line is 10 m long and has a loss rating of 0.20 dB/m. The second line is 15 m long and has a loss rating of 0.10 dB/m. The reflection coefficient at the junction (line 1 to line 2) is $\Gamma = 0.30$ . The input power to (to line 1) is 100 mW. (a) Determine the total loss of the combination in dB. (b). Determine the power transmitted to the output end of line 2.	Ap	3
4	The transmission line is connected to a transmission line load impedance $10+j20$ at 2 GHz. Find the reflection coefficient (i) at the load end of the line (ii) at a distance of 20 cm from the load.	Ap	3
5	A $50 \Omega$ line is terminated in a load impedance $25+j35 \Omega$ . With the help of the smith chart find (i) reflection coefficient and impedance at a distance of $0.2\lambda$ from the load end of the line (ii) VSWR on the line.	Ap	3



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6	<p>Find the following parameters from the smith chart. (i) Reflection coefficient (ii) VSWR and (iii) input impedance</p>  <p style="text-align: center;"><math>l = 2.5 \lambda</math></p> <p style="text-align: center;"><math>z_0 = 50 \Omega, f = 3</math> GHz</p> <p style="text-align: center;"><math>Z_L = 100 - j40 \Omega</math></p> <p style="text-align: center;"><math>Z = Zz_0</math></p>	Ap	3
7	<p>A <math>50 \Omega</math> loss less transmission line is connected to a load of <math>50 + j50 \Omega</math>. The maximum voltage measured on the line is 50 v. Find the power delivered to the load and the peak voltage at the other load end of the line.</p>	Ap	3
8	<p>Write a short note on transmission line.</p>	U	3
9	<p>Derive the transmission line impedance equation.</p>	An	3
<b>Module 4 (Basic of Antenna and wave propagation)</b>			
1	<p>Explain isotropic antenna, Omni-directional antenna and directional antenna.</p>	U	4
2	<p>The normalized radiation intensity of an antenna is given by</p> $U = \sin\theta * \sin\phi \quad 0 \leq \theta \leq \pi, 0 \leq \phi \leq \pi$ $= 0 \quad \text{elsewhere}$ <p>Find: (I) exact directivity</p> <p>(II) Azimuth and elevation plane HPBW in degrees</p>	Ap	4



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3	Explain polarization of an antenna.	U	4
4	Show that the directivity of an isotropic antenna is unity.	<u>U</u>	4
5	Explain the mechanism of Ionospheric propagation. Define critical frequency, MUF and OMF.	<u>U</u>	4
6	Explain the antenna radiation regions (near field, inductive field and radiation field related to antenna).	<u>U</u>	4
7	What is reactive near field. Explain its importance in communication and its applications.	<u>U</u>	4
8	Describe ground wave propagation.	<u>U</u>	4
9	Describe space wave propagation.	<u>U</u>	4
10	Derive the relation for maximum distance between transmitting and receiving antenna (Earth is assumed to be flat) for space wave propagation.	An	4
11	Explain sky wave propagation. Draw the labelled diagram of the ionosphere.	<u>U</u>	4
12	Explain the formation of inversion layer in troposphere.	<u>U</u>	4
13	Enlist the antenna parameters and define it.		4
14	An antenna has a directivity of 20 and a radiation efficiency of 90%. Calculate the gain in dB.	Ap	4
15	Find the gain of an antenna when physical aperture is $5 \text{ m}^2$ at 2 GHz with efficiency of 70%.	Ap	4
16	Derive Friss transmission formula. State its significance in wireless communication.	An	4
	<b>Module 5 (Wire elements and antenna array)</b>		



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1	Explain single wire radiation mechanism.	1	5
2	With neat sketch, describe formation and detachment of electric field lines for short dipole.	2	5
3	With respect to elements of Yag-Uda antenna, describe how radiation pattern can be modified.	3	5
4	With input impedance expression, explain folded dipole antenna.	4	5
5	Explain pattern multiplication of antenna array.	5	5
6	Explain in detail dipole antenna.	6	5
7	Compare Dipole, Monopole and Folded dipole antennas.	7	5
8	Derive radiation resistance of infinitesimal dipole.	8	5
9	Write short note on the following a. Log periodic antenna b. Yagi-uda Antenna	9	5
10	Compare Broadside and End fire array.	10	5
11	Derive radiation resistance of small dipole. Explain its significance	11	5
12	Find the radiation pattern of an array of 4 element fed with same amplitude and opposite phase. find its HPBW AND BWFN.	12	5
13	Explain important features of loop antenna. Discuss use of loop antenna in radio direction finding.	13	5
14	Drive an expression for array of two isotropic sources with same amplitude and in phase.	14	5



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15	Derive an expression for array factor of N element linear array, where all elements are equally fed and spaced. Also find the expression for the position of principle maxima, null and secondary maxima.	15	5
16	What is folded antenna? Draw its typical structure explain working mechanism. Give its advantages.	16	5
17	Compare broadside and End fire array.	17	5
18	Derive radiation resistance of small dipole. Explain its significance.	18	5
19	Derive expression of radiation resistance of half wavelength dipole antenna. Why, actual length of half wavelength dipole antenna is lies between $0.47 \lambda$ to $0.48 \lambda$ instead of $0.5 \lambda$ .	19	5
20	A lossless resonant half wavelength dipole antenna, with input impedance of 73 ohms, is connected to a transmission line whose characteristic impedance is 50 ohms. Assuming that the pattern of the antenna is given approximately by $U = U_0 \sin^3 \theta$ . Find the maximum absolute gain of this antenna.	20	5
21	Design a 6 element Yagi-uda antenna with folded dipole to provide a gain of 12 dBi if the operating frequency is 500 MHz.	21	5
<b>Module 6 (Aperture and Patch Antenna)</b>			
1	What are the feed mechanism of microstrip antenna, explain anyone?	U	6
2	With neat sketch explain horn antenna also describe how radiation pattern can be modified using physical dimensions of the same antenna.	U	6



**Department of Electronics and Telecommunication Engineering**

3	Design circular microstrip antenna for 10 GHz frequency application using substrate $\epsilon_r = 2.2$ with thickness of 1.588 mm.	Ap	6
4	Design circular microstrip antenna for 2.45 GHz frequency application using FR4 substrate $\epsilon_r = 4.4$ with thickness of 1.6 mm.	Ap	6
5	Draw the structure of microstrip antenna, discuss its characteristics, limitations and applications.	U	6
6	Write short note on the following a. Microstrip antenna b. Principle of parabolic reflector antenna. c. Horn antenna. d. Different feeding method of MSA	U	6
7	Describe parabolic reflector antenna and its different feeding method.	U	6
8	Design a rectangular microstrip antenna of 2.45 GHz operating frequency considering FR4 substrate with $\epsilon_r = 4.4$ with thickness of 1.6 mm.	Ap	6
9	Design rectangular microstrip antenna for 2.4GHz frequency applications using rogers RT/Duroid 5880 substrate of thickness of 1.6 mm.	Ap	6
10	List salient features of microstrip antenna.	U	6
11	Explain the working of MSA with the help of transmission line model. Also, give its specifications.	U	6



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12	Explain the corner and plane reflector. List their application.	U	6
13	Discuss the cassegrain method of feeding parabolic reflectors.	U	6





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### Department of Electronics and Telecommunication Engineering

Academic Year 2021-22

Semester: VII

Year: TY

Subject: IOT and Industry 4.0

Course Code: 1UEXDLC6052

#### Question bank

Sr. No	Question	BT Level	CO
<b>1</b>	<b>Module:01 Introduction to IoT</b>		<b>1</b>
1	Discuss the characteristics of IoT.	U	
2	Explain Physical design of IoT.	U	
3	Describe, Logical design of IoT.	U	
4	Differentiate between IoT and M2M communication.	An	
5	Discuss Functional Blocks of IoT	U	
6	List sources of IoT.	U	
7	Explain IoT Design Methodology with flow diagram.	U	
		U	
<b>2</b>	<b>Module:02 . Network &amp; Communication aspects</b>		<b>2</b>
1	Describe protocols used in Link Layer.	U	
2	Describe protocols used in the link layer.	U	
3	Describe the protocols used in the network/Internet layer.	U	
4	Describe the protocols used in the application.	U	
5	Describe the protocols used in Transport layer.	U	
6	Explain IoT enabling technologies.	U	
7	Explain RESTful environment for IoT.	U	
8	Discuss web socket architecture in detail.	U	
9	Explain Gateway for IoT with architecture.	U	
10	Discuss MQTT protocol structure.	U	
11	Discuss CoAP architecture with message format in detail	U	
12	Describe Modified OSI Model for the IoT/M2M Systems	U	
13	Describe TU-T Reference Mode	U	
14	Describe ETSI M2M Domains and High-level Capabilities	U	
15	Write a note on communication gateway.	U	
16	Write a note on SOAP	U	
17	Describe REST/RESTful.	U	
18	Describe HTTP.	U	
19	Compare Rest and Restful environment.	An	

<b>3</b>	<b>Module :03 . Data Management and Analytics for IoT</b>		<b>3</b>
1	Describe Apache Hadoop architecture with diagram.	U	
2	Explain HDFS in detail with diagram.	U	
3	Explain YARN in detail with diagram.	U	
4	Define MapReduce process for Batch Data Analysis.	U	
5	Classify Apache Oozie, Apache Spark, Apache Storm,	An	
6	Discuss Apache Storm for Real-time Data Analysis	U	
7	Differentiate between Hadoop 1.0 and Hadoop 2.0	An	
8	Discuss Chef case study	U	
9	Discuss Puppet case study	U	
10	Discuss NETCONG-YANG case study	U	
<b>4</b>	<b>Module 04: Introduction to Industry 4.0</b>		<b>4</b>
1	Introduce industry 4.0	U	
2	Explain industry 4.0 revolution	U	
3	What is Industrial Internet?	U	
4	Compare Industry 4.0 and IIoT	U	
5	Define the Conceptual framework for Industry 4.0	U	
6	Discuss the Business model for Industry IoT.	U	
7	Describe Reference architecture with diagram.	U	
8	Discuss CPS (Cyber Physical System) in detail.	U	
9	Describe Next Generation Sensors.,	U	
10	Discuss different Collaborative Platforms for industry 4.0	U	
11	Explain and Product Lifecycle Management in context of industry 4.0	U	
12	Differentiate between Augmented Reality and Virtual Reality	An	
13	Explain Augmented Reality for industry 4.0 with block diagram	U	
14	Explain Virtual Reality for industry 4.0 with block diagram	U	
15	State applications of Augmented Reality	U	
16	State applications of Virtual Reality	U	
<b>5</b>	<b>Module 05: Introduction to Industrial IoT (IIoT)</b>		<b>5</b>
1	List Industrial IoT- Applications in Healthcare domain.	U	
2	List Industrial IoT- Applications in Power Plants domain.	U	
3	List Industrial IoT- Applications in Inventory Management & Quality Control domain.	U	
4	List Industrial IoT- Applications in Plant Safety and Security domain.	U	
5	List Industrial IoT- Applications in Facility Management domain.	U	
6	Discuss the importance of Artificial Intelligence in IIoT.	U	
7	Describe the role of cyber security in Industry 4.0	U	
<b>6</b>	<b>Module 06 : Industry 4.0 Technologies and Applications</b>	<b>6</b>	<b>6</b>
1	Explain an important for businesses of today and future.	U	
2	Describe the four market drivers which have amplified the integration of IoTs within current economic systems.	U	
3	Discuss IoTs Value Creation in Agriculture industry.	U	

4	Discuss IoTs Value Creation for smart city concept.	U	
5	Discuss IoTs Value Creation in wearable technologies	U	
6	Discuss IoTs Value Creation in Health industry	U	
7	Describe IoTs Value Creation Barriers.	U	



**Department of Electronics and Telecommunication Engineering**

**Academic Year 2021-22**

**Semester: VI**

**Year: TY**

**Subject: Image Processing and Machine Vision**

**Course Code:1UEXC603**

**Question bank**

<b>Question No.</b>	<b>Module-I(Digital Image Fundamentals and Processing)</b>	<b>BT Level</b>	<b>CO</b>
1	Explain the relation of pixels with respect to its neighbors.	U	1,2
2	Explain the different steps in Image Processing with a diagram.	U	1,2
3	What are different components of image processing? Explain in brief.	U	1,2
4	What do you mean by size of an image and resolution of an image? Explain with an example.	U	1,2
5	What is sampling and quantization of an image? Explain with a neat diagram.	U	1,2
6	What is sampling and quantization of an image? Explain with a neat diagram.	U	1,2
7	Compare Point processing methods and neighborhood processing? Give examples for both.	U	1,2
8	What is Bit Plane Slicing? Explain bit plane slicing with a 4x4 image.	U	1,2
9	Prove that the equalized histogram follows uniform distribution.	U	1,2
10	What is the histogram of an image? What information do you get from the histogram?	U	1,2
11	What is histogram equalization? What changes are observed in the image output after applying equalization?	U	1,2
12	The equalized histogram of an image is not perfectly uniform. State whether the statement is true or false and justify your answer.	U	1,2
13	What is piecewise linear transformation? When is it used?	U	1,2
14	What is Gray Level Slicing? Explain with an example	U	1,2
15	.What is histogram specification? Explain with transformation functions.	U	1,2
	<b>Module –II (Image Enhancement with Time Domain and Frequency Domain Filters)</b>		
1	Explain the low pass filters used for image enhancement in the spatial domain.	U	2,3



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2	Compare the high pass and low pass filters with respect to their performance. What changes in the image do you observe? Write the masks for both filters.	U	2,3
3	What is salt and Pepper Noise? Draw the PDF of the same and explain how it can be eliminated from the image?	U	2,3
4	What do you mean by Gradient operator and Laplacian operator? Derive the masks for both.	U	2,3
5	Explain any three types of point processing techniques and their applications with examples.	U	2,3
6	What are the similarities and differences between Gradient operator and Laplacian operator?	U	2,3
7	What do you mean by Unsharp masking and High Boost filtering? What are their applications?.	U	2,3
8	What is segmentation? What are the rules followed when defining regions of an image?	U	2,3
9	Draw the profiles of a line and an edge and draw the responses when a first order and second order derivative is operated on both.	U	2,3
10	Justify why median filter is better suited for image affected with Salt-Pepper noise	U	2,3
11	Explain repetitive equalization of image produces the same results. True or false. Justify.	U	2,3
12	Explain any two properties of 2 –D Fourier transform	U	2,
13	Explain separable & convolution properties of Fourier transform	U	2,
14	Explain the basic block diagram for image enhancement in frequency domain	U	2
15	Explain the ideal low pass & high pass filter What is its drawback	U	2
16	Explain the Butterworth low pass & High pass filter.	U	2
17	Explain the Gaussian low pass & high pass filters	U	2,3
18	Explain the Gaussian low pass & high pass filters	U	2,3
19	It is difficult to threshold a poorly illuminated image. State whether the statement is true or false and justify your answer	U	2,3
20	What are different sensors used in practice? Explain in brief.	U	1,2
21	Write short notes on Intensity Resolution and Spatial Resolution Isopreference curves	U	1,2



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	Photoscopic and Scotopic vision Types of sensors and image acquisition. Averaging filters		
22	Problems based on Image Enhancement	Ap	2,3
<b>Module –III Image Morphology and Restoration</b>			
1	Explain dilation and erosion.	U	3
2	Describe opening and closing	U	3
3	Problems on dilation and erosion	Ap	3
4	Problems on opening and closing	Ap	3
5	Explain Hit-Miss Transform	U	3
6	Problems on Hit - Miss Transform	Ap	3
7	Explain region filling	U	3
8	Problems on region filling	Ap	3
9	Explain boundary extraction , thinning and thickening	U	3
10	Demonstrate image degradation with neat block diagram	U	4
11	Discuss in detail about inverse filters.	U	4
12	Explain the noise models under image restoration	U	4
13	Explain in detail about the band reject filter	U	4
14	Compare the spatial domain filters and frequency domain filters used in Image restoration	U	4
15	Discuss the principal techniques to estimate the degradation function for the image restoration.	U	4
16	Explain how inverse filters are used for image restoration.	U	4
17	Distinguish between Image Enhancement & image restoration.	U	4
18	Problems on Image Restoration and Morphology	Ap	3,4
<b>Module IV (Image Segmentation)</b>			
1	Discuss about point, line and edge detection used for image segmentation	U	2,3
2	Demonstrate how Laplacian operators are invariant to rotation.	U	2,3



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3	Explain how the graph theoretic technique is used for edge linking with example	U	2,3
4	Describe the Hough transform implementation for edge linking Explain the process of edge linking using local processing	U	2,3
5	Explain region growing, splitting and region merging methods for image segmentation..	U	2
6	Explain the LOG operator.	U	2,3
7	What is thresholding ? How it is used in image segmentation	U	2
8	Explain the role of illumination in thresholding	U	2
9	Explain the local adaptive thresholding	U	2
10	Explain the basic global thresholding	U	2
11	Explain the optimal global adaptive thresholding	U	2
12	Write short note on Hough transform	U	2,3
13	Problems on Region Growing, Region splitting	Ap	2
14	Problems on Graph Theoretic technique and Hough transform	Ap	3
15	All the problems related to image segmentation	Ap	2,3
<b>Module – V (Introduction to Machine Vision and Descriptors)</b>			
1	Explain the boundary descriptors.	U	5
2	Discuss about different boundary representations	U	5
3	Discuss the regional descriptors	U	5
4	How the texture analysis is carried out using the co-occurrence matrix	U	5
5	Explain the importance of image representation and description	U	5
6	Discuss the texture based classification for image description	U	5
7	Explain the chain code with an example.	U	5
8	Discuss about the Fourier descriptors	U	5
9	Write a short note on Boundary segments	U	5
10	Problems based on Boundary Descriptors	Ap	5
11	What do you understand by signatures? How they are used for image representation	U	5



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12	Describe topological descriptors	U	5
<b>Module VI (Machine Vision Algorithms)</b>			
1	Explain the different techniques of knowledge representation	U	6
2	Explain the classification principle for machine learning algorithm	U	6
3	Explain the classifier Design .	U	6
4	Describe the classifier learning algorithm.	U	6
5	Explain the K nearest neighborhood algorithm for classification	U	6
6	What is the confusion matrix and how is it evaluated? Explain the significance	U	6
8	Explain the Bayes decision theory continuous case,	U	6
9	Explain the Maximum Likelihood Classification	U	6
10	Discuss the Bayesian classifier	U	6
11	What is Support Vector Machine, Explain the SVM classifier	U	6
12	What is supervised classification? Explain with example	U	6
13	What is unsupervised classification? Explain with example	U	6
14	Compare Supervised and Unsupervised Classification	U	6





**Machine Learning (1UEXC602)**

**Academic year 2021-22**

**Course Outcomes:**

1. Explain the concepts related Machine Learning
2. Mathematically analyse various machine learning approaches and paradigms
3. Compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach
4. Deploy machine learning algorithms using various evaluation techniques.
5. Implement supervised and unsupervised machine learning algorithms for real-world applications, while understanding the strengths and weaknesses.
6. Fine tune machine learning algorithms and evaluate models generated from data

No.	Question	BT	CO
<b>Module 1 (Introduction)</b>			
1	Define Machine Learning. Explain how machine learning is different than conventional programming?	An	1
2	What are the types of Machine Learning? Explain the types in brief with examples.	U	1
3	Explain Supervised Learning with example.	U	1
4	Explain Unsupervised Learning with example.	U	1
5	Explain Reinforcement Learning with example.	U	1
6	Write applications of machine learning in different domain. Elaborate with example, how machine learning is useful in solving the problem.	U	1
7	Differentiate between Supervised and Unsupervised Learning.	U	1
8	Differentiate between the Supervised, Unsupervised and Reinforcement Learning with example.	U	1
9	What type of machine learning problem is, a) Predicting the survival of a passenger in the Titanic disaster b) Recognizing handwritten digit c) Forecasting sales for next 6 months for D-Mart d) Suggesting songs on Spotify e) Identifying a fraudulent transaction	An	3
<b>Module 2 (Linear Regression)</b>			
1	Write expression for hypothesis, cost function and for parameter using gradient	U	1

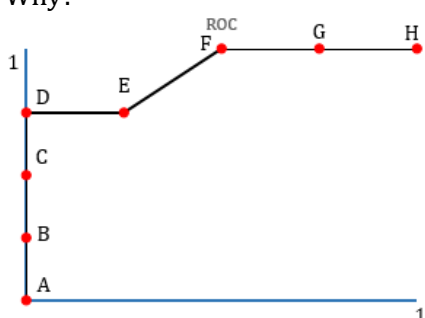
	descent for univariate linear regression. Explain each term in short.																																			
2	Write expression for hypothesis, cost function and for parameter using gradient descent for multivariate linear regression. Explain each term in short.	U	1																																	
3	Illustrate process of learning with the gradient descent for a univariate linear regression, using a bell shaped error curve. Explain how a step size is modulated on every iteration.	An	2																																	
4	Write short note on learning rate. Explain how it affects convergence with example.	U	6																																	
5	<table border="1" data-bbox="279 495 675 894"> <thead> <tr> <th>Height</th> <th>Weight</th> </tr> </thead> <tbody> <tr><td>174.706</td><td>73.62273</td></tr> <tr><td>188.2397</td><td>96.49755</td></tr> <tr><td>182.1967</td><td>99.8095</td></tr> <tr><td>177.4998</td><td>93.59862</td></tr> <tr><td>170.8227</td><td>69.04222</td></tr> <tr><td>174.7141</td><td>83.42822</td></tr> <tr><td>173.6052</td><td>76.19035</td></tr> <tr><td>170.2281</td><td>79.80019</td></tr> <tr><td>161.1795</td><td>70.94164</td></tr> <tr><td>180.8363</td><td>84.6425</td></tr> </tbody> </table> <p>The dataset is the records of the height and weight of the employees in a company. Find the predicted weight for the employees with <math>\theta_0 = 0.44</math> and <math>\theta_1 = 1.68</math>. Calculate the squared root error. Also calculate values <math>\theta_0</math> and <math>\theta_1</math> of after an iteration of gradient descent optimization.</p>	Height	Weight	174.706	73.62273	188.2397	96.49755	182.1967	99.8095	177.4998	93.59862	170.8227	69.04222	174.7141	83.42822	173.6052	76.19035	170.2281	79.80019	161.1795	70.94164	180.8363	84.6425	A	5											
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6	<table border="1" data-bbox="279 1066 540 1283"> <thead> <tr> <th>X</th> <th>Y</th> </tr> </thead> <tbody> <tr><td>0</td><td>2</td></tr> <tr><td>1</td><td>3</td></tr> <tr><td>2</td><td>5</td></tr> <tr><td>3</td><td>4</td></tr> <tr><td>4</td><td>6</td></tr> </tbody> </table> <p>The values of independent variable x and dependent value y are given in the table above. Find the least square regression line <math>y=ax+b</math> after two iterations. Predict y when X is 10.</p>	X	Y	0	2	1	3	2	5	3	4	4	6	A	5																					
X	Y																																			
0	2																																			
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7	<table border="1" data-bbox="279 1423 1242 1535"> <tbody> <tr> <td>y</td> <td>1.45</td> <td>1.93</td> <td>0.81</td> <td>0.61</td> <td>1.55</td> <td>0.95</td> <td>0.45</td> <td>1.14</td> <td>0.74</td> <td>0.98</td> </tr> <tr> <td>x</td> <td>0.58</td> <td>0.86</td> <td>0.29</td> <td>0.2</td> <td>0.56</td> <td>0.28</td> <td>0.08</td> <td>0.41</td> <td>0.22</td> <td>0.35</td> </tr> <tr> <td>z</td> <td>0.71</td> <td>0.13</td> <td>0.79</td> <td>0.2</td> <td>0.56</td> <td>0.92</td> <td>0.01</td> <td>0.6</td> <td>0.7</td> <td>0.73</td> </tr> </tbody> </table> <p>Calculate hypothesis, squared error value and updated parameter values using gradient descent. Let <math>\theta_0 = 0.434</math>, <math>\theta_1 = 1.653</math> and <math>\theta_2 = 0.0039</math>.</p>	y	1.45	1.93	0.81	0.61	1.55	0.95	0.45	1.14	0.74	0.98	x	0.58	0.86	0.29	0.2	0.56	0.28	0.08	0.41	0.22	0.35	z	0.71	0.13	0.79	0.2	0.56	0.92	0.01	0.6	0.7	0.73	A	5
y	1.45	1.93	0.81	0.61	1.55	0.95	0.45	1.14	0.74	0.98																										
x	0.58	0.86	0.29	0.2	0.56	0.28	0.08	0.41	0.22	0.35																										
z	0.71	0.13	0.79	0.2	0.56	0.92	0.01	0.6	0.7	0.73																										
8	Explain polynomial regression in brief.	U	1																																	
9	Compare advantages and disadvantages of Normal Equation over Gradient Descent.	U	3																																	
10	<p>Solve the following problem using Normal Equation.</p> <table border="1" data-bbox="279 1745 672 1885"> <thead> <tr> <th><math>X_1</math></th> <th><math>X_2</math></th> <th>Y</th> </tr> </thead> <tbody> <tr><td>0</td><td>1</td><td>2</td></tr> <tr><td>1</td><td>-2</td><td>3</td></tr> <tr><td>2</td><td>1</td><td>5</td></tr> </tbody> </table>	$X_1$	$X_2$	Y	0	1	2	1	-2	3	2	1	5																							
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3	3	4																																									
4	-1	6																																									
11	What is feature scaling? Write significance of feature scaling in machine learning.	U	6																																								
<b>Module 3 (Logistic Regression)</b>																																											
1	Write expression for hypothesis, cost function and for parameter using gradient descent for logistic regression. Explain each term in short.	U	1																																								
2	Explain logistic regression with an example.	U	1																																								
3	<table border="1"> <tr> <td>Age</td> <td>20</td> <td>32</td> <td>18</td> <td>29</td> <td>47</td> <td>45</td> <td>46</td> <td>48</td> <td>45</td> </tr> <tr> <td>Salary</td> <td>8600</td> <td>1800</td> <td>8200</td> <td>8000</td> <td>2500</td> <td>2600</td> <td>2800</td> <td>2900</td> <td>2200</td> </tr> <tr> <td></td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Bought</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> </tr> </table> <p>The above data shows the database of an automobile company whether a person with the given age and salary has bought a car or not. For <math>\theta_0 = 0.0002</math>, <math>\theta_2 = -10</math>, calculate predicted value, error and updated value of <math>\theta</math> using logistic regression after an iteration.</p>	Age	20	32	18	29	47	45	46	48	45	Salary	8600	1800	8200	8000	2500	2600	2800	2900	2200		0	0	0	0	0	0	0	0	0	Bought	0	0	0	0	1	1	1	1	1	A	5
Age	20	32	18	29	47	45	46	48	45																																		
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	0	0	0	0	0	0	0	0	0																																		
Bought	0	0	0	0	1	1	1	1	1																																		
4	Explain KNN in brief.	U	1																																								
5	<table border="1"> <tr> <td>Age</td> <td>20</td> <td>32</td> <td>18</td> <td>29</td> <td>47</td> <td>45</td> <td>46</td> <td>48</td> <td>45</td> </tr> <tr> <td>Salary</td> <td>8600</td> <td>1800</td> <td>8200</td> <td>8000</td> <td>2500</td> <td>2600</td> <td>2800</td> <td>2900</td> <td>2200</td> </tr> <tr> <td></td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Bought</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> </tr> </table> <p>Using KNN, predict whether a person with age 27 and salary 67000 will buy a car or not. Consider <math>k=3</math>;</p>	Age	20	32	18	29	47	45	46	48	45	Salary	8600	1800	8200	8000	2500	2600	2800	2900	2200		0	0	0	0	0	0	0	0	0	Bought	0	0	0	0	1	1	1	1	1	A	5
Age	20	32	18	29	47	45	46	48	45																																		
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	0	0	0	0	0	0	0	0	0																																		
Bought	0	0	0	0	1	1	1	1	1																																		
6	Explain following concepts with an example, a) Margin b) Maximal Margin Classifier c) Soft Margin Classifier d) Hyperplane e) Kernel	U	1																																								
7	Write expression for overall cost function in SVM. Explain the cost function with a graph. What is optimization objective of SVM and how is it achieved?	An	2																																								
8	Differentiate between logistic regression and SVM.	U	3																																								
9	Explain random forest in brief.	U	1																																								
10	Explain decision tree in brief.	U	1																																								
11	<table border="1"> <tr> <td>Refund</td> <td>Marital Status</td> <td>Taxable income</td> <td>Cheat</td> </tr> <tr> <td>Yes</td> <td>Single</td> <td>125k</td> <td>No</td> </tr> <tr> <td>No</td> <td>Married</td> <td>100k</td> <td>No</td> </tr> <tr> <td>No</td> <td>Single</td> <td>70k</td> <td>No</td> </tr> <tr> <td>Yes</td> <td>Married</td> <td>120k</td> <td>No</td> </tr> <tr> <td>No</td> <td>Divorced</td> <td>95k</td> <td>Yes</td> </tr> </table>	Refund	Marital Status	Taxable income	Cheat	Yes	Single	125k	No	No	Married	100k	No	No	Single	70k	No	Yes	Married	120k	No	No	Divorced	95k	Yes	A	5																
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	No	Married	60k	No		
	Yes	Divorced	220k	No		
	No	Single	85k	Yes		
	No	Married	75k	No		
	No	Single	90k	Yes		

Write and explain decision tree for the above transaction.

**Module 4 (Deployment of Machine Learning Algorithm)**

1	Define overfitting and underfitting. How to evaluate a ML model for overfitting or underfitting, explain using diagram? What measures need to be taken in case of overfitting and underfitting?	U	4
2	Why the dataset need to be split into training set, cross validation and test set. Write the ratio of division of the dataset.	U	4
3	Explain Confusion Matrix with an example.	U	4
4	Draw a confusion matrix for a ML model that predicted 97 non spam and 17 spam mail correctly, while 4 non spam and 7 spam mail incorrectly. Calculate accuracy, precision, recall, F1 score.	A	4
5	Define a) Accuracy b) Precision c) Recall d) F1-Score e) Specificity	R	4
6	Define ROC. Which of the following point on ROC gives the best threshold for the application that predicts if the patient can be discharged after Covid treatment? Why? 	An	4
7	Define ROC. What is the significance of ROC-AUC with an example.	U	4
8	Explain confusion matrix for multiclass classification with an example of 3 classes.	U	4

**Module 5 (Unsupervised Learning)**

1	Differentiate between Supervised Learning and Unsupervised Learning	U	3
2	Explain the types of Unsupervised Learning with example.	U	1
3	Explain clustering with an example.	U	2
4	Explain agglomerative clustering with example.	U	1

5	Dist	A	B	C	D	E	F	A	5
	A	0.00	0.71	5.66	3.61	4.24	3.20		
	B	0.71	0.00	4.95	2.92	3.54	2.50		
	C	5.66	4.95	0.00	2.24	1.41	2.50		
	D	3.61	2.92	2.24	0.00	1.00	0.50		
	E	4.24	3.54	1.41	1.00	0.00	1.12		
	F	3.20	2.50	2.50	0.50	1.12	0.00		
Perform hierarchical clustering on the above example.									
6	Use the k-means algorithm and Euclidean distance to cluster the following 8 examples into 3 clusters: A1=(2,10), A2=(2,5), A3=(8,4), A4=(5,8), A5=(7,5), A6=(6,4), A7=(1,2), A8=(4,9).							A	5
7	Write short note on dimensionality reduction.							U	1
8	Define dimensionality reduction. Write advantages of dimensionality reduction.							U	1
9	Write short note on Principal Component Analysis.							U	1
10	Write PCA algorithm using mathematical expressions.							U	2
<b>Module 6 (Advanced Machine Learning Algorithms)</b>									
1	Explain anomaly detection with an example.							U	1
2	Write algorithm for anomaly detection							U	2
3	How to evaluate the anomaly detection model.							U	6
4	Differentiate between Anomaly Detection and Supervised Learning							U	3
5	What are the different methods used for unsupervised learning for anomaly detection. Explain with examples.							U	1
6	Explain recommender system with an example.							U	1
7	Explain how large dataset is useful in machine learning? What is the problem with large dataset in gradient descent? How large datasets are dealt with in gradient descent.							An	5
8	Write short note on online learning.							U	1
9	Explain map reduce and data parallelism.							U	5