Swami Keshvanand Institute of Technology,
Management & Gramothan

(Accredited by NAAC with 'A^{++}' Grade)

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Affiliated to Rajasthan Technical University, Kota

1.1.2 Midterm Paper & Solution (Sample)

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Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur

I Mid Term Examination, September-2022

Semester:	III	Branch:	ME, EC, CE
Subject:	AEM-I	Subject Code:	3ME2-01, 3EC2-01, 3CE2-01
Time:	1.5 Hours	Maximum Marks:20	
Session (I/II/III): II			

PART A (short-answer type questions)
(All questions are compulsory) (3*2=6)

Q.1 State Fundamental Theorem of Finite Difference Calculus.

Q.2 Write the formulae of Simpson 1/3 rule and Simpson 3/8 Rule.

Q.3 Find the approximate value of the real root of the equation $x^3 - 3x + 4 = 0$, using the method of false position.

PART B (Analytical/Problem solving questions)
(Attempt any 2 Questions) (2*4=8)

Q.4 From the following table find the number of students who obtained

(a) Less than 45 marks (b) More than 45 marks

Marks obtained	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

Q.5 Evaluate $\int_4^{5.2} \log_e x dx$, by Trapezoidal Rule.

Q.6 Given $\frac{dy}{dx} = 1 + xy$ with initial condition that y = 1 at x = 0,

Compute y(0.1) Correct to four places of decimal by using Taylor Series Method.

PART C (Descriptive/Analytical/Problem solving/Design questions)

(Attempt any 1 Question) (1*6=6)

Q.7 Evaluate $\frac{dy}{dx}$ at x = 0.1 and x = 0.5 from the following data-

x	0	0.1	0.2	0.3	0.4	0.5	0.6
f(x)	30.28	31.43	32.98	33.54	33.97	33.48	32.13

Q.8 Use Runge Kutta method to solve $\frac{dy}{dx} = x + y,\ x_0 = 1, y_0 = 0$

for x=1.1 with h = 0.1

Swami Keshvanand Institute of Technology, Management & Gramothan,
Ramnagaria, Jagatpura, Jaipur-302017

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Solution of Question Paper

I Mid-Term Examination, Sept. -2022

Branch/Semester: EC, ME, CE, III	Subject: AEM-I	Subject Code: 3EC201, 3ME201, 3CE201
Duration: 1.5 hours	Date: 29.9.22 Session (I/II/III): II	Max Marks: 20
Submitted By: Dr. Jyoti Arora		

Part-A

1. If $f(x)$ is a polynomial of n^{th} degree in x, then the n^{th} difference of $f(x)$ is constant [2]

i.e $\Delta^n f(x) = \text{Constant} = \lfloor n \, a_n h$

and $\Delta^{n+1} f(x) = 0$

2. Simpson 1/3 Rule [2]

$$\int_{x_0}^{x_n} y \, dx = \frac{h}{3}\left[(y_0 + y_n) + 4(y_1 + y_3 + y_5 + \cdots + y_{n-1}) + 2(y_2 + y_4 + \cdots + y_{n-2})\right]$$

Simpson 3/8 Rule

$$\int_{x_0}^{x_n} y \, dx = \frac{3h}{8}\left[(y_0 + y_n) + 3(y_1 + y_2 + y_4 + y_5 + \cdots + y_{n-1}) + 2(y_3 + y_6 + y_9 + \cdots + y_{n-3})\right]$$

3. Let $f(x) = x^3 - 3x + 4 = 0$ [2]

$f(-2) = 2$ and $f(-3) = -14$

$\therefore$ Root will lie between -2 and -3.

let $x_1 = -2$, $x_2 = -3$

$$x_3 = \frac{x_1 f(x_2) - x_2 f(x_1)}{f(x_2) - f(x_1)} = \frac{-34}{16} = -2.125$$

Solution of Question Paper

I Mid-Term Examination, Sept. -2022

Branch/Semester: EC, ME, CE, III	Subject: AEM-I	Subject Code: 3CE201, 3ME201, 3EC201
Duration: 1.5 hours	Date: 29.9.22 Session (I/II/III): II	Max Marks: 20
Submitted By: Dr. Jyoti Arora		

also $f(-2.125) = 0.779$ (+ve)

$\therefore$ Root lies b/w -2.125 and -3

2. Taking $x_2 = -2.125$ and $x_3 = -3$

$$x_4 = \frac{x_2 f(x_3) - x_3 f(x_2)}{f(x_3) - f(x_2)}$$

$$= -2.171$$

which is the required root. [4]

Part-B

4.

x	y	I	II	III	IV
40	31				
		42			
50	73		9		
		51		−25	
60	124		−16		37
		35		12	
70	159		−4		
		31			
80	190				

$$x = x_0 + uh$$

$$45 = 40 + u \times 10 \quad = 0.5$$

NG Forward Interpolation formula

$$y = y_0 + u\Delta y_0 + \frac{u(u-1)}{\lfloor 2} \Delta^2 y_0 + \frac{u(u-1)(u-2)}{\lfloor 3} \Delta^3 y_0 + \frac{u(u-1)(u-2)(u-3)}{\lfloor 4} \Delta^4 y_0$$

Solution of Question Paper

I Mid-Term Examination, Sept. -2022

Branch/Semester: EC, ME, CE	Subject: AEM-I	Subject Code: 3EC2-01, 3ME2-01, 3CE2-01
Duration: 1.5 hours	Date: 29.9.22 Session (I/II/III): II	Max Marks: 20
Submitted By: Dr. Jyoti Arora		

$$y = 31 + 0.5 \times 42 + \frac{(0.5)(0.5-1)}{2} \times 9 + \frac{0.5(0.5-1)(0.5-2)}{\lfloor 3} \times -25$$

$$+ \frac{(0.5)(0.5-1)(0.5-2)(0.5-3)}{\lfloor 4} \times 37$$

$y = 47.8672 \cong 48$

No. of students who obtained less than 45 marks = 48

No. of students who obtained More than 45 marks = 190 − 48 = 142 Ans.

[4]

5.

x:	4	4.2	4.4	4.6	4.8	5	5.2
y:	1.3863	1.4351	1.4816	1.5260	1.5686	1.6094	1.6486

$h = \frac{b-a}{n}$

$h = \frac{5.2-4}{6}$

$h = 0.2$

By Trapezoidal Rule

$$I = \int_4^{5.2} \log_e x \, dx$$

$$= \frac{h}{2}\left[(y_0 + y_6) + 2(y_1 + y_2 + y_3 + y_4 + y_5)\right]$$

$$= 1.8276$$

By actual Integration

$$I = \int_4^{5.2} (\log_e x)\,dx = \left[x \log_e x - x\right]_4^{5.2}$$

$$= 1.8280 \quad \text{Ans.}$$

6. $\frac{dy}{dx} = 1 + xy$, $y(0) = 1 \Rightarrow x_0 = 0, y_0 = 1$ [4]

$$y' = 1 + 0 \times 1 = 1$$

$$y'' = y + x\frac{dy}{dx} = 1 + 0 \times 1 = 1$$

$$y''' = \frac{dy}{dx} + \frac{dy}{dx} + x\frac{d^2y}{dx^2}$$

$$= 2\frac{dy}{dx} + x\frac{d^2y}{dx^2} = 2 \times 1 + 0 \times 1 = 2$$

$$y^4 = 2\frac{d^2y}{dx^2} + \frac{d^2y}{dx^2} + x\frac{d^3y}{dx^3}$$

$$= 3\frac{d^2y}{dx^2} + x\frac{d^3y}{dx^3} = 3 \times 1 + 0 \times 2 = 3$$

$$y_1 = 1 + hy_0' + \frac{h^2}{\lfloor 2}y_0'' + \frac{h^3}{\lfloor 3}y_0''' + \frac{h^4}{24}y_0^4 + \cdots$$

$$= 1 + 0.1 \times 1 + \frac{(0.1)^2}{2} \times 1 + \frac{(0.1)^3}{\lfloor 3} \times 2 + \frac{(0.1)^4}{24} \times 3$$

$$y_1 = 1.1053 \quad \text{Ans.}$$

Solution of Question Paper

I Mid-Term Examination, Sept. -2022

Branch/Semester: EC, ME, CE, III	Subject: AEM-I	Subject Code: 3EC2-01, 3ME2-01, 3CE2-01
Duration: 1.5 hours	Date: 29.9.22 Session (I/II/III): II	Max Marks: 20
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Part-C [6]

(7)

x	y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$	$\Delta^5 y$	$\Delta^6 y$
0	30.28	1.15	0.40	−1.39	2.25	−3.90	6.4
0.1	31.43	1.55	−0.99	0.86	−1.65	2.5	
0.2	32.98	0.56	−0.13	−0.79	0.85		
0.3	33.54	0.43	−0.92	0.06			
0.4	33.97	−0.49	−0.86				
0.5	33.48	−1.35					
0.6	32.13						

for $x = 0.1$

let $x_0 = 0.1$

$$x = x_0 + uh$$

$$0.1 = 0.1 + u \times 0.1$$

$$\Rightarrow u = 0$$

$$(y')_{u=0} = \frac{1}{h}\left[\Delta y_0 - \frac{1}{2}\Delta^2 y_0 + \frac{1}{3}\Delta^3 y_0 - \frac{1}{4}\Delta^4 y_0 + \frac{1}{5}\Delta^5 y_0\right]$$

$$= \frac{1}{0.1}\left[1.55 - \frac{1}{2}\times -0.99 + \frac{1}{3}\times 0.86 - \frac{1}{4}\times -1.65 + \frac{1}{5}\times 2.5\right]$$

$$= 32.441667 \quad \text{Ans.}$$

for $x = 0.5$

let $x_n = 0.5$

$x = x_n + uh$

$0.5 = 0.5 + u \times 0.1$

$\Rightarrow u = 0$

$$(y')_{u=0} = \frac{1}{h}\left[\nabla y_n + \frac{1}{2}\nabla^2 y_n + \frac{1}{3}\nabla^3 y_n + \frac{1}{4}\nabla^4 y_n + \frac{1}{5}\nabla^5 y_n\right]$$

$$= \frac{1}{0.1}\left[-0.49 + \frac{1}{2}x - 0.92 + \frac{1}{3}x - 0.79 + \frac{1}{4}x 1.65 + \frac{1}{5}x - 3.9\right]$$

$= -24.0583$ Ans.

[6]

8. $f(x, y) = x + y$, $x_0 = 1$, $y_0 = 0$

Runge Kutta formula is

$$y_{n+1} = y_n + k$$

$$k = \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)$$

where $k_1 = hf(x_n, y_n)$

$k_2 = hf\left(x_n + \frac{h}{2}, y_n + \frac{k_1}{2}\right)$

$k_3 = hf\left(x_n + \frac{h}{2}, y_n + \frac{k_2}{2}\right)$

$k_4 = hf(x_n + h, y_n + k_3)$

Solution of Question Paper

I Mid-Term Examination, Sept. -2022

Branch/Semester: EC, CE, ME	Subject: AEMI	Subject Code: 3EC2-01, 3CE2-01, 3ME2-01
Duration: 1.5 hours	Date: 29.9.22 Session (I/II/III): II	Max Marks: 20
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$k_1 = hf(x_0, y_0)$

$= 0.1 f(1, 0)$

$= 0.1 (1 + 0)$

$k_1 = 0.1$

$k_2 = hf\left(x_0 + \frac{h}{2}, y_0 + \frac{k_1}{2}\right)$

$k_2 = 0.11$

$k_3 = hf\left(x_0 + \frac{h}{2}, y_0 + \frac{k_2}{2}\right)$

$k_3 = 0.1105$

$k_4 = hf(x_0 + h, y_0 + k_3)$

$k_4 = 0.12105$

$k = \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)$

$k = \frac{1}{6}(0.1 + 2 \times 0.11 + 2 \times 0.1105 + 0.12105)$

$k = 0.1103$

$y_1 = y_0 + k$

$= 0 + 0.1103$

$y_1 = 0.1103$ Ans. (at $x = 1.1$)

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I Mid Term Examination, Sept.-2022

Semester:	**VII**	**Branch:**	**ECE**
Subject:	**Cyber Security**	**Subject Code:**	**7CS6-60.2**
Time:	**1.5 Hours**	**Maximum Marks:**	**24**
Session (I/II/III): I			

PART A (short-answer type questions)

(All questions are compulsory)

Attempt all questions. **(4 x 2=8)**

1. Define cyber stalking?
2. Define Phishing and spamming.
3. State 5 cybercrimes which can happen against organization.
4. Write down the traditional and modern technique of credit card fraud.

PART B (Analytical/Problem solving questions)

(Attempt any 2 Questions) **(2*4=8)**

5. Explain the cloud computing and services provided by Cloud Computing?
6. Botnets are known as fuelforcybercrimes. Explain Botnet architecture.
7. Define Cyber criminals. Write down the cybercriminal attack technique.

PART C (Descriptive/Analytical/Problem solving/Design questions)

(Attempt any 1 Question) **(1*8=8)**

8. Explain the structure and offenses under Information Technology Act 2000.
9. Explainorganizationalsecuritypoliciesasmeasuresinmobilecomputingera

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Swami Keshvanand Institute of Technology, Management & Gramothan, Ramnagaria, Jagatpura, Jaipur-302017

Solution of Question Paper

I Mid-Term Examination, Sept. -2022

Branch/Semester: EC/VII	Subject: Cyber Security	Subject Code: 7CS6-60.2
Duration: 1.5 hours	Date:1/10/2022 Session (I/II/III): I	Max Marks:24
Submitted By: Dr. P.K.Jain Manju Choudhary		

Ans:1 Cyber Stalking:

- Stalking is the act of following a particular person for a long time. Usually, a stalker follows the following person everywhere and also threatened by repeatedly calling or sending messages.
- In cyberstalking, the stalking is done by using the internet or electronic media which involves sending emails and SMSs to that person or victim.
- Cyber stalkers take unfair advantage of the internet to keep them unidentified. The cyberstalking cases are going on increasing with the widespread internet boom.
- Cyberstalking is a serious crime and there are few provisions in India to deal with it.

Types of Cyber Stalking-

- Catfishing
- Monitoring location check-ins on social media
- Visiting virtually via Google Maps Street View
- Hijacking webcam
- Installing Stalker ware
- Looking at geotags to track location

Ans:2 Phishing and Spamming:

Phishing: It is believed that Phishing is an alternative spelling of "fishing," as in "to fish for information." Phishing (pronounced: fishing) is an attack that attempts to steal your money, or your identity, by getting you to reveal personal information -- such as credit card numbers, bank information, or passwords -- on websites that pretend to be legitimate.

Phishing attacks are the practice of sending fraudulent communications that appear to come from a reputable source. It is usually done through email. The goal is to steal sensitive data like credit card and login information, or to install malware on the victim's machine. Phishing is a common type of cyber attack that everyone should learn about in order to protect themselves.

Spamming:

- Spam is the abuse of electronic messages systems (including most broadcast media, digital delivery

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systems) to send **unsolicited bulk messages indiscriminately.**

- Spam is digital junk mail and unsolicited communications sent in bulk through an electronic messaging system.
- Unrequested, disruptive, and usually promotional, spam messages are designed to flood as many inboxes as possible. Traditionally, spam has been sent via email, but also includes SMS and social media messaging.
- People who create **electronic Spam** are called **spammers.**
- Similar abuses in other media: instant messaging Spam, Usenet newsgroup Spam, web search engine Spam, Spam in blogs, online classified ads Spam, mobile phone messaging Spam, social networking Spam, file sharing network Spam, video sharing sites, etc

Ans:3 State 5 cybercrimes which can happen against organization:

- Unauthorized accessing of computer
- Password sniffing
- Denial-of-service attacks
- Virus
- E-Mail bombing
- Salami attack
- Logic bomb
- Trojan horse
- Data diddling
- Industrial spying
- Crimes emanating from Usenet newsgroup
- Computer network intrusions

Branch/Semester: EC/VII	Subject: Cyber Security	Subject Code 7CS6-60.2
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Ans:4 Traditional and Modern Technique of credit card fraud:

TRADITIONAL TECHNIQUES

A. **APPLICATION FRAUD**-It is paper-based fraud.

- ID THEFT- Where an individual pretends to be someone else
- FINANCIAL FRAUD- Stealing a credit card is either by pickpocket or from postal service

2. **MODERN TECHNIQUES**

A. Triangulation- Using third party

B. Credit card generators-It facilitates generation of valid credit card numbers with expiry date

C. Skimming- Crooks use a small device to steal credit card information.

D. Site Cloning- Site cloning is creating a web page or the full website which is an exact replica of a reputed website.

Ans:5 Cloud Computing and Services provided by Cloud Computing are as follows:

- **Cloud computing:** Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software. Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it. Services can be both public and private—public services are provided online for a fee while private services are hosted on a network to specific clients. Cloud security has become an increasingly important field in IT.

Cloud Computing Services:

- **Infrastructure-as-a-service:** It is like Amazon Web services that provide virtual servers with unique IP address and blocks of storage on demand. Customers benefit from an Application Programmable Interface from which they can control their servers. As customers can pay for exactly the amount of service they use, like for electricity or water.
- **Platform-as-a-service:** It is a set of software and development tools hosted on the provider's

servers. Developers can create applications using the provider's API. Google Apps is one of the most famous PaaS providers. Developers should take notice that they are not any interoperability standards.

- **Software-as-a-service:** It is the broadcast market. In this the provider allows the customer only to use its applications. The software interacts with the user through a user interface. These application can be anything from Web-based E-Mail to applications such as Twitter or Last.fm.

Ans:6 Botnets are known as fuel for cybercrimes:

- A botnet (also known as a zombie army) is a number of Internet computers that, although their owners are unaware of it, have been set up to forward transmissions (including spam or viruses) to other computers on the Internet.
- The term botnet is derived from the words robot and network. A bot in this case is a device infected by malicious code, which then becomes part of a network, or net, of infected devices controlled by a single attacker or attack group.
- A bot is sometimes called a zombie, and a botnet is sometimes referred to as a zombie army. Both names (bot and zombie) imply the mindless automatic propagation of something malicious (malware) by agents that are possessed in some way (by the threat actor).
- The botnet malware typically looks for vulnerable devices across the internet, rather than targeting specific individuals, companies or industries.
- Objective for creating a botnet is to infect as many connected devices as possible and to use the computing power and resources of those devices for automated tasks that generally remain hidden to the users of the devices.
- For example, an ad fraud botnet that infects a user's PC will take over the system's web browsers to divert fraudulent traffic to certain online advertisements. However, to stay concealed, the botnet won't take complete control of the web browsers, which would alert the user.

Botnet Architecture-

- Once the desired number of devices is infected, attackers can control the bots using two different approaches.
- The traditional client-server approach involves setting up a command and control (C&C) server and sending automated commands to infected botnet clients through a communications protocol, such as Internet Relay Chat (IRC).

- The bots are often programmed to remain dormant and await commands from the C&C server before initiating any malicious activities.
- The other approach to controlling infected bots involves a peer-to-peer network. Instead of using C&C servers, a peer-to-peer (P2P) botnet relies on a decentralized approach. Infected devices may be programmed to scan for malicious websites or even for other devices in the same botnet. The bots can then share updated commands or the latest versions of the botnet malware.
- The P2P approach is more common today, as cybercriminals and hacker groups try to avoid detection by cybersecurity vendors and law enforcement agencies, which have often used C&C communications to monitor for, locate and disrupt botnet operations.

Ans:7 Cyber criminals, categories and Cybercriminal attack technique:

- Cybercriminals are individuals or teams of people who use technology to commit malicious activities on digital systems or networks with the intention of stealing sensitive company information or personal data, and generating profit.
- Cybercriminals are known to access the cybercriminal underground markets found in the deep web to trade malicious goods and services, such as hacking tools and stolen data.
- Laws related to cybercrime continue to evolve across various countries worldwide. Law enforcement agencies are also continually challenged when it comes to finding, arresting, charging, and proving cybercrimes.

Cyber Criminals' categorization-

Type I: Cybercriminals- hungry for recognition

- Hobby hackers
- IT professionals
- Politically motivated hackers
- Terrorist organizations

Type II: Cybercriminals- not interested in recognition

- Psychological perverts
- Financially motivated hackers
- State-sponsored hacking
- Organized criminals

Type III: cybercriminals- the insiders

- Former employees seeking revenge
- Competing companies using employees to gain economic advantage through damage and/or theft

Cybercriminal attack technique:

- Botnet - a network of software robots, or bots, that automatically spread malware.
- Fast Flux - moving data quickly among the computers in a botnet to make it difficult to trace the source of malware or phishing websites.
- Zombie Computer - a computer that has been hacked into and is used to launch malicious attacks or to become part of a botnet.
- Social Engineering - using lies and manipulation to trick people into revealing their personal information. Phishing is a form of social engineering.
- Denial-of-Service attacks - flooding a network or server with traffic in order to make it unavailable to its users.
- Skimmers - Devices that steal credit card information when the card is swiped through them. This can happen in stores or restaurants when the card is out of the owner's view, and frequently the credit card information is then sold online through a criminal community.

Answer 8:

Indian parliament passed the law-Information Technology Act, 2000. The **IT Act 2000** has been conceptualized on the **United Nations Commissions on International Trade Law** (UNCITRAL) model.

The Information Technology (IT) Act 2000 can be defined as: "to provide legal recognition for transactions carried out by means of electronic data interchange and other means of electronic communication, commonly referred to as "electronic commerce", which involve the use of alternatives to paper-based methods of communication and storage of information, to facilitate electronic filing of documents with the Government agencies and further to amend the Indian Penal Code, the Indian Evidence Act, 1872, the Bankers Books Evidence Act, 1891 and the Reserve Bank of India Act, 1934 and for matters connected therewith or incidental thereto.

The Act essentially deals with the following issues:

- Legal Recognition of Electronic Documents

- Legal Recognition of Digital Signatures
- Offenses and Contraventions
- Justice Dispensation Systems for cyber crimes

Structure of IT Act

(a) Contents

- The Information Technology Act, 2000 contains the following :-
- 13 chapters.
- 94 sections.
- 4 schedules.

(b) Sections

Some of the important sections of the IT Act 2000 are :-

- Section 1 to 14 Legal aspects for Digital Signature.
- Section 15 to 42 License for Digital Signature Certificate.
- Section 43 to 47 Penalties and compensation.
- Section 48 to 64 Tribunals and appeal to High Court, etc.
- Section 65 to 79 Offences.
- Section 80 to 94 Miscellaneous Provisions.

Offenses Under the IT Act, 2000

1. Tampering with computer source documents:

Section 65 of this Act provides that Whoever knowingly or intentionally conceals, destroys or alters or intentionally or knowingly causes another to conceal, destroy or alter any computer source code used for a computer, computer programme, computer system or computer network, when the computer source code is required to be kept or maintained by law for the being time in force, shall be punishable with imprisonment up to three year, or with fine which may extend up to two lakh rupees, or with both.

- **Section 65** is tried by any magistrate. This is cognizable and non- bailable offense. Imprisonment up to 3 years and or Fine up to Two lakh rupees.

2. Hacking with the computer system:

Section 66 provides that-

(1) Whoever with the intent to cause or knowing that he is likely to cause wrongful loss or damage to the public or any person destroys or deletes or alters any information residing in a computer resource or diminishes its value or utility or affects it injuriously by any means, commits hacking.

(2) Whoever commits hacking shall be punished with imprisonment up to three years, or with fine which may extend up to two lakh rupees, or with both.

Punishment: Imprisoned up to three years and fine which may extend up to two lakh rupees or with both.

3. Publishing of Obscene Information In Electronic Form:

- **Section 67** of this Act provides that Whoever publishes or transmits or causes to be published in the electronic form, any material which is lascivious or appeals to the prurient interest or if its effect is such as to tend to deprave and corrupt persons who are likely, having regard to all relevant circumstance, to read see or hear the matter contained or embodied in it.
- Shall be **punished** on first conviction with imprisonment of either description for a term which may extend to five years and with fine which may extend to one lakh rupees and in the event of a second or subsequent conviction with imprisonment of either description for a term which may extend to ten years and also with fine which may extend to two lakh rupees.

4. Power of Controller to give directions:

Section 68 of this Act provides that

(1) The Controller may, by order, direct a Certifying Authority or any employee of such Authority to take such measures or cease carrying on such activities as specified in the order if those are necessary to ensure compliance with the provisions of this Act, rules or any regulations made the reunder.

(2) Any person who fails to comply with any order under sub-section (1) shall be guilty of an offense and shall be liable on conviction to imprisonment for a term not exceeding three years or to a fine not exceeding two lakh rupees or to both.

- The offense under this section is non-bailable & cognizable.
- Punishment: Imprisonment up to a term not exceeding three years or fine not exceeding two lakh rupees.

5. Directions of Controller to a subscriber to extend facilities to decrypt information:

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Section 69 provides that-

(1) If the Controller is satisfied that it is necessary or expedient so to do in the interest of the sovereignty or integrity of India, the security of the State, friendly relations with foreign States or public order or for preventing incitement to the commission of any cognizable offense; for reasons to be recorded in writing, by order, direct any agency of the Government to intercept any information transmitted through any computer resource.

(2) The subscriber or any person in charge of the computer resource shall, when called upon by any agency which has been directed under sub-section (1), extend all facilities and technical assistance to decrypt the information.

(3) The subscriber or any person who fails to assist the agency referred to in subsection shall be punished with imprisonment for a term which may extend to seven years.

Punishment: Imprisonment for a term which may extend to seven years. The offense is cognizable and non-bailable.

6. Protected System:

Section 70 of this Act provides that –

- The appropriate Government may, by notification in the Official Gazette, declare that any computer, computer system or computer network to be a protected system.
- The appropriate Government may, by order in writing, authorize the persons who are authorized to access protected systems notified under sub-section (1).
- Any person who secures access or attempts to secure access to a protected system in contravention of the provision of this section shall be punished with imprisonment of either description for a term which may extend to ten years and shall also be liable to fine.

Punishment: The imprisonment which may extend to ten years and fine.

7. Penalty For Misrepresentation:

Section 71 provides that-

Whoever makes any misrepresentation to, or suppresses any material fact from, the Controller or the Certifying Authority for obtaining any license or Digital Signature Certificate, as the case may be, shall be

punished with imprisonment for a term which may extend to two years, or which fine which may extend to one lakh rupees, or with both.

Punishment: Imprisonment which may extend to two years or fine may extend to one lakh rupees or with both.

8. Penalty for breach of confidentiality and privacy:

Section 72 provides that-

Save as otherwise provide in this Act or any other law for the time being in force, any person who, in pursuance of any of the powers conferred under this Act, rules or regulation made thereunder, has secured access to any electronic record, book, register, correspondence, information, document or other material without the consent of the person concerned discloses such material to any other person shall be punished with imprisonment for a term which may extend to two years, or with fine which may extend to one lakh rupees, or with both.

9. Penalty for publishing Digital Signature Certificate false in certain particulars:

Section 73 provides that – (1) No person shall publish a Digital Signature Certificate or otherwise make it available to any other person with the knowledge that-

- The Certifying Authority listed in the certificate has not issued it; or

  (b) The subscriber listed in the certificate has not accepted it; or

  (c) The certificate has been revoked or suspended unless such publication is for the purpose of verifying a digital signature created prior to such suspension or revocation.

  (2) Any person who contravenes the provisions of sub-section (1) shall be punished with imprisonment for a term which may extend to two years, or with fine which may extend to one lakh rupees, or with both.

Punishment: Imprisonment of a term of which may extend to two Years or fine may extend to 1 lakh rupees or with both.

10. Publication For Fraudulent Purpose:

Section 74 provides that-

Branch/Semester: EC/VII	Subject: Cyber Security	Subject Code: 7CS6-60.2
Duration: 1.5 hours	Date:1/10/2022 Session (I/II/III): I	Max Marks:24
Submitted By: Dr. P.K.Jain Manju Choudhary		

Whoever knowingly creates, publishes or otherwise makes available a Digital Signature Certificate for any fraudulent or unlawful purpose shall be punished with imprisonment for a term which may extend to two years, or with fine which extends to one lakh rupees, or with both.

Explanation: This section prescribes punishment for the following acts:

- Knowingly creating a digital signature certificate for any
- fraudulent purpose or,
- unlawful purpose.

Punishment: Imprisonment for a term up to two years or fine up to one lakh or both.

11. Act to apply for offense or contravention committed outside India

Section 75 provides that-

- Subject to the provisions of sub-section
- the provisions of this Act shall apply also to any offense or contravention committed outside India by any person irrespective of his nationality.
- For the purposes of sub-section (1), this Act shall apply to an offense or Contravention committed outside India by any person if the act or conduct constituting the offense or contravention involves a computer, computer system or computer network located in India.

Explanation: This section has a broader perspective including cyber crime, committed by cyber criminals, of any nationality, any territoriality.

Power to investigate offenses:

- **Section 78** provides that – Notwithstanding anything contained in the **Code of Criminal Procedure, 1973**, a police officer not below the rank of Deputy Superintendent of Police shall investigate any offense under this Act.

Advantages:

Some advantages of the application of the IT Act 2000 are :-

- Helpful to promote e-commerce.
- Enhance the corporate business.
- Filling online forms.
- High penalty for cyber crime.

Though it has many advantages, it has been misused by many people in order to gain themselves or for the sake or otherwise to harm others.

Answer 9: **Importance of Security Policies relating to Mobile Computing Devices:**

Growth of mobile devices used makes the cyber security issue harder than what we would tend to think. People (especially, the youth) have grown so used to their mobiles that they are treating them like wallets! For example, people are storing more types of confidential information on mobile computing devices than their employers or they themselves know; they listen to music using their hand-held devices One should think about not to keep credit card and bank account numbers, passwords, confidential E-Mails and strategic information about organization. Imagine the business impact if mobile or laptop was lost or stolen, revealing sensitive customer data such as credit reports, social security numbers (SSNs) and contact information.

Operating Guidelines for Implementing Mobile Device Security Policies

Through the following steps we can reduce the risk when mobile device lost or stolen

1. Determine whether the employees in the organization need to use mobile computing devices or not.
2. Implement additional security technologies like strong encryption, device passwords and physical locks.
3. Standardize the mobile computing devices and the associated security tools being used with them.
4. Develop a specific framework for using mobile computing devices.
5. Maintain an inventory so that you know who is using what kinds of devices.
6. Establish patching procedures for software on mobile devices.
7. Label the devices and register them with a suitable service.
8. Establish procedures to disable remote access for any mobile.
9. Remove data from computing devices that are not in use
10. Provide education and awareness training to personnel using mobile devices.

Organizational Policies for the Use of Mobile Hand-Held Devices

There are many ways to handle the matter of creating policy for mobile devices.

- **One** way is creating a distinct mobile computing policy.
- **Another** way is including such devices under existing policy.
- Organizations are heavily dependent upon a mobile workforce with access to information, no matter

where they travel.

- However, this mobility is putting organizations at risk of having a data breach (Violation) if a laptop containing sensitive information is lost or stolen.
- Hence, physical security is very important to protect the information on the employees' laptops.

Physical security countermeasures are as follows

- **Cables and hardwired locks:** The most cost-efficient and ideal solution to safeguard any mobile device is securing with cables and locks, specially designed for laptops.
- **Laptop safes: Safes made of polycarbonate –** the same material that is used in bulletproof windows, police riot shields and bank security screens – can be used to carry and safeguard the laptops
- **Motion sensors and alarms:** Alarms and motion sensors are very efficient in securing laptops.
- **Warning labels and stamps:** Warning labels containing tracking information and identification details can be fixed onto the laptop to deter aspiring thieves. These labels cannot be removed easily and are a low-cost solution to a laptop theft.
- keeping the laptop close to oneself wherever possible.
- Carrying the laptop in a different and unobvious bag
- Creating the awareness among the employees about the sensitive information contained in the laptop.
- Making a copy of the purchase receipt of laptop.
- Installing encryption software to protect information stored on the laptop
- Using personal firewall software to block unwanted access and intrusion.
- Updating the antivirus software regularly.
- Tight office security using security guards and securing the laptop by locking it down in lockers when not in use.
- Never leaving the laptop unattended in public places.
- Disabling IR ports and wireless cards when not in use.
- Choosing a secure OS.
- Registering the laptop with the laptop manufacturer to track down the laptop in case of theft.
- Disabling unnecessary user accounts and renaming the administrator account.
- Backing up data on a regular basis.

Solution of Question Paper

I Mid-Term Examination, Sept. -2022

Branch/Semester: EC/VII	**Subject: Cyber Security**	**Subject Code: 7CS6-60.2**
Duration: 1.5 hours	**Date:1/10/2022 Session (I/II/III): I**	**Max Marks:24**
Submitted By: Dr. P.K.Jain Manju Choudhary		

A few logical access controls are as follows:

1. Protecting from malicious programs/attackers/social engineering.
2. Avoiding weak passwords/open access.
3. Monitoring application security and scanning for vulnerabilities.
4. Ensuring that unencrypted data/unprotected file systems do not pose threats.
5. Proper handling of removable drives/storage mediums/unnecessary ports.
6. Password protection through appropriate passwords rules and use of strong passwords.
7. Locking down unwanted ports/devices.
8. Regularly installing security patches and updates.
9. Installing antivirus software/firewalls/intrusion detection system (IDSs).
10. Encrypting critical file systems.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

I Mid Term Examination, Nov.-2022

Semester:	V	**Branch:**	EC
Subject:	EW	**Subject Code:**	5EC4-02
Time:	1.5 Hours	**Maximum Marks:**	20
Session (I/II/III):	I		

Note: Smith chart as a Supplementary material provided during examination

PART A (short-answer type questions)

(All questions are compulsory) **(3*2=6)**

Q. A telephone line has R=40Ω/km, L=80mH/km, G=0 and C= 15 μF/km. At f=2 kHz obtains
(a) The characteristic impedance of the line (b) The propagation constant

Q.2 Write Maxwell's equation in differential and integral form.

Q.3 Explain the physical significance (cases) of relative permittivity in a conducting (ε_{rc}) medium for dielectric and conducting behaviour.

PART B (Analytical/Problem solving questions)

(Attempt any 2 Questions) **(2*4=8)**

Q.4 Derive the voltage and current equations for transmission line. Also deduce the characteristics impedance for loss less and lossy medium

Q.5 Derive the boundary conditions for electric field using Maxwell equations at the interface of two dielectric mediums.

Q.6 A uniform plane wave traveling in a medium having dielectric constant 9, has peak electric field of 20 V/m. The frequency of the wave is 1 GHz. Find the wavelength and peak magnetic field of the wave. If at some location (z=0) and some instant (t=0), the electric field is 8V/m, find the magnitudes of the electric

field and magnetic field at z= 3m and t= 80 msec. Assume that wave is mov
z-direction.

PART C (Descriptive/Analytical/Problem solving/Design questior
(Attempt any 1 Question) **(1**

Q.7 State Poynting Theorem. Derive the expression for net outward l
through the surface.

Q.8 A lossless transmission line with characteristics impedance 50 ohm is 30
long and operates at 2 MHz. The line is terminated with a load of 60+j80
Calculate (Using Smith Chart)

(a) VSWR
(b) Position of First voltage Minima
(c) Distance of first stub for impedance matching.

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Solution of Question Paper

I Mid-Term Examination, Nov. -2022

Branch/Semester: V	Subject: Electromagnetics Waves	Subject Code: 5EE4-02
Duration: 1.5 hours	Date: 10/11/2022 Session (I/II/III): II	Max Marks: 20
Submitted By: Dr. Shubhi Jain, Mr. Ankit Agarwal		

PART A (short-answer type questions)
(All questions are compulsory) **(3*2=6)**

Q.1 A telephone line has R=40Ω/km, L=80mH/km, G=0 and C= 15 μF/km. At f=2 kHz obtains (a) The characteristic impedance of the line (b) The propagation constant

Answer:

$$Z_0 = \frac{\sqrt{R + j\omega L}}{\sqrt{G + j\omega C}} = \frac{\sqrt{40 + j2 * 3.14 * 2 * 10^3 * 80 * 10^{-3}}}{\sqrt{0 + j2 * 3.14 * 2 * 10^3 * 15 * 10^{-6}}}$$

$$Z_0 = \sqrt{5329 - j212.3}$$

$$\gamma = \sqrt{(R + j\omega L)(G + j\omega C)}$$

$$\gamma = \sqrt{-189.3 + j7.53}$$

Q.2 Write Maxwell's equation in differential and integral form.

Answer: Differential form

S. No.	Maxwell Equation	Remarks
1.	$\nabla . D = \rho_v$	*Gauss's law*
2.	$\nabla . B = 0$	*Nonexistence of isolated magnetic charge*
3.	$\nabla \times E = -\frac{\partial B}{\partial t}$	*Faraday's law*
4.	$\nabla \times H = J + \frac{\partial D}{\partial t}$	*Ampere's circuit law*

Integral form:

$$\oint_S D . ds = \int_v \rho_v \, dv$$

$$\oint_S B . ds = 0$$

$$\oint_L E . dl = -\frac{\partial}{\partial t} \int B . ds$$

$$\oint_L H . dl = \int_S \left(J + \frac{\partial D}{\partial t}\right) . dS$$

Solution of Question Paper

I Mid-Term Examination, Nov. -2022

Branch/Semester: V	**Subject: Electromagnetics Waves**	**Subject Code: 5EC4-02**
Duration: 1.5 hours	**Date: 10/11/2022 Session (I/II/III): II**	**Max Marks: 20**
Submitted By: Dr. Shubhi Jain, Mr. Ankit Agarwal		

Q.3 Explain the physical significance (cases) of relative permittivity in a conducting (ε_{rc}) medium for dielectric and conducting behavior.

Answer- Physical Significance: The relative permittivity (dielectric constant) of a conducting medium for dielectric is always complex and it is a function of frequency. The behavior of medium is now become frequency dependent.

Case 1: if $\frac{\text{Conduction Current Density}}{\text{Displacement Current Density}} = \frac{\sigma}{\omega\varepsilon_0\varepsilon_r} \gg 1$

=> medium is good Conductor

Case 2: if $\frac{\text{Conduction Current Density}}{\text{Displacement Current Density}} = \frac{\sigma}{\omega\varepsilon_0\varepsilon_r} \ll 1$

=> medium is good dielectric

Case 3: if $\frac{\text{Conduction Current Density}}{\text{Displacement Current Density}} = \frac{\sigma}{\omega\varepsilon_0\varepsilon_r} \sim 1$

=> medium can niether be called good conductor nor a good dielectric

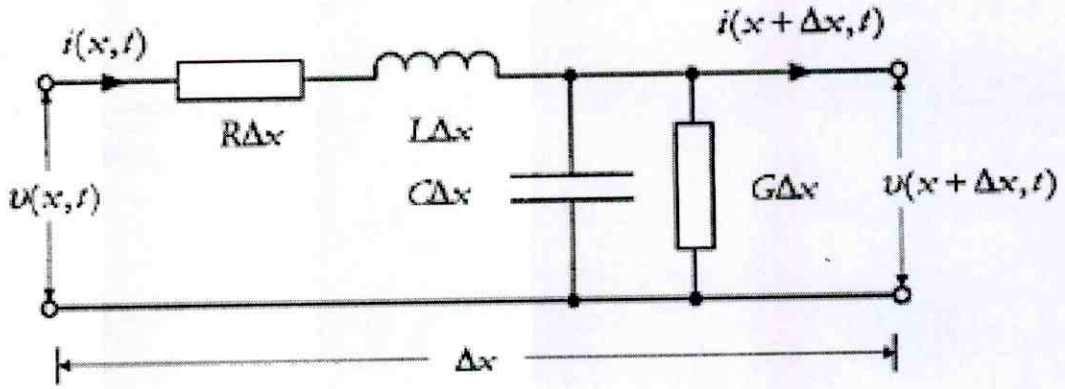
PART B (Analytical/Problem solving questions)

(Attempt any 2 Questions) **(2*4=8)**

Q.4 Derive the voltage and current equations for transmission line. Also deduce the characteristics impedance for loss less and lossy medium

Answer: Voltage & Current equation for Transmission line

Let us consider a small section of a transmission line of length Δx. Let the voltage at the input be V and current at the input be I. Due to the voltage drop in the series arm, the output voltage will be different from the input voltage, say V+ ΔV. Similarly due to current through the capacitance and the conductance the output current will be different from the input through the current, say I+ ΔI



Apply the KVL at Output Loop

The Voltage Across the $G\Delta X$ and $j\omega c\Delta X$ is $(V + \Delta V)$

$$V - (R\Delta X + j\omega L\Delta X)I - (V + \Delta V) = 0$$

Then we can write-

$$\Delta V = -(R\Delta X + j\omega L\Delta X)I \ldots\ldots\ldots (1)$$

$$\frac{\Delta V}{\Delta X} = -(R + j\omega L)I \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Apply KCL at shunt loop because current flow in series is same

$$I - (G\Delta X + j\omega C\Delta X)V - (I + \Delta I) = 0$$

$$\Delta I = -(G\Delta X + j\omega C\Delta X)V \ldots\ldots\ldots (3)$$

By taking ΔX common in equation (1) and (2) we can write-

$$\frac{\Delta I}{\Delta X} = -(G + j\omega C)V \ldots\ldots\ldots\ldots\ldots (4)$$

Now if the lumped circuit model should be valid for arbitrarily high frequency (the analysis has to be carried out in the limit $\Delta X \rightarrow 0$.

So from equation (3) and (4) we can write-

$$\lim_{\Delta X \to 0} \frac{\Delta V}{\Delta X} = \frac{dV}{dX} = -(R + j\omega L)I \ldots\ldots\ldots (5)$$

$$\lim_{\Delta X \to 0} \frac{\Delta I}{\Delta X} = \frac{dI}{dX} = -(G + j\omega C)V \ldots\ldots\ldots (6)$$

Differentiating eqn. (5) with respect to X we get-

$$\frac{d^2V}{dX^2} = -(R + j\omega L)\frac{dI}{dX} \ldots\ldots\ldots (7)$$

From equation (6) and (7) we can write-

$$\frac{d^2V}{dX^2} = (R + j\omega L)(G + j\omega C)V \ldots\ldots\ldots (8)$$

From equation (9), (10) and (11) we can write-

$$\frac{d2V}{dX2} = \gamma^2 V \ldots\ldots\ldots (13)$$

$$\frac{d2I}{dX2} = \gamma^2 I \ldots\ldots\ldots (14)$$

The general solution to the differential equations mentioned in equation (13) and (14) is-

$$V(X) = V^+ e^{-\gamma X} + V^- e^{\gamma X} \ldots\ldots\ldots (15)$$

$$I(X) = I^{+}e^{-\gamma X} + I^{-}e^{\gamma X} \dots\dots\dots (16)$$

Where $V^{+}, V^{-}, I^{+}, I^{-}$ are the arbitrary complex constants which are to be evaluated from the boundary conditions, where it becomes clear later that $e^{-\gamma X}$ wave is propagation in +X direction and $e^{\gamma X}$ wave is propagating in -X Direction

deduce the characteristics impedance for loss less and lossy medium

Characteristics Impedance of Loss less Transmission Lines

$$Z_0 = \sqrt{\frac{(R + j\omega L)}{(G + j\omega C)}}$$

If R=G=0

$$Z_0 = \sqrt{\frac{(j\omega L)}{(j\omega C)}}$$

$$Z_0 = \sqrt{\frac{L}{C}}$$

lossy medium

R << wL, G << wC

$$Z_0 = \sqrt{\frac{j\omega L\left(\frac{R}{j\omega L} + 1\right)}{j\omega C\left(\frac{G}{j\omega C} + 1\right)}}$$

$\frac{R}{j\omega L} << 1$ & $\frac{G}{j\omega C} << 1$ so $\frac{R}{j\omega L} = \approx 0$

$$Z_0 = \sqrt{\frac{L(0+1)}{C(0+1)}} = \sqrt{\frac{L}{C}}$$

Q.5 Derive the boundary conditions for electric field using Maxwell equations at the interface of two dielectric mediums.

Answer- **Two dielectric mediums**

To determine the boundary conditions, we need to use Maxwell's equations.

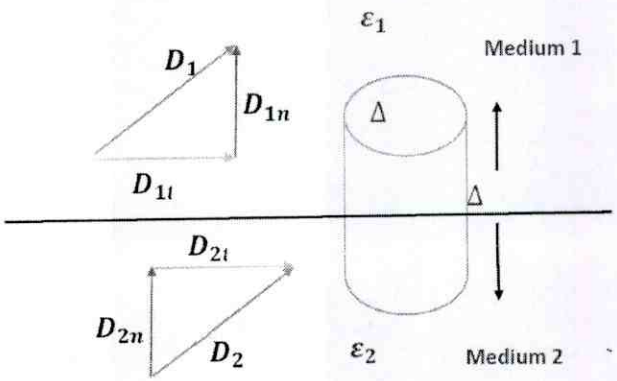
$$\oint_S D.ds = Q_{enc}$$

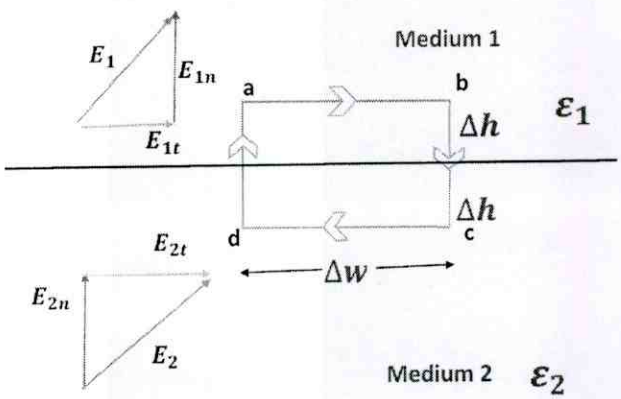
$$\oint_L E.dl = 0$$

Also we need to decompose the electric field intensity E into two orthogonal components:

$$E = E_t + E_n$$

Where ***Et*** and ***En*** are, respectively, the tangential and normal components of E to the interface of interest. A similar decomposition can be done for the electric flux density D.





$$\oint_L E.dl = 0$$

$$\oint_L E.dl = \oint_a^b E.dl + \oint_b^c E.dl + \oint_c^d E.dl + \oint_d^a E.dl = 0$$

$$\oint_a^b E.dl = E_{1t}\,\Delta w$$

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$$\oint_b^c E.dl = -(E_{1N} + E_{2N})\frac{\Delta h}{2}$$

$$\oint_c^d E.dl = -E_{2t}\Delta w$$

$$\oint_d^a E.dl = (E_{1N} + E_{2N})\frac{\Delta h}{2}$$

$$\oint_a^b E.dl + \oint_b^c E.dl + \oint_c^d E.dl + \oint_d^a E.dl = (E_{1t} - E_{2t})\Delta w$$

$$(E_{1t} - E_{2t})\Delta w = 0$$

$$E_{1t} = E_{2t}$$

$$\frac{D_{1t}}{\varepsilon_1} = \frac{D_{2t}}{\varepsilon_2}$$

$$\varepsilon_2 D_{1t} = \varepsilon_1 D_{2t}$$

Hence Proved

Q. 6 A uniform plane wave traveling in a medium having dielectric constant 9, has peak electric field of 20 V/m. The frequency of the wave is 1 GHz. Find the wavelength and peak magnetic field of the wave. If at some location (z=0) and some instant (t=0), the electric field is 8V/m, find the magnitudes of the electric field and magnetic field at z= 3m and t= 80 msec. Assume that wave is moving in z-direction.

Answer: The electric field of a wave travelling in +z direction can be written as:

$$E = 10\ cos\ (\omega t - \beta z + \varphi)$$

(1) $\omega = 2\pi f = 2\pi \times 10^9\ rad/s$

(2) $\beta = \omega\sqrt{\mu\varepsilon} = 2\pi \times 10^9 \sqrt{\mu_0\varepsilon_0}\sqrt{\varepsilon_r}$ = 20 π rad/m

(3) at z=0 and t=0, Let say phase is ϕ

$8 = 20\cos(\varphi) \Rightarrow \varphi = \cos^{-1}\left(\frac{8}{20}\right) = 23.57°$

Intrinsic Impedance of the medium

$$\eta = \frac{\eta_0}{\sqrt{\varepsilon_r}} = \frac{120\,\pi}{\sqrt{9}} = 40\pi\ ohm$$

The Magnetic Field is given by:

Solution of Question Paper

I Mid-Term Examination, Nov. -2022

Branch/Semester: V	Subject: Electromagnetics Waves	Subject Code: 5EE4-02
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$$H = \frac{E}{\eta} = \frac{20\cos(2\pi \times 10^9 t - 20\pi z + 23.5°)}{40\pi}$$

At z= 3 m , t= 80 ms

$$H = \frac{E}{\eta} = \frac{20\cos(2\pi \times 10^9 t - 20\pi z + 23.5°)}{40\pi} = \frac{20\cos(2\pi \times 10^9 \times 80 \times 10^{-3} - 20\pi \times 3 + 23.5°)}{40\pi}$$

$$H = \frac{E}{\eta} = \frac{20\cos(1.6\pi \times 10^8 - 60\pi + 23.5°)}{40\pi} = 0.145 \text{ A/m}$$

PART C (Descriptive/Analytical/Problem solving/Design questions)

(Attempt any 1 Question) (1*6=6)

Q.7 State Poynting Theorem. Derive the expression for net outward power through the surface.

Answer: Poynting Theorem states that in a given volume, the stored energy changes at a rate given by the work done on the charges within the volume, minus the rate at which energy leaves the volume. According to pointing theorem, the surface integral of P over a closed surface is equal to the total power leaving the closed surface. Poynting Theorem is strictly valid only for closed surface.

For the net outward power through the surface take the maxwell equation

Let us take the Maxwell's equation:

$$\nabla \times E = -\frac{\partial B}{\partial t} = -\mu \frac{\partial H}{\partial t}$$

$$\nabla \times H = J + \frac{\partial D}{\partial t} = J + \varepsilon \frac{\partial E}{\partial t}$$

We know, vector identity

$$\nabla.(A \times C) = C \cdot (\nabla \times A) - A \cdot (\nabla \times C)$$

Where A and C are any two arbitrary identity.

$$\nabla.(E \times H) = H \cdot (\nabla \times E) - E \cdot (\nabla \times H)$$

Using Maxwell's equation:

$$\nabla.(E \times H) = H \cdot \left(-\mu \frac{\partial H}{\partial t}\right) - E \cdot \left(J + \varepsilon \frac{\partial E}{\partial t}\right)$$

$$\nabla.(E \times H) = H \cdot \left(-\mu \frac{\partial H}{\partial t}\right) - E \cdot \left(J + \varepsilon \frac{\partial E}{\partial t}\right)$$

$$\frac{\partial\,(A.C)}{\partial t} = A\cdot\frac{\partial C}{\partial t} + C\cdot\frac{\partial A}{\partial t}$$

$$\frac{\partial\,(A.A)}{\partial t} = 2\,A\cdot\frac{\partial A}{\partial t}$$

$$A\cdot\frac{\partial A}{\partial t} = \frac{1}{2}\,\frac{\partial\,(A.A)}{\partial t} = \frac{1}{2}\,\frac{\partial\,|A|^2}{\partial t}$$

since J = σE, and taking σ not a function of time.

$$\nabla.(E\times H) = -\frac{\mu}{2}\,\frac{\partial\,|H|^2}{\partial t} - \frac{\varepsilon}{2}\,\frac{\partial\,|E|^2}{\partial t} - \sigma\,|E|^2$$

$$\nabla.(E\times H) = -\frac{\mu}{2}\,\frac{\partial\,|H|^2}{\partial t} - \frac{\varepsilon}{2}\,\frac{\partial\,|E|^2}{\partial t} - \sigma\,|E|^2$$

Taking volume integral on the both side of above equation

$$\oint_v \nabla.(E\times H)\,dv = \oint_v \left(-\frac{\mu}{2}\,\frac{\partial\,|H|^2}{\partial t} - \frac{\varepsilon}{2}\,\frac{\partial\,|E|^2}{\partial t} - \sigma\,|E|^2\right) dv$$

using the divergence theorem

$$\oint_s (E\times H)\,da = \oint_v -\frac{\mu}{2}\,\frac{\partial\,|H|^2}{\partial t}\,dv - \oint_v \frac{\varepsilon}{2}\,\frac{\partial\,|E|^2}{\partial t}\,dv - \oint_v \sigma\,|E|^2\,dv$$

$$\oint_s (E\times H)\,da = -\frac{\partial}{\partial t}\oint_v \frac{\mu}{2}|H|^2\,dv - \frac{\partial}{\partial t}\oint_v \frac{\varepsilon}{2}|E|^2\,dv - \oint_v \sigma\,|E|^2\,dv$$

$$\oint_s (E\times H)\,da = -\frac{\partial}{\partial t}\left\{\oint_v \frac{\mu}{2}|H|^2\,dv + \oint_v \frac{\varepsilon}{2}|E|^2\,dv\right\} - \oint_v \sigma\,|E|^2\,dv$$

$$\oint_s (E\times H)\,da = -\frac{\partial}{\partial t}\left\{\oint_v \frac{\mu}{2}|H|^2\,dv + \oint_v \frac{\varepsilon}{2}|E|^2\,dv\right\} - \oint_v \sigma\,|E|^2\,dv$$

Net outward Power W = $\oint_s (E\times H)\,da$

Since the surface integral of (E X H) gives the total power flow from the surface, the quantity (E X H), therefore, represents the power density on the surface of the volume.

Q.8 A lossless transmission line with characteristics impedance 50 ohm is 30 metres long and operates at 2 MHz. The line is terminated with a load of 60+j80 ohms. Calculate (Using Smith Chart)

(a) VSWR

(b) Position of First voltage Minima

(c) Distance of first stub for impedance matching.

Swami Keshvanand Institute of Technology, Management & Gramothan, Ramnagaria, Jagatpura, Jaipur-302017

Solution of Question Paper

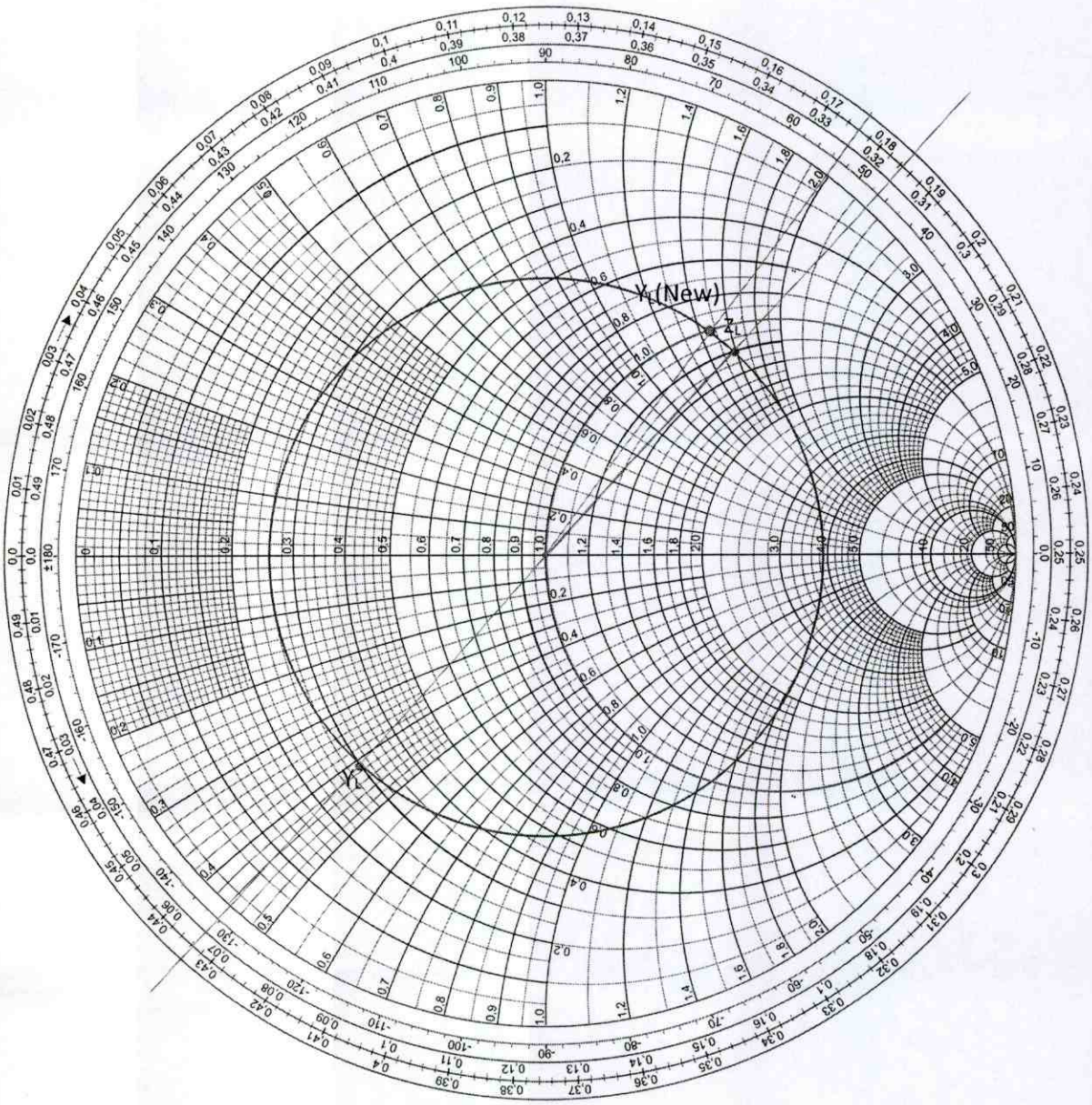
I Mid-Term Examination, Nov. -2022

Branch/Semester: V	Subject: Electromagnetics Waves	Subject Code: 5EC4-02
Duration: 1.5 hours	Date: 10/11/2022 Session (I/II/III): II	Max Marks: 20
Submitted By: Dr. Shubhi Jain, Mr. Ankit Agarwal		

Answer: Z_L= 60+j80

Z_0= 50

Z_L'= 1.2+j1.6



VSWR= 3.9 (Approximate)

Voltage Minima occurs at R=0 point. At this point L= 0.5λ

the position of Z_L' is 0.185λ. if Z_L is shift to 0.5λ the first voltage minima occues. for this Z_L is shift towards load at a distance of 0.5λ- 0.185λ= 0.315λ

for distance of first stub rotate Y_L in clockwise direction to cut the unit circle 1+jx. with respect to this point calculate the wavelength of that point and the wavelength difference between the Y_L and Y_L(new) after shift the Y_L at 1+jX circle.

Wavelength of Y_L=0.434λ

Wavelength of Y_L(New)= 0.146λ

Distance of first stub is (0.5–0.434+0.176)λ = 0.242λ

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II Mid Term Examination, May-2023

Semester:	VI	Branch:	ECE
Subject:	Information Theory and Coding	Subject Code:	6EC4-05
Time:	1.5 Hours	Maximum Marks:	20
Session (I/II/III): I			

PART A (short-answer type questions)

(All questions are compulsory) (3*2=6)

Q.1 Write the difference between blocks code and convolutional code.

Q.2 Explain the role of minimum distance in error correction and detection.

Q.3 Define the following terms

(a) Code rate (b) Code word

PART B (Analytical/Problem solving questions)

(Attempt any 2 Questions) (2*4=8)

Q.4 Draw and design the (7, 4) Encoder for cyclic code with $G(p)=1+p+p^3$ and d=1100. Also find the code word.

Q.5 The generator polynomial for a (7, 4) cyclic code is given by $G(P) = 1+p+p^3$.Determine systematic code vector for message vector 1010.

Q.6 A parity check code has the parity check matrix

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

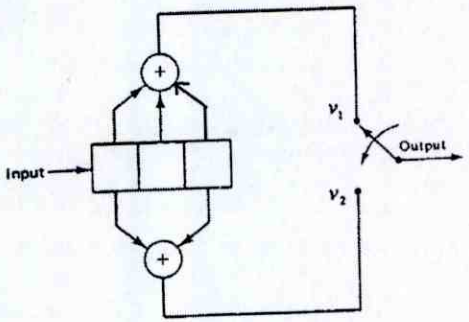
(a) Determine the generator matrix G.

(b) Find the code word that begins 101.

(c) Suppose that the received word is 110110.Decode this received word.

PART C (Descriptive/Analytical/Problem solving/Design questions)
(Attempt any 1 Question) (1*6=6)

Q.7 Consider the convolutional encoder shown in fig.



(a) Find the impulse response of the encoder.

(b) Find the output code word if the input sequence is 101.

Q.8 The parity check matrix of a (7,4) Hamming code is as under:

$$H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

Calculate the syndrome vector for single bit errors.

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Solution of Question Paper

II Mid-Term Examination, May. -2023

Branch/Semester: ...ECE/VI....	Subject: ...ITC.....	Subject Code: ...6 EC4-05
Duration: 1.5 hours	Date: 26:5:23 Session (I/II/III):	Max Marks:...20...
Submitted By:Rajni Idiwal, Abhinandan Jain		

Part A

Ques 1. Differentiate between block codes & convolutional code.

Ans 1:-

Block codes	convolutional codes
1. Information bits followed by parity bits	1. Information bits are spread along the sequence
2. Block codes are memoryless	2. convolutional code have memory.
3. Block codes take k input bits and produce n output bit. when k and n are large	3. Convolutional codes take a small number of input bits and produce a small number of output bits each time period.

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Solution of Question Paper

II Mid-Term Examination, May. -2023

Branch/Semester: ...ECE/VI....	Subject: ...ITC.....	Subject Code: 6EC405
Duration: 1.5 hours	Date: 26.5.23 Session (I/II/III):	Max Marks:...20...
Submitted By: Rajni Idiwal, Abhinandan Jain		

Ques 2 Explain the role of dmin minimum distance in error correction and detection

Ans 2 :- The error detection and correction capabilities of a coding technique depend on the minimum distance dmin

1. Detect upto s error per word $d_{min} \geq (s+1)$
2. Correct upto t errors per word $d_{min} \geq (2t+1)$
3. Correct upto t errors and detect $s > t$ error per word $d_{min} \geq (t+s+1)$

Ques 3 :- Define the following terms

Ans (a) Code rate :- The code rate is defined as the ratio of the number of message bits (k) to the total number of (n) in a code word.

(b) code word :- The code word is the n-bit encoded block of bits. it contains message bits and parity bits or redundant bits

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Solution of Question Paper

II Mid-Term Examination, May. -2023

Branch/Semester: ...ECE/VI....	Subject: ...ITC.....	Subject Code: 6EC4-05
Duration: 1.5 hours	Date: 26.5.23 Session (I/II/III):	Max Marks:...20...
Submitted By: Rajni Idiwal, Abhinandan Jain		

Part B

Q.4 :- Draw and design the (7,4) Encoder for cyclic ~~encoder~~ with $g(p) = 1+p+p^3$ and $d = 1100$. Also find the code word.

Soln $G(p) = p^3 + p + p^3 1$

or $G(p) = p^3 + 0p^2 + p + 1$ — (1)

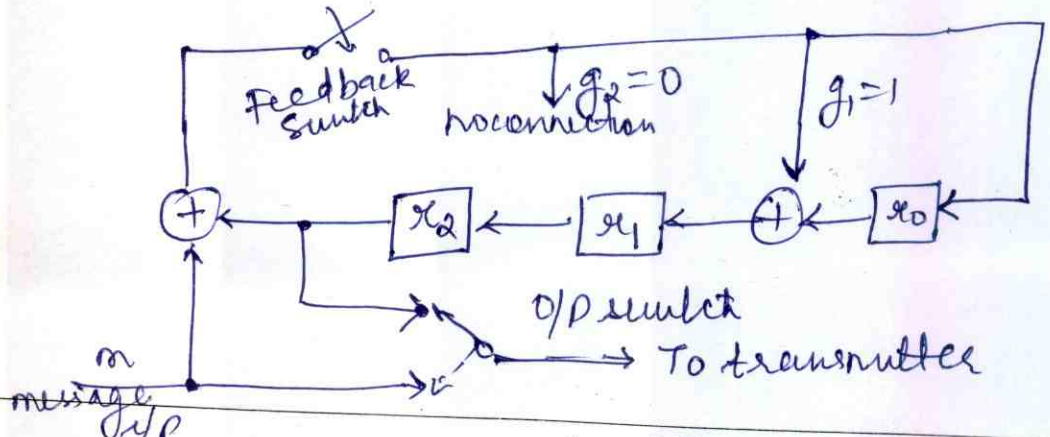
Generalized Equation

$$G(p) = p^3 + g_2 p^2 + g_1 p^1 + 1 \quad — (2)$$

comparing equation (1) & (2), we get

$$g_1 = 1 \quad \& \quad g_2 = 0$$

$$n - K = 3$$



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Solution of Question Paper

II Mid-Term Examination, May. -2023

Branch/Semester: ...ECE/VI....	Subject: ...ITC.....	Subject Code: .....
Duration: 1.5 hours	Date:..... Session (I/II/III):	Max Marks:...20...
Submitted By:Rajni Idiwal, Abhinandan Jain		

I/P message m	Register bits I/p before shift			Register bits O/p after shift		
	$r=r_2'$	$r_1=r_1'$	$r_0=r_0'$	$r_2'=r_1$	$r_1'=r_0+r_2+m$	$r_0'=r_2$
-	0	0	0	0	0	0
1	0	0	0	0	1	1
1	0	1	1	1	0	1
0	1	0	1	0	0	1
0	0	0	1	0	1	0

The check bits are $C_2 C_1 C_0 = 0\ 1\ 0$

$\therefore X = (m_3 m_2 m_1 m_0 C_2 C_1 C_0$

$\boxed{X = 1\ 1\ 0\ 0\ 0\ 1\ 0}$

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Solution of Question Paper

II Mid-Term Examination, May. -2023

Branch/Semester: ...ECE/VI....	Subject: ...ITC.....	Subject Code: ..6EC405
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Submitted By:Rajni Idiwal, Abhinandan Jain		

Ques 5:- The Generator polynomial for a (7, 4) cyclic Hamming is given by by

$$G(p) = 1 + p + p^3$$

Determine syetematic code vector for message vector 1010

Soln:- $n = 7 \quad k = 4 \quad n-k = 3$.

There will be $2^4 = 16$ Message words.

Given to us a $M = (m_0 m_1 m_2 m_3) = 1010$

message polynomial $M(p) = 1 + p^2$

Generator polynomial $M(p) = 1 + p + p^3$

For Systematic form

Multiply $M(p)$ by p^{n-k}

$$p^{n-k} M(p) = p^3(1 + p^2)$$

$$p^{n-k} M(p) = p^3 + p^5$$

divide $p^{n-k} M(p)$ by $G(p)$

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Solution of Question Paper

II Mid-Term Examination, May. -2023

Branch/Semester: ...ECE/VI....	Subject: ...ITC.....	Subject Code: ...6EC403
Duration: 1.5 hours	Date: 26.5.23 Session (I/II/III):	Max Marks:...20...
Submitted By:Rajni Idiwal, Abhinandan Jain		

$$\frac{p^{n-k}M(p)}{g(p)} = \frac{p^3+p^5}{1+p+p^3}$$

$p^3+0p^2+p+1 \;\overline{)}\; p^5+0p^4+p^3+0p^2+0p+0$

p^2 ← Quotient polynomial $Q(p)$

$p^5+0p^4+p^3+p^2$

p^2+0p+0

↑ Remainder polynomial $C(p)$

Remainder polynomial $C(p) = 0+0p+p^2$

↑ Represent parity bits

∴ Code word polynomial

$$X(p) = p^{n-k}M(p) \oplus C(p)$$

$$\therefore = [0+0p+0p^2+p^3+0p^4+p^5+0p^6] \oplus [0+0p+0p^2]$$

or $X(p) = [0+0p+p^2+p^3+0p^4+p^5+0p^6]$

Code word vector $x = [001 ; 1010]$

Parity bits — Message bits

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Solution of Question Paper

II Mid-Term Examination, May. -2023

Branch/Semester: ...ECE/VI....	Subject: ...ITC.....	Subject Code: ...ECH-05
Duration: 1.5 hours	Date: 26.5.23 Session (I/II/III):	Max Marks:...20...
Submitted By:Rajni Idiwal, Abhinandan Jain		

Ques 6 :- A parity check matrix code has the parity check matrix

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

(a) Determine the Generator matrix

(b) Find the code word that begins with 101

(c) Suppose that received word is 110110. Decode the received word.

Soln :- Here $n = 6$ $k = 3$ $n-k = 3$

(i) We know

$$[H] = [P^T : I_{n-k}]_{n-k \times n}$$

$$[H]_{3\times 6} = [P^T : I_3]_{3\times 6}$$

$$H = \left[\begin{array}{ccc|ccc} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 \end{array}\right]$$

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Duration: 1.5 hours	Date:...26.5.23 Session (I/II/III):	Max Marks:...20...
Submitted By:Rajni Idiwal, Abhinandan Jain		

or $P^T = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}_{3\times 3}$

$P = (P^T)^T = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$

Generator matrix

$G = [I_K : P_{K\times(n-K)}]_{K\times n}$

$G = \left[\begin{array}{ccc:ccc} 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \end{array}\right]_{3\times 6}$

(ii) Message vector

$M = [1\ 0\ 1]$

$[C_0\ C_1\ C_2] = [m_0\ m_1\ m_2]\,[P]$

$= [m_0\ m_1\ m_2] \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$

$C_0 = (m_0 \times 1) \oplus (m_1 \times 0) \oplus (m_2 \times 1) = m_0 \oplus m_2$

$C_0 = 1 \oplus 1 = 0$

Solution of Question Paper

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Duration: 1.5 hours	Date: ~~26.5.23~~ Session (I/II/III):	Max Marks:...20...
Submitted By:Rajni Idiwal, Abhinandan Jain		

Similarly $c_1 = (m_0 \times 1) \oplus (m_1 \times 1) \oplus (m_2 \times 0) = m_0 \oplus m_1$

substituting $m_0 = 1$ & $m_1 = 0$

$$c_1 = 1 \oplus 0 = 1$$

and $c_2 = (m_0 \times 0) \oplus (m_1 \times 1) \oplus (m_2 \times 1)$

$$= m_1 \oplus m_2$$

$$c_2 = 0 \oplus 1 = 1$$

$\therefore$ parity word $C = [0\ 1\ 1]$

(iii) Recieved code word, $Y = 110\ 110$

Syndrome $S = YH^T$

$$S = [1\ 1\ 0\ 1\ 1\ 0] \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$S = [0\ 1\ 1]$$

This is the same as second row of the transpose matrix H^T. which indicates that there is no error in the second bit of the recieved signal

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Duration: 1.5 hours	Date: 26.5.23 Session (I/II/III):	Max Marks:...20...
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Error

$Y = 1\,1\,0\,1\,1\,0$

correct word $X = 1\,0\,0\,1\,1\,0$ Ans.

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⑦ The equation for the outputs

$$v_1 = x_0 \oplus x_1 \oplus x_2$$

$$v_2 = x_0 \oplus x_2$$

a) The impulse response of the circuit:

Input	x_0	x_1	x_2	v_1	v_2
	0	0	0		
1 →	1	0	0	1	1
0 →	0	1	0	1	0
0 →	0	0	1	1	1
	0	0	0		

The impulse response is

(11 10 11).

b. The output code word if the input sequence is 101.

Input

1 → 11 10 11

0 → 00 00 00

1 → 11 10 11

11 10 00 10 11

Solution of Question Paper

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Duration: 1.5 hours	Date: ~~26.5.23~~ Session (I/II/III):	Max Marks:...20...
Submitted By:Rajni Idiwal, Abhinandan Jain		

The output code word is: 1110001011.

Sol. 8:

The parity check matrix is:

$$H = \begin{bmatrix} 1 & 1 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 \end{bmatrix}$$

The syndrome vector is given by:

$$S = EH^T$$

Let us consider single bit error in first place:

$$E = 1000000$$

$$S = [1000000] \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}$$

$$S = [1\ 1\ 1]$$

If $E = 0100000$

$$S = [0100000] \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} = [1\ 1\ 0]$$

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Solution of Question Paper

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Duration: 1.5 hours	Date: 26.05.23 Session (I/II/III):	Max Marks:...20...
Submitted By:Rajni Idiwal, Abhinandan Jain		

if $E = 0010000$

$$S = [0010000] \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} = [1\ 0\ 1]$$

if $E = 0001000$

$$S = [0001000] \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} = [0\ 1\ 1]$$

if $E = 0000100$

$$S = [0000100] \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} = [1\ 0\ 0]$$

if $E = 0000010$

$$S = [0000010] \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} = [0\ 1\ 0]$$

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असतो मा सद्गमय

Solution of Question Paper

II Mid-Term Examination, May. -2023

Branch/Semester: ...ECE/VI....	Subject: ...ITC.....	Subject Code: ...6.EC4-05
Duration: 1.5 hours	Date: 26.05.23 Session (I/II/III):	Max Marks:...20...
Submitted By:Rajni Idiwal, Abhinandan Jain		

if $E = 0000001$

$$S = [0000001] \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} = [0\ 1\ 1]$$

Syndromes for various error vectors:

Error vectors with single bit errors:	Syndrome vectors
0 0 0 0 0 0 0	0 0 0
1 0 0 0 0 0 0	1 1 1
0 1 0 0 0 0 0	1 1 0
0 0 1 0 0 0 0	1 0 1
0 0 0 1 0 0 0	0 1 1
0 0 0 0 1 0 0	1 0 0
0 0 0 0 0 1 0	0 1 0
0 0 0 0 0 0 1	0 1 1