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AUDIO PRODUCTION
Authors

Ravindra Dubey, Former Dean, Kasturi Ram College of Higher Education, Narela, Delhi
Units (1.2, 1.3, 1.5.2, 2.2.2, 2.3.2, 3.0, 3.2, 6.4, 10)

Dr Apoorva Buttan, Assistant Professor, Amity School of Communication, Amity University, India
Units (1.4, 1.6, 2.2.3, 4.5, 6.2-6.3, 7.8, 9, 11.3, 12, 14.2.1, 14.3-14.3.2, 14.3.5)

Paulomi M Jindal, Freelance Author
Units (1.5-1.5.1, 2.3.2.3.1, 11.2, 13.2-13.3, 14.2, 14.4)

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Audio production is related to the study of recording, producing, editing and transmission of audio for various mediums. Audio production is the critical process of treating the sound to produce the required aural picture so that the audience is able to hear what the producers want them to. This requires a deep understanding of the subject of sound and software related to recording and editing. There can be many different places where audio production plays a very important part including radio, movies, theatre, music, television, internet, etc. The focus of this book will be only radio production.

From the tentative beginnings of wireless, radio has today grown to become almost a universal mode of communication. Even in developing countries like India, no matter how isolated a community, radios are found in almost every home. Such a wide reach allows governments to use radios not only to inform, but also for social purposes. This book will also help the students learn about all that is needed to create quality radio productions. It will introduce you to concepts related to radio production. It will also discuss the different equipment associated with radio production. It will also examine the various issues related to radio journalism.

This book, Audio Production, is written with the distance learning student in mind. It is presented in a user-friendly format using a clear, lucid language. Each unit contains an Introduction and a list of Objectives to prepare the student for what to expect in the text. At the end of each unit are a Summary and a list of Key Words, to aid in recollection of concepts learnt. All units contain Self-Assessment Questions and Exercises, and strategically placed Check Your Progress questions so the student can keep track of what has been discussed.
UNIT 1 HISTORY, BASICS AND FUTURE OF RADIO

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1.0 INTRODUCTION

Radio has been the means of providing information and entertainment for a long time. Most of us have heard of ‘Binaaca Geetmala’ which was the first filmi programme to be beamed on radio in India. Radio caters to all categories of people—children, youth and the adults. With the advancement of technology, private players have entered the field of radio in India. In this unit, you will learn about the history, basics and future of radio.

1.1 OBJECTIVES

After going through this unit, you will be able to:

- Discuss the history of radio
- Describe the developments and advancements in radio journalism in India
- Explain radio in today’s media scenario and future of radio
- Examine the basics of sound recording
1.2 HISTORY OF RADIO

It was wireless telegraphy that originated from a combination of a number of discoveries of electro-magnetic waves, the wireless telegraph and the triode amplifier valve by scientists and technicians from different countries.

A Danish scientist Hans Christian Oersted in 1819 discovered that electric current created magnetic effect. Later, Alessandro Volta recorded the production of electricity by chemical means in 1829. After six decades, James Clerk Maxwell, came out with his theory of electromagnetism. This theory proved the existence of radio waves. Later a German Physicist Heinrich Hertz concluded that like light waves, electric current can be projected into space as radio waves. In 1888, Hertz published a paper which provided the basis for modern radio transmission.

An Italian scientist Guglielmo Marconi fanatically worked on Hertz research. Using Hertz’s theory, he succeeded in setting his radio waves in motion by generating a spark that leaped across a gap. He filled up a glass tube with metal fillings and put them in touch with radio waves. The metal fillings cohered. Then he loosened them up and by tapping the tube on the table, he again repeated his experiment. This is how wireless communication was born. Prior to this, transmission of Morse code (telegraph) required the laying of string wires from one point to another.

John Fleming in 1904 invented vacuum tube which enabled the transmission of voice. Later Reginald Fessenden and Lee Dee Forest contributed to its further development. It was Fessenden’s theory that radio wave can be sent as a continuous wave on which voice can be super-imposed. Earlier they used to be sent in bursts that accommodated the dots and dashes of the Morse code.

Dee Forest improvised on Fleming’s vacuum tube into audition tube that contained three electrodes instead of two that belonged to Fleming. The audition tube was capable of amplifying sound to a bigger extent and it became a crucial development towards transmission of the voice.

Developments were later added to these inventions in due course of time and finally it took the shape of radio broadcasting. The sole use of wireless telegraphy was to ship and ship to shore communication. It took ten years for it to develop into broadcasting. The World War was the sole reason for industrialization of wireless telegraphy.

The Emergence of Radio in India

The pioneers of broadcasting in India were the amateur radio clubs in Calcutta (now Kolkata), Madras (now Chennai), Bombay (now Mumbai) and Lahore after several experimental broadcasts were conducted in Bombay and other cities.

The Radio Club of Calcutta was the first amateur radio club to start functioning in November 1923. Madras Presidency Radio Club came close on its heels in May 1924 and began broadcasting in July. The clubs came together because
of financial crunch to form Indian Broadcasting Company Ltd. (IBC) in 1927. This was a private company on the lines of European Broadcasting. The IBC built two weak little stations at Calcutta and Bombay. Within three years, the company had as many as 7000 listeners. However, due to lack of revenue it lost a great deal of money and decided to go into liquidation. There was no support from the government. At the last moment BBC started an Empire programme on the short wave. There was a sudden rush from Europeans to buy radio sets to be able to listen to this programme and 8000 sets were purchased in bulk after imposing a 15 per cent import duty on them.

The government-run broadcasting was set up and was named as Indian State Broadcasting Service (ISBS). Lionel Fielden was made its first controller. It was his idea to rename this service as All India Radio (AIR).

AIR after Independence

When British Raj ended in 1947, All India Radio had a small network of six stations. There were 2.5 lakh receiving sets which meant one set for every 12500 persons in the country. This would hardly characterize the organization as a mass communication system; and among the available mass media radio was the only channel that had the potentiality to be quickly developed into an effective and truly national service. That was particularly the case, since the reach of the printed word was limited as only about 30 per cent of the population was literate and 80 per cent lived in villages. So out of necessity, the quick development of the radio became the policy of the planners and the government under the successive five year plans.

AIR came to be known as Akashvani in 1957. Since then it has emerged as the biggest media organization of the central government, with its programmes received by over 3 crore radio receiver sets in India. As a fast and instantaneous communication medium, it has an in built advantage of overcoming the country’s formidable literacy, linguistic, cultural and physical barriers. It could also involve different types of people and integrate various kinds of cultural, musical, dance and folk art forms that are found in India. During the British period this was not possible because the alien government had little respect for national aspirations as also for an indigenous form of entertainment. After independence this attitudinal obstacle ended.

Luckily, AIR had experienced personal and ‘its innovative zeal was unbounded.’ For example, in 1948 AIR Bombay arranged to interview the Hollywood Greer Garson through an intercontinental link arranged by the Post and Telegraph department. In fact, that spirit had infused largely the software policy of AIR. Accordingly, the main thrust of its programmes was on putting out need – based innovative programmes. In addition, that was the requirement of the time after the communal bloodbath of partition, the urgency of emotional integration after the reorganization of states and initiation of the process of integrated planning.
The programme advisory committees set up at various stations and guidelines evolved in August 1980 too have sought to inject a high spirit of professionalism in broadcasting programmes and to make them more receptive to constructive criticism. To this end, listeners' letters, regular feedback service, and analysis of listeners' reactions by audience research units to the programmes broadcast have also made significant contribution.

The manifestation of the spirit of innovativeness was evident when AIR covered sports events during Asiad 1982. In fact, it proved to be a landmark coverage. AIR broadcasted the various events to listeners all over the country. It also furnished facilities for dubbing and relaying the events to foreign broadcasting organizations. A team of nearly 550 people consisting of programmers, engineers and technicians were placed on duty in different stadia to catch the events in sound and convey them to listeners. All the technical infrastructure required for this historic event was provided internally.

### Check Your Progress

1. Who discovered that electric current created magnetic effect?
2. What was suggested the name AIR?

## 1.3 DEVELOPMENTS AND ADVANCES IN RADIO JOURNALISM IN INDIA

Over the years, All India Radio has expanded its range of programming. Today its home service programmes are transmitted for 3.91 lakh hours every year, excluding 1.76 lakh hours of Vividh Bharati programmes. Further, All India Radio also presents programmes in seventeen different foreign languages and eight Indian languages for over 56 hours daily on its external service to listeners aboard so as to present India’s point of view on important issues.

Radio is considered to be the music box for the common man. Previously, music, particularly, Indian classical music was considered to be the reserve of the rich. Due to the radio, different kinds of Indian music, whether they are classical, folk, film based, tribal, devotional, and so on can be enjoyed by anyone who owns a radio. Studies show that radio stations spend about 40 per cent of their total broadcasting time to programmes related to music. Thus, it can be said that All India Radio is facilitating the protection of the Indian musical heritage by acquainting the younger generation with the Indian classical music tradition.

AIR is seeking to scout new talents continually through regular music auditions as well as annual music competitions. Young and promising artists of higher grades are regularly featured in public concerts as well as in zonal hook up programmes. Classical music programmes comprise a weekly national programme of music which presents to the nation music by leading practitioners of both Hindustani and
Karnataka schools of music. As a promotional measure, a festival of music, known as radio sangeet sammelan is also organized every year. The recordings of these concerts are broadcast on AIR’s network in the country. One of the significant achievements of AIR’s national programmes in music as also of radio sangeet sammelan is integration through the interaction of the two major styles of Indian music. Eminent artists as well as the more promising younger talents in both styles are presented in these programmes which are beamed on the national network.

Since 1973, it also broadcasts a national programme of regional music, which brings to the listeners the rich tradition of folk and the light music of various regions. Besides, AIR stations put out sizeable chunks of folk and light music in their programmes. In 1952, it started the orchestral programme called ‘vadyavrinda’ consisting of both Hindustani and Karnataka instrumentalists. The Delhi unit has done remarkable experiments in orchestration of Indian music and has wide repertoire of a variety of compositions based on traditional ragas and fold tunes. The Madras unit comprised mainly Karnataka musicians. AIR is also paying equal attention to the development of folk light and choral music.

Even today, discerning people like to listen to radio news bulletins for they attempt to give comprehensive and speedy coverage of news and views in addition to commentaries and discussions on current affairs. Besides focusing on major trends in political, economic, social, cultural and scientific fields they give adequate attention to rural development, parliamentary proceedings and sports activities. News is broadcast daily through 254 bulletins. Of these, 68 bulletins in 19 languages are beamed from the home service from Delhi, 123 original bulletins in 60 languages and dialects and 63 bulletins of external services in 24 languages. Specialized news, sports news, state and development news, slow speed bulletins in English, Hindi and Urdu, a weekly bulletin of human interest stories constitute other important bulletins of AIR covered by its own correspondents. In days when parliament is in session, daily commentaries in English and Hindi review the day’s proceedings in the two Houses. Since 1977, a weekly coverage has also been introduced. A similar coverage of state legislatures is broadcast for state capitals in the languages concerned.

The external services broadcasts are designed to project a true and objective image of the country to listeners abroad. They explain the country’s point of view on matters of national and international importance. They also seek to acquaint listeners with the ideas and achievements of India as an open society, as also its secular ideals. These broadcasts are equally significant to service as a link with people of Indian origin living or settled abroad.

AIR beams programmes for special audiences and occasions. Specific programmes are relayed for the armed forces, women and children, youth, students, industrial workers, rural and tribal people. 14 stations broadcast daily programmes for the armed forces. Almost 55 stations present programmes twice a week in original languages for women. The objective of these programmes is to provide entertainment and impart necessary information on household topics. Programmes
on family welfare, a very important sector of human progress are planned and produced by 36 family welfare units at various stations of the broadcasting network. These programmes are integrated with the general programmes as well as those meant for the special audiences like rural, folk, women, youth and industrial workers.

The early sixties saw a vast growth in rural broadcasting. Auxiliary transmitting centres were installed to extend the coverage of the existing station. Farm and home units were created at several stations. By 1965, every station of AIR started broadcasting special programmes especially for rural listeners for about 30 to 75 minutes on a daily basis. Besides, a daily programme on hardcore agriculture and weather reports are broadcast for 45 to 55 minutes from 64 farm and home units, located in different AIR stations. These programmes aimed at providing educational and informational support to the intensive agricultural and rural development programmes. They also seek to disseminate new agricultural technology to farmers in their local languages or dialects, besides covering other subjects like rural cooperation, animal husbandry, poultry, fisheries and cottage industries. 31 stations present specially conceived and cooperatively developed programmes called the ‘farm school of AIR’ where instruction and guidance on farming is provided to listeners. In this programme, lessons on subjects like rice and wheat cultivation use of fertilizers, dairy, poultry, fisheries and nutrition are given. The evaluation of these programmes has indicated that the audience finds them extremely useful. It is interesting to learn from the record projects of agricultural universities that AIR’s rural programmes are not only useful to the villagers but also command credibility and acceptability. The imprint of AIR is best known by the terms — radio seeds and radio fertilizers.

In order to provide a forum for the self-expression of the youth between the age of 15 to 30 years, AIR broadcasts a programme for youth called ‘yuvavani’ from 74 stations. This service provides an opening for the talents of this age group to present their viewpoints by participating in a wide range of programmes, talks, discussions, interviews, plays, features and music. Under these programmes a youth news bulletin is also broadcast by the youths.

AIR is an extensive arm of India’s cultural activities. Its programmes include at least two plays a week. Besides, original plays, radio adaptations of outstanding stage plays, novels and short stories are also broadcast. Since 1956 outstanding plays from Indian languages are being transmitted in the national programme of plays. The national programme of features which commenced in 1956 focuses attention on matters of national importance or interest in political, economic, social or cultural spheres. In fact, many people with a literary bent of mind lay great emphasis on AIR’s literary and cultural programmes and draw mental exhilaration from them.

AIR is becoming a good aid in school education. Most AIR stations broadcast programmes based on the school curriculum to reach students in interior areas. Radio support to university correspondence degree courses is also provided by several stations.
Sports events in India and abroad are covered by reviews, running commentaries and voice dispatches. In metropolitan centres a daily sports service is put for 95 minutes covering all important sports events. In addition, two news bulletins, one in English and other in Hindi, of five minutes duration, and weekly sports newreels are also broadcast.

There are special occasions which attract special programmes on the national hook up of AIR. These include the Republic day, Independence Day, anniversaries, visits of foreign dignitaries or the visits of Indian dignitaries abroad.

Radio is a popular entertainer as well. Vividh Bharati, a popular broadcast for this purpose is transmitted from 31 centres including two short wave transmitters at Mumbai and Chennai. The total duration of Vividh Bharati is 12 hours and 45 minutes on week days and 12 hours and 15 minutes on Sundays and holidays. The programmes which are generally acclaimed are music, humorous skits, short plays and features.

AIR introduced broadcasting of commercials on November 1, 1967. That is a part of marketing service, through it brings revenue as well. Today the service is provided by 28 centres. Advertisements are accepted in any language as tape recorder spots of 7, 15, 30 and 60 seconds duration.

Radio as a mass media tool and the concept ‘radio for all’ will be roughly measured in terms of the number of radio receiving or transistor sets in the country. Since independence these sets have increased manifold to an aggregate of around 3 crores. The number may increase with the lifting of licence fee this year. In terms of diffusion rate it means nearly 4.4 sets for 100 persons. Still a figure below the minimum UNESCO norm of 5 sets for 100 people or one set for each family. In the Indian context, however, the redeeming situation is that one set can be used to serve a larger number of people beyond the household. In addition, there are about 1.6 lakh community sets which operate in rural areas. Although the transistor revolution which has swept every part of the country has reduced the importance of community sets, some recent studies have underlined the need of continuing to have community receiver sets at least in selected areas. In the sixties, when the community listening scheme was in full swing and assessed, it was revealed that the discussions in community listening and deliberations were excellent or good and that participants learnt a ‘great deal’ or quite a lot. Also in addition, these forums developed rapidly into decision-making bodies capable of speeding up common pursuits of the village.

The government’s interest in radio and its concern about its growth were reflected in the allocations to broadcasting in its successive five year plans. As a result AIR grew in size and status. Today this national service comprises 86 stations including two Vividh Bharati commercial centres, one at Chandigarh and other at Kanpur. In addition, the network includes two auxiliary study centres at Bhubaneswar and Shantiniketan.
AIR’s programmes are beamed from 162 transmitters of which 126 are medium wave. Broadly speaking we may say that AIR now serves about 90 per cent of population and about four-fifths of the total area of the country. More than any other media, its sweep includes far flung areas like Leh and Laddakh, Tawang in Arunachal Pradesh and the distant islands like the Andaman and Nicobar and the Lakshadweep. One may hope that it is not in the distant future that AIR may reach its full moon day by claiming to cover all the areas of the country and its entire population.

Simultaneously, AIR has also staged a leap forward in its software and research development aspect. Today it does face occasional fireworks or adverse comments of critics. It also has an intrinsic weakness of not enjoying high credibility because of its being a government controlled medium. Yet, AIR is considered by media authorities and researchers to have proved its worth and utility both as an informational channel and a development and cultural activist. Still more, it has provided healthy entertainment through its various light and humorous programmes. Extension research and other field surveys have already given great credit to radio both as a credible promoter of suitable climate for development and progress and also for having advanced farm educational and cultural renaissance. Its contribution in the form of transmitting useful and timely information, motivation and suggestions for rural development is conceded. Its sponsors claim that radio is helping to create a climate of opinion in which social change can take place and people could be involved in the process. One can safely presume that along with TV, documentaries and farm journals, AIR will provide an adequate communication umbrella to integrated rural broadcast, feedback interviews, ‘meet the activists and innovators’ and critic series, impact studies and others. Thus, AIR has an activating role in furthering India’s culture, education, music and other practising arts. The increasing number of Walkman transistors and the growing popularity of listeners’ letters are obvious indications.

Radio has also extended its support to distance learning students and universities. With the diversification of the programmes of radio, a need was felt to have a standard to define the ‘ethical’ and the ‘unethical.’ Let’s discuss these codes and ethics in India.

**Broadcasting Code**

The present broadcasting policy is based on the All India Radio (AIR) Code of 1970 which specifies that broadcasts on All India Radio will not permit the following:

(i) Criticism of friendly countries
(ii) Attack on religion or communities
(iii) Anything obscene or defamatory
(iv) Incitement to violence or anything against the maintenance of law and order
(v) Anything amounting to contempt of court
(vi) Aspersions against the integrity of the President, Governors and Judiciary

(vii) Attack on a political party by name

(viii) Hostile criticism of any state or the centre

(ix) Anything showing disrespect to the Constitution or advocating change in the constitution by violence; but advocating change in a constitutional way should not be debarred.

The Broadcasting Code also prohibits ‘direct publicity of an individual or of a commercial benefit to an organization’ and the use of ‘trade names amounting to direct advertising.’ The Code applies to criticism in the nature of a personal tirade, either of a friendly government or of a political party or of the Central Government or any State Government. However, it does not debar references to and/or dispassionate discussion of policies pursued by any of them. Adds the Code, ‘if a Station Director finds that the above Code has not been respected in any particular or particulars by an intending broadcaster he will draw the latter’s attention to the passage objected to. If the intending broadcaster refuses to accept the Station Director’s suggestions and modify his/her script accordingly, the Station Director will be justified in rejecting his or her broadcast. Cases of unresolved differences of opinion between a Minister of a State Government and a Station Director about the interpretation of the Code with respect to a talk to be broadcast by the former will be referred to the Minister of Information and Broadcasting, Government of India, who will decide finally whether or not any change in the text was necessary in order to avoid violation of the Code.’

Clause 2 of Article 19 of the Indian Constitution forms the base of the Code and other restrictions on broadcasting. Other restrictions include the broadcasting of the news of the death of high dignitaries such as the President, the Vice-President, the Prime Minister and a few others only after it has been cleared by the Home Secretary. The AIR correspondent has to get the news from him, inform the News Room, before it can be broadcast. This was the sole reason behind extreme delay in the announcement of the news of Indira Gandhi’s assassination, though the BBC had made it known worldwide four hours earlier. According to an agreement arrived at by all political parties in 1977, air time continue to be allocated for political broadcasting prior to national and state elections.

Ethics of Broadcasting

Radio and television were introduced in India as the carriers of entertainment and education for the general public. The prime objective behind this introduction was “public service.” The government used both these electronic media for its own propaganda as well as for commercial interest. Non-broadcast media like video and cable are in the private sector and therefore are beyond control and regulation. The government tried to regulate cable and satellite TV. However, the efforts of the government aimed at regulation proved to be ineffective because of the involvement of a large number of operators and sub-operators.
The ethics of broadcasting are not much different than those for the print media as far as broadcast news is concerned. These pertain to questions of accuracy and fairness, respect for privacy and religious beliefs/practices of different communities, the need for caution in reporting violence and communal disturbances and in criticizing judicial acts, the right to reply, respect for the confidentiality of sources and the need to eschew obscenity and vulgarity.

The coverage of Operation Bluestar by All India Radio and Doordarshan is a case in point here. Else for that matter, consider their announcement of the assassination of Indira Gandhi and Rajiv Gandhi. What were the ‘ethics’ involved in their low-key coverage of the storming of the Golden Temple at Amritsar and their rather late declaration of the news about the assassinations of the Gandhis? According to the point of view of a professional journalist, news should be transmitted immediately after the event no matter what is the event or who are the persons involved.

However, there is an alternative view that tragic news which affects an entire nation and which might lead to violence, may be withheld or delayed for a while till atmosphere becomes calm and the law and order situation is under control. This alternative view suggests that professional ‘ethics’ cannot take precedence as these professional journalistic ethics have been evolved in Western liberal democracies and often have little relevance to the social and cultural needs of developing countries.

However, the misuse of the airwaves by the government for blatant political party propaganda, or for criticism of opposition parties without representing their perspective, must be termed ‘unethical’. Also ‘unethical’ is the false representation of rallies, strikes and ‘bandhs’ to suit the ruling party’s interests. The deliberate non-coverage of events of public concern and also the banning of programmes expressing alternative views on controversial issues is also considered ‘unethical’ since broadcasting is not the private property of any political party or commercial broadcaster, as the 1994 Supreme Court declaration that ‘the airwaves are public property’ has made amply clear. All India Radio’s monopoly of news on radio is also questionable: so is the auctioning of airwaves to private broadcasters for the rank commercialization of FM radio.

**Prasar Bharati Bill**

The Prasar Bharati Bill was largely based on the recommendations of the Verghese Committee Report. The Prasar Bharati Bill that was introduced by the Janata Party government in 1979. However, there were some differences between the Verghese Committee Report and the Janata Party Prasar Bharati bill on the question of autonomy. The Janata Party bill favoured the creation of a Broadcasting corporation with an act of Parliament while the Verghese Committee wanted broadcasting autonomy to be a part of the Indian Constitution. This, the Committee felt would ensure that no future government could subvert the independence of the corporation. The Bill that was introduced in Parliament was closer in content to
Janata Party bill on the question of autonomy. The Prasar Bharati Bill became an act of Parliament in 1990 after being approved by both the Lok Sabha and Rajya Sabha.

Let us study some of the provisions of the Prasar Bharati Act.

The Prasar Bharati Act 1990:

- Called for the establishment of a Broadcasting Corporation, known as Prasar Bharati, to ‘define its composition, functions and powers’.
- Granted autonomy to All India Radio and Doordarshan.
- Called for the creation of the Prasar Bharati Board that would manage the affairs of the corporation.
- Also stated that all the property, assets, debts, liabilities, payments of money due, all suits and legal proceedings involving Akashvani (All India Radio) and Doordarshan were transferred to Prasar Bharati.

Despite passing the Act in 1990, successive Governments decided not to finalize the Act. It took another 7 years for the implementation of the ‘Prasar Bharati Act.’ In the meanwhile, the Government set up committees to examine the working of Radio and Television in the country. These included the Vardan Committee (1991), the Ram Vilas Paswan Committee (1995), and the Sengupta Committee in 1996.

The Vardan Committee suggested that Doordarshan should devote ‘at least 20 per cent of total broadcasting time on each channel to socially relevant programmes.’ Further, ‘no more than ten per cent in terms of time of the programmes broadcast should be imported.’ It also recommended that ‘while dealing with any matter of controversy, the programme shall present all points of view in a fair and impartial manner.’

The Sengupta Committee was set up by the Ministry of Information and Broadcasting under the Chairmanship of Dr N.K. Sengupta to review the provisions of ‘Prasar Bharati (Broadcasting Corporation of India) Act, 1990’ and to make recommendations regarding the restructuring of Prasar Bharati. The committee had several meetings and also interacted with media experts, representatives of various associations of the employees and executives of Doordarshan and All India Radio. The Committee noted that there had been a sea change in the media scenario in the world and in India since the Prasar Bharati Act was enacted in September 1990. In a short span of five years, a significant paradigm shift had occurred from State monopoly of electronic media to virtual laissez faire. The privatization of AIR’s FM service by way of leasing out of slots to private operators and the plethora of satellite channels had ended the monopoly of the State-owned electronic media. This was however more true of television than of radio. More significantly, the committee noted that in the light of various judgments of the Supreme Court, the government was required to set up an independent authority to regulate the airwaves. It was in this context that the Committee proceeded with its deliberations bearing in mind that
the Prasar Bharati Act required certain relevant modifications if it had to reflect the true spirit of autonomy, accountability and national needs and aspirations. The Committee was of the opinion that there was no need to change the whole Act, but would recommend that it was necessary to alter some of the provisions, introduce some newer ones and delete few of the existing provisions in order to make the Act workable. The Ram Vilas Paswan Committee noted that there should be a regulatory body to oversee both public and private telecasting/broadcasting. It also noted that the provisions of the Prasar Bharati Act, which was unanimously passed by Parliament in 1990, should be kept in mind while framing the regulatory mechanism which should be an independent autonomous authority. Some of the recommendations of the Ram Vilas Paswan Committee made its way into the Broadcasting Bill that was introduced in Parliament in May 1997.

The Prasar Bharati Bill was finally enacted on September 15, 1997.

Broadcasting television under the AIR was started in 1959. Later on in 1975, the SITE technology was tested and its success made the government further adopt the home grown satellite INSAT in 1982. Doordarshan, the government sponsored national television network started broadcasting in 1976 which later brought the advent of advertisement and other programmes. International satellite and its broadcast through CNN came in 1991, followed by Star network and later on many different Indian satellite based television broadcasts through Zee network and channels.

With the emergence of television, viewers became more interested in watching rather than listening. The emergence of private FM radio channels has brought back radio in the lifestyle of common man. Nowadays, we listen to radio while driving car or doing household work. Also, when we are tired and we need to de-stress, we simply tune in to the radio and listen to filmi songs as per our requirement. Hence, radio has come a long way from All India Radio (AIR) to channels such as Radio Mirchi, Radio Fever and others. You will learn about the private radio stations in Unit 10.

1.3.1 Development of Technology in Radio

Before digital technology was developed, audio recording relied on an analogue process. An analogue signal is a continuously variable electrical signal whose shape is defined by the shape of the sound wave produced. In the analogue recording process, a duplicate or electromagnetic representation of the sound wave of the original sound source can be stored on magnetic tape. For example, a microphone converts sound pressure changes to changes in voltage that are sent down the microphone cable and recorded into audio tape as changes in magnetic strength. Each time analogue signal is recorded or processed in some fashion, it is subject to degradation because the signal changes shape slightly. Analogue encoding is similar to creating a line graph to show a statistical analysis. All measurements are on a continuous line that curves up and down with no discrete points. The recording process is like trying to retrace a curve on a graph; the reproduction is always
slightly different than the original. In addition to this generation loss, since analogue
recording relies on magnetic pulses stored on the tape, any defect or decrease in
the magnetic properties of the tape means a loss of signal quality. Typical problems
for analogue recording have included noise and distortion, flutter and hiss and
limited dynamic range.

In today’s production studio, computers and other equipments use a digital
recording process. By digital technology, we mean the process of converting original
audio waveform information into an electrical signal composed of a series of ‘on’
and ‘off’ pulses. In other words, the digital process is a conversion into binary
numbers. All computers handle information in this manner by associating a binary
number with each letter of the alphabet and each number and then manipulating
this binary data. Digital encoding is accomplished in a discrete fashion, similar to
looking at individual numbers in a statistical analysis and writing them down in a set
order. The audio signal starts out as analogue, but it can be converted to digital by
going through four basic stages: filtering, sampling, quantizing and coding.

First, the original sound signal is sent through a low-pass filter that strips off
the frequencies that are above the range of human hearing. Although originally
inaudible, these frequencies can be shifted into an audible range during recording
and playback. The filtered analogue signal is next divided many times a second in
a process known as analogue-to-digital conversion or simply sampling. Each sample
represents the amplitude of the audio signal at the moment the sample is taken.
The more samples are taken and converted to binary data, the more exact a
reproduction of the original sound signal can be recorded on to tape or some
other storage medium. The process is much like that of film, where 24 still
photographs are taken per second. When these photographs are played back at
the same rate, they create the illusion of movement. When audio samples are
played back, they create the illusion of a adjacent sound. To do so, however,
many more than 24 samples must be taken per second. Most digital audio equipment
utilizes sampling rates of 32, 44.1 and 48 thousand samples per second. The sampling
rate must be at least twice the highest frequency of audio signal to enable high-
quality and accurate encoding and decoding.

Since we cannot get sounds above 20 KHz, the sampling rate should be
slightly greater than twice 20 KHz, which is one reason why the most common
digital sampling rate is 44.1 KHz. Lower sampling rate can be utilized for lower
quality recordings. Higher sampling rates produce audiophile-quality sound, which,
to be appreciated, must be played on highest fidelity equipment.

Quantizing and coding are the stages that assign a numerical value to each
individual sample. The samples taken of the amplitude of the audio signal can fall
at any point within the range of amplitudes, from absolutely silent to very loud.
Between these two extremes, or indeed between any two points as geometry tells
us, there are an infinite number of other points. Quantizing breaks up these infinite
points into a more manageable number, rounding samples up or down to the nearest
value. The term ‘bit depth’ refers to the quantizing levels; the more levels, the more
accurate information you would have about the signal, as samples will be rounded
up or down. For example, a 1-bit system would signify just two quantizing levels – either no amplitude or maximum amplitude – and that does not give us much information about the sound. Each additional bit doubles the number of levels – two bits give four levels, three bits give eight levels and so on. The standard bit rate for most digital recording is 16 bits, with some compact disc and DVD recording now being done with 20 bit or 24 bit technology. Sixteen bits can represent 65536 values. Higher bit depth equals lower noise and better fidelity of the digital recording.

Coding involves putting 0s and 1s in a precise order corresponding to the values measured during the quantizing process. The binary, or digital, ‘word’ represents each individual sample’s quantized (rounded up or down) voltage level at that particular moment. The analogue-to-digital (A/D) converter is the electronic circuit that accomplishes this task. Remember, it is the binary data that is actually recorded, not an analogue representation of the signal. With digital technology, we can copy from tape to tape with no measurable loss of quality. Along with the improved frequency response, wide dynamic range, and drastically reduced noise and distortion, this ability to re-record with no decrease in quality has contributed greatly to the acceptance of digital in radio production.

To transform the digital signal back to analogue, the recorded numbers are sent to a digital-to-analogue (D/A) converter where each sample is read and decoded. A signal of the corresponding analogue amplitude is produced and ‘held’ for the individual samples, producing a stair-step signal that represents the analogue signal. Finally, a filter employs an exact mathematical attribute for each sample to create a correct reproduction of the original analogue signal.

Check Your Progress

3. When was broadcasting of commercials introduced by AIR?
4. When was the Prasar Bharati Bill finally enacted in India?
5. What are quantizing and coding of audio samples?
been able to maintain its popularity. Consumers are time starved these days and hence, radio is a wonderful medium of infotainment. It caters to multiple demands of the listeners also giving them the flexibility to multitask.

Radio has been the biggest companion for the people struck by natural calamities and disasters. Radio has great REACH even targeting the remotest villager. It is ACCESSIBLE to the consumers very easily. During the Uttarakhand floods, the locals who heard about the flash floods in Kedarnath on radio rushed to rescue the pilgrims. It can ENGAGE the consumers in different ways just with the power of words. Prime Minister Narendra Modi chose the radio medium to reach out to the masses only through this medium. It has RELEVANCE as the content is local and current. All India Radio broadcasts weather forecast for farmers, fishermen cautioning them in extreme weather conditions. Consumers have great TRUST in this mighty medium. When all the communication channels were snapped due to Tsunami in Tamil Nadu and Andaman & Nicobar Islands, radio was the only medium that informed people with the live updates in the region.

The radio medium has registered a reach to almost 99% of the Indian population and has made a mark in the rural India as well. Its portability and inexpensiveness makes it a sought after medium of infotainment amongst all. Content is the king on radio and with programmes targeting the niche listeners, radio has surpassed the barriers like illiteracy. With more than 800 radio channels in India, the medium has been able to reach the listeners in various languages, dialects and creative forms.

Radio will never die as it is the most versatile medium providing customized content targeting niche audience with broadcast through FM, AM, online, community radio.

Future

The radio industry has a lot more potential to be explored with the advent of digital media platforms. The radio has gone through an immense transition in the past decade – from broadcast to podcast. According to the report titled ‘Media for the masses: The promise unfolds’ published by KPMG & FICCI, radio industry is expected to record a growth of 16.1% by the year 2021 and revenue of Rs. 4,780 crores. The radio sector will also open gateway for large number of jobs for the position of station manager, producer, radio jockeys, scriptwriter, reporter, editor, production assistant etc.

Since radio has a vast reach and due to its hyperlocal nature, it is expected to grow in the years to come. Content rules this medium and is also extensively utilized by the advertisers. Radio spots (ads) are cheap and targets a large consumer base hence many local advertisers choose to broadcast their advertisement. Radio is consistently in bringing change in the society with constructive communication and meaningful discussions. The demand for radio is completely market driven as the advertisers compete in the local market through this media. The cost incurred for audio production
Internet of Things (IoT) has already opened the new avenues for radio and better communication. IoT has enabled easy sharing of audio data possible through WiFi and therefore, radio has a long way to go.

1.5 BASICS OF SOUND RECORDING

In this section, you will be introduced to some of the basics of sound recording

1.5.1 Introduction to Acoustics

Sound, as described in physics, is a vibration that results in an easy to hear mechanical wave that emanates on pressure and displacement and uses a medium like air or water to propagate itself. Physiology and psychology looks at sound from a different perspective and describes sound as receiving of waves that are recognized by the brain as sound.

ANSI/ASA S1.1-2013 has defined sound as:

- Oscillation in pressure, stress, particle displacement, and particle velocity propagated in a medium with internal forces (e.g., elastic or viscous) or the superposition of such propagated oscillation.
- Auditory sensation evoked by the oscillation described above.

From a physical stand point, sound is the stimulus and can be visualized as a wave motion through a medium, air or other elastic media. Looking at it from a psychophysical angel, we consider hearing as one of the senses that most living creatures have. This is because sound excites the hearing mechanism resulting in the perception of the sound.

Both the physical and psychophysical aspects of sound are important to us because we are interested in the physical disturbance of air in a room due to sound, and are also interested in how a person listening in the room perceives that disturbance.

Media, like air, water and solid, allow sound to propagate through it in the form of waves. Sound waves originate from a sound source like a drum, vehicle engine or clapping hands. The medium surrounding the sound source begins to vibrate, and as the sound source continues, the vibrations move away from the source at the speed of sound, which is the sound wave. At a particular distance from the sources, the pressure, velocity, and displacement of the sound will vary from one instance of time to another. Likewise, at a particular instance in time, the pressure, velocity, and displacement will vary. Whatever the medium through which the sound waves propagate, whether, solid, liquid or gas, the particles of the medium do not travel with the sound waves. A significant aspect of sound waves that we includes as pecks reflected, refracted, or diffracted by the medium while being propagated.
In any study of sound, the behaviour of sound needs to be looked at. There are three factors that affect the behaviour of sound:

- **Density and pressure relationship**: Temperature of the medium affects the relationship between density and pressure, which in turn governs the speed of sound in that medium.
- **Movement of the medium**: If the medium is itself in motion, like the wind or a moving vehicle, the sound is carried further.
- **Viscosity of the medium**: In many cases the viscosity of the medium determines the rate of sound loss or attenuation, thereby, affecting the motion of the sound through that medium. The attenuation caused by viscosity is insignificant for media like air and water.

We have understood that sound needs some form of matter like gases, liquids, solids, and plasmas to be able to propagate. The term medium is used to refer to this matter, which means that sound does not propagate through vacuum.

Acoustics is distinct from sound although they go hand-in-hand. Acoustics involves the study of any kind of mechanical waves in media, such as, gases, liquids and solids including aspects of vibration, sound, ultrasound and infrasound. Society today requires acoustics applications in most fields, particularly those industries that deal with the control of audio and noise.

The origin of the term acoustic is Greek and its Latin synonym is ‘sonic’. Sonics is a term that is used as a synonym for acoustics. From this we get the terms ‘ultrasonic’ to refer to frequencies above the audible range and ‘infrasonic’ for frequencies below the audible range.

Hearing is one of the most critical senses of most living creatures, including humans. The science of acoustics spreads across all aspects of society like music, medicine, architecture, industrial production, and warfare. Animals also use sounds to communicate like in mating and marking territories.

The definition of acoustics according to ANSI/ASA S1.1-2013 is:

- Science of sound, including its production, transmission, and effects, including biological and psychological effects.
- Those qualities of a room that, together, determine its character with respect to auditory effects.

The generation, propagation and reception of mechanical waves and vibrations are the elements of acoustics studies. The diagram below depicts the steps followed in any acoustic occurrence.

**Fig. 1.1 Steps in Acoustic Occurrence**
Let us take a brief look at each step:

- **Cause:** Sound can originate from any source, whether natural or willfully produced (volitional).
- **Generating mechanism (transduction):** Transduction can happen with different processes. It is basically the conversion of some form of energy into sonic energy that produces a sound wave.
- **Acoustic wave propagation:** The acoustic wave equation describes how energy is carried throughout the propagating medium by the acoustic wave.
- **Reception (transduction):** The energy is converted again into other forms that could be natural or willfully produced volitional.
- **Effect:** Finally, the effect is what is perceived as sound.

The entire process revolves around the main segment, which is propagation.

### Speech, Music and Noise

Everyone is familiar with common signals like speech, music, and noise. Speech is one of the key components of human communication and it is something we hear through most of the day. Music is another means of communication which gives us pleasure. On the other hand, noise is considered as something that is unwanted and disturbs our communication medium of speech and music and also the periods of silence.

#### Speech

We need to understand speech sounds to be able to understand how sounds are produced. Speech is not a constant sound, it is extremely variable and highly transitory (momentary). It is more of a passing of energy between the three dimensions of frequency, sound level, and time. To be able to depict sound in all three dimensions, a sound spectrogram needs to be used.

Other than speech, humans can produce many kinds of sounds like coughing, crying, snoring, and laughing each of these show distinct patterns on the sound spectrogram. The spectrograms appear similar to horizontal lines with the frequency spaced vertically.

Speech is generated by two functions that work independent of each other. One is the source of the sound and the other is what we know as the vocal system or voice tract. They work in a series, with the sound source generating the sound and the vocal tract shaping it to form intelligible speech.

#### Sources of Sound

There are basically three different sources that give us the following types of sound:

- **Voiced sounds:** These are sounds that emanate from the vocal cords. As air from the lungs move past the slit between the vocal cords they make the
The vocal cords vibrate. The air emerges as pulses of air that produces a sound. The slit between the vocal cords is called the glottis.

- **Fricative sounds**: This sound is made by using the teeth, tongue or lips to form a constriction and force air through it using controlled pressure which produces a significant turbulence in the air that creates the sound. The sound is created by the vocal tract and is used to create sounds like f, s, v, and z.

- **Plosive sounds**: These sounds are formed by holding the breath and allowing pressure to build, then releasing the breath suddenly. Sounds like k, p and t are formed by plosive sound and are normally followed by a rush of fricative sound.

When we speak we do not think of the way the sounds are emitted, but voiced sounds, fricative sounds and plosive sounds are the three types of sound that help us form intelligible speech.

**Vocal Tract**

The second function in the generation of speech is the vocal tract. The vocal tract is a section of 6.7 inch (17 cm.) between the vocal cords and the lips. This area consists of the following:

- Lips
- Jaw
- Tongue
- Velum (this can open or close the nasal cavity like a trapdoor). The size varies from zero to about 3 sq. in. (20 sq. cm.).
- Nasal cavity. This is about 4.7 in. (12 cm.) long and has a volume of about 3.7 cu. in. (60 cu. cm.).

The dimensions are significant as they impact the resonances of the vocal tract and thus, affect the speech sounds.

**Directionality**

The strength of speech sounds vary according to the directionality. For example, the head casts a sound shadow that effectively weakens the speech sounds that move towards the back of a person. What would be the best way to measure directionality? The mouth is a good place to measure directionality as it is a continuous source of speech sounds. To get a precise measure of the effects of direction, averaging must be meticulously followed to cater to the variability and complexity of speech sounds. In both the horizontal and vertical planes, directional effects range from 5 decibels (dB) to 12 dB, depending on the frequency band. However, the torso effect comes into play for the vertical plane.

**Music**

When we consider musical sounds we see that there are a whole lot of variations. The range can vary from a form close to a sine-wave emanating from a single...
instrument or single voice and can reach the complexity of a musical band consisting of many different instruments and/or voices. The complexity comes from the fact that the tonal texture of the notes of each instrument is different from another. The same principle applies to voices.

### Auditory area

The human ear has to accommodate the frequency range and the dynamic range of a host of sounds like speech, music and all other sounds. The auditory area is a complex component of the ear that provides the capability to hear a wide range of frequencies as well as dynamic ranges. Only a small portion of this auditory area is used for speech having an average dynamic range of about 42 dB and the 170- to 4,000-Hz frequency range comprises 4.5 octaves.

The music area of the auditory area is much larger than the speech area as music has a greater range of level and frequency. The dynamic range for music is around 75 dB and the frequency range is approximately between 50 and 8500 Hz covering 7.5 octaves. The human ear has an octave range of 10. A wider frequency range is required to meet high-fidelity standards. Short-term transients are of considerable importance although their contribution to the overall average is minimal and require greater dynamic and the frequency ranges to accommodate these transients.

### Noise

"Signal" means information is being conveyed. So, is it correct to consider noise as an information carrier? We make different noises that are not proper language, like cheering (Yay) or derision (Boo) or acknowledgement (Hmm). However, these noises convey a lot of information about our attitude to something or someone. So, noise modulated in a particular way is a basic part of communication of this kind. Another way of communication is to shape noise by interrupting it in spurts to form dots and dashes. Information on the acoustical quality of a room can be conveyed by a decaying band of noise. There are also undesirable types of noise and quite often it is difficult to differentiate between an unpleasant noise and a carrier of information. For example, the noise emitted by an automobile engine, although undesirable in most cases, communicates information on the health of the engine. A noise that is communication to you may be considered a noise to someone else. For example, in a party, the music from a high-fidelity system will be beautiful sounds to the participants in the party, but to the next door neighbour it is noise. Boundaries are established to minimize undesirable sounds and at the same time ensure that information carriers are heard by those who are meant to hear them.

### Acceptable Noise

Till now we have looked at noise as undesirable. Then, what is acceptable or good kind of noise? We are increasingly using noise as a measurement tool in acoustics. As this type of noise conveys information, it can be termed as good noise. The same noise can be good as well as bad, depending on the context in
which we hear it. When you are listening to your favourite music, the ringing of a phone will be bad noise. However, in a different context, the ringing of the phone may convey that a call that you were waiting for has come.

Accurately measuring pure tones is much more difficult than a narrow band of noise. A microphone picking up a pure sound in a studio will produce an output that will vary drastically from position to position, because of the resonances in the room. For a band of noise, one octave wide, the position to position variation would turn out to be more uniform, but the relevant information would still be captured. So, when measuring the sound output in a studio the narrow band of noise would be more useful than a pure tone.

Random noise

Electrical circuits are prime sources of random noise and are very difficult to minimize. Thermionic vacuum tubes contain cathodes that produce high amplitude noise with a wide spectrum when heavy ions fall back on them. Even more noise is generated when gas molecules are released into the evacuated space. Today, silicon diodes or other solid-state devices are used along with an amplifier, voltmeter, and attenuator to create random noise. Noise that has amplitudes distributed in a ‘normal’ or ‘Gaussian’ (Bell-shaped) pattern is considered purely random in character. A measurement of random noise over equally spaced times would show a typical Gaussian distribution curve because the readings would consist of a combination of positive, negative, greater and smaller samples.

White and Pink Noise

You will also come across references to white noise and pink noise. Let us see what they are and how to differentiate.

- **White noise**: Similar to white light, white noise is where you have a uniform distribution of energy throughout the spectrum. You get a flat distribution of energy.

- **Pink noise**: When you observe a prism with white light passing through it, the light is broken down into a range of colours. The longer wavelength of light or light in the lower frequency region is associated with the colour red. Similarly, noise in the lower frequency is associated with red. Pink noise is that noise that has a higher frequency in the low frequency region. That is, noise in the low-frequency region that exhibits high energy levels. The slope is downward of 3 dB per octave.

The origins of these two terms come from the use of the two types of spectrum analysers.

- **Constant bandwidth analyser**: This has a passband tuned throughout the spectrum with fixed width and can have a 5 Hz bandwidth. White noise having a flat spectrum, when measured with a constant-bandwidth analyzer, will result in another flat spectrum as a constant energy would be measured throughout the band.
• **Constant percentage bandwidth analyser:** This works on the principle of changing bandwidth with frequency. For example, in the one-third octave analyser, a frequency of 100 Hz has a bandwidth of only 23 Hz absorbing less noise energy. Whereas, the bandwidth is 2,300 Hz when the frequency is 10 kHz and absorbs much more noise energy. This type of analyser results in an upward-sloping of 3 dB per octave.

It is desirable to achieve a flat response throughout the frequency range when measuring the audio-frequency of any object like instruments and rooms. Assuming that the characteristic of a system that needs to be measured has an almost flat frequency and is fed with some white noise, the measurement would show an upward slope at 3 dB per octave. However, it would be preferable close to flat measurement to enable recognition of the deviations. A noise with a downward slope at 3 dB per octave will help achieve this goal. So, the white noise can be passed through a filter to achieve such a downward sloping noise or what we know as pink noise. Pink noise in a close-to-flat system like an amplifier or room will result in a close-to-flat response, making the deviations from flatness very obvious. This is the significance of pink noise.

**Signal distortion**

Let us now see how signals are impacted when passed through various types and forms of signal processing gear like transducers and amplifiers. Some of these are discussed below:

- **Bandwidth limitation:** A different signal output is obtained as compared to the input, when the lows or highs are cut by the passband of an amplifier. Although, the overall effect of reducing record surface noise by a scratch filter is improved output, the signal itself becomes poorer due to it.

- **Nonuniform response:** The signal waveshape can also get altered with the peaks and valleys within the passband.

- **Distortions in time:** Signals can get degraded when incidents like incorrect speed and fast fluctuations in that speed. The result that gets introduced in the signal is known as ‘wow’ and ‘flutter’.

- **Phase distortion:** Time relationship between signal components will get upset when phase shifts are introduced.

- **Dynamic distortion:** The original dynamic range of a signal can get changed with the use of a compressor or expander. This also is a form of distortion.

- **Crossover distortion:** The output devices in class-B amplifiers conduct for only half of the cycle. Crossover distortion is caused when there are discontinuities near zero output.

- **Nonlinear distortion:** A one-to-one relationship exists between input and output in truly linear amplifiers and nonlinear tendencies are controlled through feedback. When a pure tone is passed through the ear, which is not linear, the ear can hear the harmonics. Simultaneously, when two loud tones...
are passed, the ear itself generates sum and difference tones that can be heard along with their harmonics. This effect can be simulated by a cross-modulation test on an amplifier. No sum or difference tones or harmonics would be generated with an amplifier that is perfectly linear. Frequency elements produced within the component but were not there in the input signal is nonlinear distortion.

- **Transient distortion:** A bell rings when it is hit and this can be somewhat replicated in an amplifier by applying a steep wavefront signal. This is the reason why it is difficult to reproduce signals like piano notes. Transient forms of distortion in systems can be evaluated by using sophisticated measuring techniques like transient intermodulation (TIM) distortion, slew induced distortion, and so on.

**Harmonic distortion**

Several methods have been adopted to evaluate the effects of circuit nonlinearities and the harmonic distortion method is the one most widely used and is very easy to comprehend. The methodology followed is to drive a high purity sine wave on the device. A changed output waveshape, which is appearance of harmonic components that were not part of the pure sine wave, signifies that the signal has encountered a nonlinear situation. A wave analyzer having a constant passband width of, say, 5 Hz, can be used to measure these harmonic distortion products.

**Loudness — Frequency Relationship**

Initial work on loudness was done by Fletcher and Munson at Bell Laboratories. Subsequently, there have been many refinements by others. An international standard (I.S.O. 226) has been adopted based on the work of Robinson and Dadson on the family of equal-loudness.

Loudness is a very subjective term as it relates to the response of the listener. Sound-pressure level and loudness level are purely physical terms. The loudness of sound from sound-level measurements is measured in units of sones by the loudness level. Frequency and sound-pressure level greatly influence perceived loudness. For example, with a frequency of 1000 Hz and a sound-pressure level of 30 dB produces a loudness level of 30 phons. However, with a frequency of 20 Hz and an additional sound-pressure of 58 dB produces an equally loud sound.

The ear’s sensitivity to bass notes is less than its sensitivity to midband notes at low levels. This leads us to conclude that the quality of reproduced music, as detected by the ear, depends on the volume-control setting. The ear responds at a different frequency when listening to background music at low levels than when listening to music at higher levels.

**Loudness Control**

Let us look at a hypothetical situation. You are playing a recorded piece of music with the volume control adjusted so that it plays in the background. Let us assume
it is at 60 phons. However, the music may have originally been played at a different loudness level at the recording studio, say at 80 phons. The lower loudness level during the playback will disturb the balance of the bass and treble even if the volume is increased. It will be necessary to increase the bass and treble to achieve a satisfactory balance.

Most amplifiers have loudness controls that attempt to compensate for the change in frequency response of the ear by adjusting electrical networks for different loudness levels. But this only works with a specific loudness level of reproduced sound and does not completely resolve the problem. There are many factors that influence the output, including particularly the volume-control setting. Some of the factors are:

- Loudspeakers come with different acoustic output for a given input power
- Gain of preamplifiers, power amplifiers, tuners, and phono pickups will vary between brands and also between circuits
- Listening-room conditions vary from room to room

With some many variables, it is a challenge to design a loudness control that matches with the sound-pressure level at the ear of a particular listener. To achieve that level of perfection, the loudness control must be calibrated according to each listener’s system and environment.

**Area of Audibility**

![Chart showing the area of audibility](image)

**Fig. 1.2** The Auditory Area of the Human Ear is Bordered by Two Threshold Curves. (A) The threshold of hearing delineating the lowest level sounds the ear can detect. (B) The threshold of feeling at the upper extreme. All of our auditory experiences occur within this area.

This chart was created based on inputs obtained from groups of trained listeners. The two curves A and B characterize the limits of our sensitivity to loudness. Curve A signifies that human ears, at the threshold of hearing, are most sensitive.
around 3 kHz. A person with average hearing can just about hear a sound-pressure level of 0 dB, at this region. Curve B signifies that for the human ears, the sound has reached the threshold of feeling, where the listener feels a tickling sensation in the ears. You will note that the sound-pressure level is about 120 or 130 dB and beyond this the listener will feel pain and damage to the ear is imminent, if not already taking place.

The audibility area lies between these two thresholds and is two dimensional in nature. The vertical dimension is the sound-pressure level and the horizontal dimension is the range of frequencies that the ear can perceive. All the sounds that have a frequency and level within this auditory area can be heard by humans.

Humans differ from many animals as far as area of audibility is concerned. Let us see some examples:

- The bat uses sonar signals. These are far above the upper frequency limit of our ears.
- The hearing ability of dogs go higher than humans. That is why ultrasonic dog whistles are found to be very useful.

Infrasonic and ultrasonic sounds fall within the true sound category but cannot be perceived by humans.

**Loudness — Sound-Pressure Level Relationship**

The unit of loudness level is the phon that is related to sound-pressure level at 1000 Hz. To understand human reaction to the loudness of sound, a subjective unit of loudness is needed. After a lot of research and many experiments later, the only consensus is that when sound pressure is increased by 10 dB, an average person’s response is that the loudness has doubled. The sone has been adopted as the unit of subjective loudness and one sone is defined as the loudness that a person experiences when listening to a sound of 40-phon loudness level.

**Loudness and Bandwidth**

Single frequency tones are not good indicators of subjective loudness. The noise of an aircraft when taking off sounds louder although it may produce the same sound pressure as that of a tone. Research has established that the loudness of sound, within certain limits, is affected by the bandwidth. Take for example three sounds with a sound pressure level equivalent to 60 dB. The bandwidths of the three sounds stand at 100, 160, and 200 Hz but have the same intensity but different loudness. Both the 100 Hz and 160 Hz bandwidths have the same 60 phons loudness level and 4 sones loudness. However, the noise is much louder with the 200 Hz bandwidth.

**Loudness of Impulses**

Response of the ear to short duration transients is an important aspect that needs attention as both speech and speech essentially consist of transients. When a 1000
Hz tone is played in a one-second burst, it sounds louder than if it was played in an extremely short burst, which gives a sound similar to a click. So, what we see is that the duration of the sound impacts the perceived loudness of a sound. A 3 millisecond pulse with a 15 dB higher level will sound as loud as a 500 millisecond pulse. Tones and random noise have more or less the same relationship. The conclusion is that the human ear is less sensitive to short transient sounds.

Pitch — Frequency Relationship

Pitch is a function of frequency but not related in a linear sense. Pitch is a subjective term and so has a subjective unit called mel. On the other hand, the term frequency is physical and measured in cycles per second known as Hertz. The frequency of a signal does not change when the sound-pressure level is increased or decreased, which is not the case with the pitch of a sound as it may depend on sound-pressure level. By definition, a pitch of 1000 mels has a 1000 Hz tone having a sound-pressure level of 60 dB.

Timbre vs. spectrum

Timbre is the ear’s perception of complex sounds and applies mainly to sounds produced by various musical instruments. Although two instruments, like the guitar and the sitar, play the same note, each instrument has its own timbre. Timbre is a relative term and is determined by the number and relative strengths of the instrument’s harmonics. Timbre has an analogous physical term called spectrum. A set of harmonics is produced by a musical instrument, whereas the ear interprets harmonics in its own subjective way. The ear’s perception may differ considerably from the measured spectrum.

The ear: An analyzer

When listening to music, you are able to distinguish between the different sounds from the different instruments and/or voices. Despite the fact that a mixture of sounds hit the ear, the human ear/brain combination is so powerful that it can separate the different individual sounds from the complex sound waves.

The ear: A measuring instrument

The ear cannot be used for physical measurements of sound. It can make comparisons like detecting sound-level differences, which is a subjective sensation. The ear can differentiate between tones separated by 0.3 per cent that is between 0.3 Hz at 100 Hz and 3 Hz at 1,000 Hz.

Meters vs. the ear

There is a considerable gap between subjective judgments of sound quality and room acoustics and objective measurements. We use terms like warmth, blend and bassiness but we cannot measure these parameters with measuring instruments. However, research is going on in this area.
Precedence effect

Sound intensities over short intervals are integrated by the ear’s hearing mechanism. The direct sound and reflections are gathered and combined such that it appears that the sound is coming from the original source with added loudness. This is possible during a certain time window beyond which discrete echoes dominate.

Nature of Sound

1. Reflection

Think back on your experience of shouting in an open field or open area with no obstacles around. The sound waves move out in all directions and do not return. If you tried the same thing in a room where there are obstacles like chairs, tables, walls and floors, the direction of the waves is changed, in other words, they reflect. So, sound from a source goes past you once in a direct path and when it strikes the room boundary may cross you again as a reflection and this may continue more than once till it fades away. Sounds reflected more than once tend to sound different from the original sound or the sound that is not followed by a reflection.

Refraction

Sound normally does not travel very far with a few kilometers being considered maximum. Several reasons contribute to this inadequacy.

- Sound radiators are not efficient enough to be able to actually radiate too much power.
- The earth’s surface is rough and thus, energy is lost as wavefronts drag across it.
- Although minimal, loss also happens due to dissipation in the atmosphere.

Research is underway on how the transmission of sound is influenced by temperature and wind gradients.

The term refraction means bending the path of waves that also results in a change in speed and wavelength of the waves. Refraction is a change in the direction of sound propagation when it passes from one medium to another medium.

Diffraction

We have observed that sound can travel around obstacles and corners. When music is played in one room, it can be heard in other rooms as well. Reflections are partly responsible for this, but diffraction also causes this to happen. Diffraction is when sound bends and travels in other directions while still maintaining its natural straight line path. In an open space without any reflecting surfaces, diffraction can occur. However, the sound is different in distant parts of the home as compared to the sound at the source. Typically, you will notice that the bass notes dominate over the treble notes. The reason is that bass notes easily diffract around corners and obstacles, due to their longer wavelengths.
Rectilinear propagation

We have learnt that sound wavefronts travel in straight lines and at mid/high audible frequencies we get sound rays that are likened to pencils and also travel in straight lines but are perpendicular to the wavefront. This rectilinear movement of both sound wavefronts and sound rays do change direction when they encounter an obstacle. Diffraction is the term used to define the process by which the direction of sound wavefronts and sound rays is changed.

Shorter or higher frequency wavelengths will lower the chances of diffraction. That is why, light, having extremely short wavelengths, diffracts less than sound. An obstacle has to be large enough compared to the wavelength of the sound to be able to diffract the sound.

Diffraction and Wavelength

The term acoustical size, which is measured in terms of the wavelength of the sound, refers to the effectiveness of an obstacle to diffract sound. This effectiveness to diffract sound is determined by the frequency of the sound. An obstacle may be able to diffract sound with a frequency of 10 Hz, but may not be able to cause even a flutter when the frequency is 1000 Hz.

Absorption Noise

According to the law of conservation of energy, energy can neither be created nor destroyed but can be changed from one form to another. Likewise, in a room, the excess energy cannot be eliminated but it is possible to change it into a harmless form with the help of sound-absorbing materials. Sound absorbers fundamentally work in the same way and can be of one of these types:

- Porous absorbers
- Panel absorbers
- Volume or resonance absorbers

Sound energy works on the vibration of air particles. One way of dissipating sound energy is in the form of heat.

Dissipation of sound energy

Imagine a solid concrete wall covered with an acoustical material. Let us see what happens when a sound wave is directed at the wall. Figure 1.10 graphically depicts the action and the reaction.

- The sound wave ‘S’ traveling through air first strikes the acoustical material covering the wall.
- There is some loss of heat ‘E’ in the air for high audio frequencies
- A portion of the sound wave ‘A’ is returned to the air as a reflection from the surface of the acoustical material
Some of the sound passes through the acoustical material. As the acoustical material is denser than air, the sound is refracted downward.

- There is some loss of heat 'F' and 'H' due to the frictional resistance with the acoustical material.

- The sound wave passes through the acoustical material and strikes the surface of the concrete wall.
  - A component of the sound wave 'B' is reflected back in the acoustical material and subsequently to the air.
  - Some of the sound passes through the wall. The wall being much denser than the acoustical material results in the sound being refracted sharply downward.
  - There is further loss of heat 'G', 'J' and 'I' in the concrete wall and acoustical material.

- The sound wave gets weaker as it travels and now strikes the boundary between the concrete wall and the air beyond it.
  - Again a reflection 'C' is experienced.
  - The sound wave passes into the air ‘D’ with a reduced downward refraction.
  - There is some loss of heat ‘K’ in the air.

We have witnessed a set of rather complex events that the sound wave ‘S’ experiences in its journey. As it moves from one medium to another, the sound energy is converted to heat energy and dissipated, thereby making the original sound energy weaker. The refractions do not dissipate the heat, it only bends the ray.

1.5.2 Varieties of Microphones

When sound waves enter a microphone, they set in motion a chain of events that culminates in the apparent re-creation of the sound by the radio speakers. As the beginning pathway for the process, the microphone is of primary importance. If a microphone is improperly selected, improperly used or damaged, the sound quality will be distorted by the time it reaches the listener.

Sound waves are generated when we speak and they also are generated by speakers in radio and television sets. All broadcast sounds begin and end as longitudinal pressure waves, but they cannot be sent from studio to receiver in that state. For sounds to be broadcast, they must be converted from physical waves to electric energy. The process of transforming energy is called transduction and the first step in that conversion is microphone.

Microphones are classified according to internal structure, pickup pattern and intended use. As a radio professional, you most likely will have a say in the microphones you use, but you should be able to recognize the types given to you so that you can use each to its best advantage.
Types of Microphones

Let us go through the various kinds of microphones, classified as per the internal structure.

(i) Ribbon or Velocity Microphones

The ribbon or velocity microphone contains a metallic ribbon that is supported at the ends between the poles of a permanent magnet. The ribbon moves when sound waves strike it, generating voltage that is immediately relayed to the audio console. This type of microphone is extremely sensitive to all sounds within a great frequency range that is flattering to human voice and is unaffected by changes in air pressure, humidity and temperature. In addition, it resists picking up reflected sound.

A ribbon mic works best if the speaker stands or sits eight inches to one foot away and speaks directly into it. This range usually provides deeper voice quality. If you find you have voice reproduction problems at close range, speak at an oblique angle across the mic’s front screen.

(ii) Dynamic or Pressure Microphones

In the dynamic or pressure microphone, a lightweight molded diaphragm attached to a small wire coil is suspended in a magnetic field. Sound waves strike the diaphragm and are relayed to the coil and the movement of the coil within the magnetic field transforms physical energy into electrical impulses. The dynamic microphone has a number of advantages. It is more rugged than the other types, can be used outdoors with less wind blast, can be as small as a person’s fingertip and can perform better in a wider range of applications than any other type of microphone. Only a well-trained audio operator is likely to be bothered by the fact that it does not reproduce the subtle colorations achieved by a high quality ribbon or condenser mic.

When you use a dynamic mic, stand or sit six to ten inches away from and to one side of the front screen of the instrument. By talking slightly across the screened surface, you should project your voice quality at its best, especially if you speak at high volume or are given to excessive sibilance or popping.

(iii) Condenser or Electrostatic Microphones

Often found in professional recording studios and FM stations, the condenser or electrostatic microphone is similar to the pressure mic in that it has a diaphragm but instead of a coiled wire it has a fixed plate opposite the diaphragm. As sound waves strike and move the diaphragm, the voltage between the moving diaphragm and the fixed plate changes thereby varying the sound signal.

If you are asked to work with a high-quality condenser mic, you should treat it in a manner similar to a dynamic mic. If the extreme sensitivity of the condenser
mic is creating sibilance or popping problems, try working farther away from it or speaking into it at an angle. One or both these adjustments should correct the problem. Condenser mics require power for their operation. When used away from a station, they are powered by batteries. If you experience problem with a condenser mic, first check to make sure that the battery is inserted in the proper position and is not dead.

The pressure zone microphone (PZM) is a condenser mic designed to allow direct and reflected sound waves to enter the microphone at the same time. Other mics pick up both direct and reflected sound but with a slight lag between the two, the result of varying distances from sound source to mic. The PZM eliminates this lag and has very little sound distortion. One definite advantage of a PZM microphone is that it does not look like a mic, which can reduce nervousness on the part of inexperienced guests.

**Pickup Patterns**

A microphone’s pickup or polar pattern is the shape of the area around it from which it can accept sounds for transmission with maximum fidelity and optimal volume. Fidelity refers to the degree to which the electronically produced sound resembled the original sound—in other words, its faithfulness to the original sound. Nearly all microphones can pick up sounds from the areas outside their ideal pattern, but with reduced quality. For best results, speak from within the pickup pattern and generate enough volume so that the volume control knob can be kept at a minimal level. If you are off mic (out of the pattern) or if you speak too softly, the volume control will have to be turned up and the microphone will distort your voice as it also transmits unwanted sounds from outside the pattern. When you use a stand, hand-held, or control-room mic, you need to know the pickup pattern of the instrument, must position yourself properly and also adjust your voice level to optimize the sound.

Manufacturers classify microphones according to four pickup patterns:

1. Unidirectional—only one side of the microphone is live.
2. Bidirectional (or figure eight)—two sides of the mic are live
3. Omnidirectional (also called non-directional or spherical)—the mic is live in all directions.
4. Multidirectional (polydirectional or switchable)—two or more patterns can be achieved by adjusting a control.

Nearly all unidirectional microphones have cardioid (heart shaped) pickup patterns. Cardioid patterns range from wide to narrow (or tight) to hypercardioid patterns which have a narrow front angle of sound acceptance and pick up very little sound from the sides. Hypercardioid mics are used chiefly as shotgun mics in television studios.
The PZM has hemispheric pickup pattern, which means that when the mic is placed on a flat surface such as a table, the area of sound acceptance is one-half of a sphere like the northern hemisphere of the globe.

### Intended Use

Since recording studios and radio stations employ distinctive production methods, microphones have become increasingly specialized. They can therefore be classified according to intended or best use. A microphone of one design may be ideal for one kind of work but inappropriate for another. For example, one dynamic or omnidirectional mic may have been designed to be hand held and another to be permanently mounted above an audio console. Let us go through the different classifications of microphones.

(a) **Announce Microphones**

Announce microphones are found in radio station on air and production studios and in audio recording studio announce booth and they are also used for off-camera film and television narration.

(b) **Stand Microphones**

Stand microphones are used chiefly in the production of radio commercials and voice-over narration for television commercials.

(c) **Hand-held Microphones**

Hand-held microphones are versatile. They can be used indoor or outdoor and can be fitted into a desk mount.

(d) **Lapel or Lavaliere Microphones**

Lavaliere mics (lavs) are miniaturized microphones that can be clipped to a lapel, blouse, necktie or other item of clothing. They are extremely small, are of excellent sound quality and their use frees both the hands to perform whatever function may require manipulation.

(e) **Headset Microphones**

Miniaturized microphones connected to headsets are standard for play-by-play sports announcers. Both dynamic and condenser mics are used with headsets, but they must be designed to include a honeycomb pop filter in front of the diaphragm.

(f) **Wireless Microphones**

Wireless microphones are practical for work at remote locations and for studio work when performers need to move without the restraint of a mic cable. This type of mic is widely used in television production as in talk shows where programme hosts move among audience members to receive their comments.
Advances in microphone technology make it likely that instruments not even mentioned here will be in use by the time you enter the field of media performance. Regardless of progress in miniaturization, sensitivity and fidelity, however, the principles of microphone use will remain the same for many years.

**The Use of Microphone Cables**

Running microphone cables parallel to power cords often creates hum and interference problems. The solution is often as simple as moving a microphone cable a meter away from any power cord.

Fluorescent lights can also stimulate an annoying buzz in audio. Computers and certain types of medical equipment, particularly if they are near audio cables or equipment can also produce unwanted noise.

By carefully listening to your audio pickup with a set of high-quality, padded earphones, you can normally get hold of these problems before it is too late.

Wireless microphones can resolve many audio problems in production.

In a wireless microphone, a dynamic microphone or condenser microphone is connected to a miniature FM (frequency modulated) radio transmitter. As the microphone’s audio signal is converted into a radio frequency (wireless) signal and transmitted throughout the production area, these microphones are also referred to as RF microphones.

There are two kinds of wireless microphones: the self-contained (all-in-one) unit and the two-piece type.

In the self-contained, handheld unit, as shown in Figure 6.1, the microphone, transmitter, battery and antenna are all part of the microphone housing.

![Wireless Microphone](Fig. 1.3 Wireless Microphone)

A two-piece wireless unit is generally preferred when small and modest clips on microphones are desired.

In this case, the microphone is connected to a separate transmitting unit that can be clipped to the belt, put in a pocket, or hidden underneath clothing.
Wireless microphones, earlier had to face problems related to interference and fading, which have now been eliminated. Today, RF microphones are extensively used in both studio and on-location productions.

Some camcorders have built-in receivers for wireless microphones. Hence, this eliminates the microphone cable that generally connects the reporter or interviewer to the camera.

1.5.3 The Broadcast Chain

Broadcasts are of two types: ‘recorded’ or ‘live’. Recorded broadcasts have the provision of rectification of errors, and removal of material that is superfluous or unnecessary, rearranging it, applying slow-motion and repetitions, and other techniques for enhancement of the programme. However, live events such as sports television may be inclusive of some aspects including slow-motion clips of important goals/hits, etc., in course of the live telecast.

Distribution of a broadcast may take place via several physical means. If it comes directly from the radio studio at a single station or television station, it is simply sent through the studio/transmitter link to the transmitter and hence from the television antenna located on the radio masts and reaches out to the world. A communications satellite may also facilitate a programme, played either live or recorded for being transmitted later. Networks of stations may simulcast the same programming at the same time, originally via microwave link, now usually by satellite.

Stations or networks may also be distributed by means of physical media, such as magnetic tape, compact disc (CD), DVD, and sometimes other formats. These are usually included in another broadcast, such as when electronic news gathering (ENG) returns a story to the station for being included in a news programme.

The final leg of broadcast distribution is how the listener or viewer receive the signal. It may come over the air as with a radio station or television station to an antenna and radio receiver, or may come through cable television or cable radio (or ‘wireless cable’) via the station or directly from a network. The Internet may also bring either internet radio or streaming media television to the recipient, especially with multicasting allowing the signal and bandwidth to be shared.

Check Your Progress

6. What is ultrasonic?
7. Define pink noise.
8. What is timbre?
9. What is diffraction?
10. Name the type of microphone in which a lightweight molded diaphragm is attached to a small wire coil suspended in magnetic field.
### 1.6 DIFFERENT KINDS OF STUDIOS VIS-À-VIS PROGRAMME FORMATS

In this section, you will learn about the concepts of studios in relation to the programme formats.

**Radio Studio**

Radio studio is a technically equipped facility where the production for a radio programme takes place. All equipments, software and hardware necessary for production are available in the studio like microphones, audio console, talk-back etc. The studios are sound proofed, air-conditioned and acoustically treated so that the listeners hear no disturbances and broadcast is smooth.

In a radio station, there can be three types of studios.

**Firstly, on-air studio,** secondly, **production studio** and thirdly, **digital studio.** Let’s briefly have a look at these types.

**On-air studio:** A live broadcast happens through this studio where the presenter of Radio Jockey talks to the listeners, conversation with the guests happen, the listeners call the RJ and all this becomes a part of the programme. The news that is heard on FM is broadcast from this kind of studio. The studio entry door is quite heavy to open and flashes an on-air sign to restrict unwanted movement. There is a small empty passage inside this door, this space is called sound lock as it prevents any external disturbances. Recording, Editing and Storage equipments are available in the studio. The studio has one recording room and one control room.

**Production studio:** The programmes which are not broadcast live but recorded for scheduled are produced in this studio. Dramas, interviews, promos, jingles, features are all recorded here. This studio also acts as a back-up studio for on-air shows in case of any extra studio requirement.

**Discussion Studio:** The studio is used for on-air programmes and live discussions or simply programmes with spoken words and no background music and sound effects.

**Control Room:** This room is situated adjacent to the studio. The presenter/announcer can see the control room executive through a glass partition who may ask to wrap up the show or kickstart the show using non-verbal gestures. The programmes are fully monitored from the control room which are equipped with specialized consoles and recording equipment. The control room receives the audio from the studio and later it reaches the transmitter.

**Transmitter Control Room:** In TCR, the transmitter is connected with a player on which the recorded programmes are played for transmission. In case of live programme, the transmission takes place from the studio directly and the transmitter is connected to the control room.
Transmitters are located at a remote location outside the city boundary. The equipment is quite huge in comparison to the studio equipment. There are two types of transmitters: Low Power Transmitter (LPT) and High Power Transmitter (HPT). The reach and coverage of HPT is more and hence is used for national level broadcasts like ‘Mann Ki Baat’. For Medium Wave (MW) broadcasts, Medium Wave Broadcast transmitters are used while for Short Wave (SW) transmission, Short Wave Broadcast Transmitters are used.

Digital Studio: With the advent of technology and convergence in all fields of media, radio industry is also revolutionizing. The radio studios are also turning completely digital with the use of computer screens, internet, smartphones simultaneously. The digital media has invaded the industry in a massive manner, the RJs these days have to multitask and use sophisticated software and digital media platforms like Instagram, Facebook etc. The digital studios are extensively used for Internet radio where the need of control room and transmitter control room have reduced and the streaming of audio is directly done through servers. The streaming audio available on internet is known as Podcasts.

Acoustics in Studio: An acoustically treated doesn’t allow any unwanted standing waves to enter the microphones and disturb the transmission. It absorbs the sound controls the reverberation (it is similar to echo, the continuing sound) time, the better are the acoustics, the lesser is the reverberation time. The acoustics help to ensure that the sound received by the listener is natural. The studios are fitted with specialized foam tiles on the floors, ceiling and walls for soundproofing. Some make-shift studios also use thermocol sheets for sound-proofing.

Microphones in Studio: As you have learnt in the previous section, one of the most essential equipment available in a studio is a microphone. Radio stations have many types of microphones, some are specifically designed for the voice overs and on-air programmes. Microphones (mics) help in converting the sound waves to electric signals. Using a microphone to speak needs a specialized skill as a mic amplified the sound.

A uni-directional microphone picks up the sound from only one direction and are suited for news presentations. A bi-directional microphone picks up sound from two directions and are suitable for interviews while an omni-directional microphone picks up sound from all the directions and are most suitable for discussions and dramas.

RJs and presenters wear headphones to avoid disturbance in the studio. As soon as the microphone is switched on in the radio studio, the speakers of the monitors are muted automatically. This helps in smooth transmission and helps in avoiding the feedback loop.

Check Your Progress

11. What is sound lock?

12. What is used by studios for sound-proofing?
1.7 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. A Danish scientist Hans Christian Oersted in 1819 discovered that electric current created magnetic effect.

2. The government-run broadcasting was set up and was named as Indian State Broadcasting Service (ISBS). Lionel Fielden was made its first controller. It was his idea to rename this service as All India Radio (AIR).

3. AIR introduced broadcasting of commercials on 1 November 1967.

4. The Prasar Bharati Bill was enacted on 15 September 1997.

5. Quantizing and coding are the stages that assign a numerical value to each individual sample. The samples taken of the amplitudes of the audio signal can fall at any point within the range of amplitudes, from absolutely silent to very loud.

6. Ultra sonic refers to frequencies above the audible range.

7. Pink noise is that noise that has a higher frequency in the low frequency region.

8. Timbre is the ear’s perception of complex sounds and applies mainly to sounds produced by various musical instruments.

9. Diffraction is when sound bends and travels in other directions while still maintaining its natural straight line path.

10. It is in the dynamic or pressure microphone, a lightweight molded diaphragm is attached to a small wire coil suspended in magnetic field.

11. There is a small empty passage inside this door, this space is called sound lock as it prevents any external disturbances.

12. The studios are fitted with specialized foam tiles on the floors, ceiling and walls for soundproofing. Some make-shift studios also use thermocol sheets for sound-proofing.

1.8 SUMMARY

- A Danish scientist Hans Christian Oersted in 1819 discovered that electric current created magnetic effect.
- Using Hertz’s theory, he succeeded in setting his radio waves in motion by generating a spark that leaped across a gap.
- John Fleming in 1904 invented vacuum tube which enabled the transmission of voice. Later Reginald Fessenden and Lee Dee Forest contributed to its further development.
The Radio Club of Calcutta was the first amateur radio club to start functioning in November 1923.

The government-run broadcasting was set up and was named as Indian State Broadcasting Service (ISBS).

Lionel Fielden was made its first controller. It was his idea to rename this service as All India Radio (AIR).

When British raj ended in 1947, All India Radio had a small network of six stations.

Since 1973, AIR also broadcasts a national programme of regional music, which brings to the listeners the rich tradition of folk and the light music of various regions.

Over the past decade and a half, digital technology has revolutionized the process of radio production.

Tape recorders with big tap spools and even audio cassette recorders have now become obsolete, while reel to reel tape recorders and turntables lie idle in many radio studios.

An analogue signal is a continuously variable electrical signal whose shape is defined by the shape of the sound wave produced. Analogue encoding is similar to creating a line graph to show a statistical analysis.

Radio is an accessible medium with mass outreach. The audio medium is the second most accessed media platform (first being the television) according to a report published by Nielsen. Even with the advent of new media, radio has been able to maintain its popularity. Consumers are time starved these days and hence, radio is a wonderful medium of infotainment. It caters to multiple demands of the listeners also giving them the flexibility to multitask.

In today’s production studio, computers and other equipments use a digital recording process.

From a physical stand point, sound is the stimulus and can be visualized as a wave motion through a medium, air or other elastic media.

Acoustics involves the study of any kind of mechanical waves in media, such as, gases, liquids and solids including aspects of vibration, sound, ultrasound and infrasound.

Speech is one of the key components of human communication and it is something we hear through most of the day.

Noise is considered as something that is unwanted and disturbs our communication medium of speech and music and also the periods of silence.

The vocal tract is a section of 6.7 inch (17 cm.) between the vocal cords and the lips.

When sound waves enter a microphone, they set in motion a chain of events that culminates in the apparent re-creation of the sound by the radio speakers.
• Microphones are classified according to internal structure, pickup pattern and intended use.

• Radio studio is a technically equipped facility where the production for a radio programme takes place. All equipments, software and hardware necessary for production are available in the studio like microphones, audio console, talk-back etc. The studios are sound proofed, air-conditioned and acoustically treated so that the listeners hear no disturbances and broadcast is smooth.

• In a radio station, there can be three types of studios. Firstly, on-air studio, secondly, production studio and thirdly, digital studio.

1.9 KEY WORDS

• Absorption: In acoustics, the changing of sound energy to heat is called absorption.

• Acoustics: It refers to the science of sound as well as the effect a given environment has on sound.

• Bandwidth: It is the frequency range passed by a given device or structure.

• Diffraction: The distortion of a wavefront caused by the presence of an obstacle in the sound field is known as diffraction.

1.10 SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions

1. Write a short note on the origins of radio.
2. Briefly explain the Broadcasting Code and ethics of broadcasting in India.
3. What has been the different technology used in Radio since its inception?
4. What is the difference between sound and acoustics? List the facts which affect the behaviour of sounds.
5. List the steps in acoustic occurrence.
6. Briefly explain the nature of sound.
7. Write a short note on the different kinds of studios vis-à-vis programme formats.

Long Answer Questions

1. Discuss the emergence of radio in India and AIR after independence.
2. Describe the developments in radio journalism with special reference to AIR.
3. Examine the Prasar Bharati Bill and its passage.
4. Write short notes on: (i) noise, (ii) loudness, (iii) signal distortion, (iv) pitch.
5. What are the different types of microphones? Explain the concept of broadcasting chain.

1.11 FURTHER READINGS


UNIT 2 RECORDING AND TRANSMISSION SYSTEM

Structure
2.0 Introduction
2.1 Objectives
2.2 Basics of Transmission Systems
   2.2.1 Transmitters, Antennas, Receivers and Amplifiers
   2.2.2 Microphones and Antennas in Radio production
   2.2.3 Modulation: AM and FM
2.3 Recording Techniques and Editing Consoles
   2.3.1 High Fidelity, Stereo and Multi-track Recording Techniques
   2.3.2 Creating the Stereo Effect
   2.3.3 Audio Control Devices: Boards, Consoles and Mixers
2.4 Answers to Check Your Progress Questions
2.5 Summary
2.6 Key Words
2.7 Self Assessment Questions and Exercises
2.8 Further Readings

2.0 INTRODUCTION

Radio production involves the working of different technical elements in tandem. This involves both the transmission and recording system. The basic transmission and receiver system form the cohesive radio communication system. This involves aspects of antenna, oscillators, modulators, power, amplifiers etc. The recording system on the other hand is concerned with the manner in which the sound is recorded and handled. In this unit, you will learn about the concepts of antennas, receivers and amplifiers, the concepts of modulation and the technique of high fidelity, stereo and multi-track recording and editing consoles.

2.1 OBJECTIVES

After going through this unit, you will be able to:

- Describe the concepts of antennas, receivers and amplifiers
- Discuss modulation both AM and FM
- Explain the concept of high fidelity, stereo and multi-track recording and editing consoles
2.2 BASICS OF TRANSMISSION SYSTEMS

In this section, you will learn about the basics of transmission systems including the concepts of modulation both AM and FM. Describe the concepts of antennas, receivers, amplifiers and high fidelity systems.

2.2.1 Transmitters, Antennas, Receivers and Amplifiers

Radio communication system is made up of two very important elements: radio transmitters and radio receivers.

Transmitters and Receivers

Radio transmitters are the devices which are used to send radio signals for broadcast. This requires certain important elements to work: power, oscillator, modulator, amplifier and antenna. The power or the electrical supply for the transmitter is needed for its working, the oscillator which is responsible for creating alternating current on the frequency at which the transmitter is to send signals. This is known as the carrier wave. The modulator is responsible for adding information to the carrier wave through altering its intensity or frequency (AM or FM). The amplifier is responsible for the increasing the strength of the signal and the antenna converts the signals into waves for transmission.

Radio receivers work in the totally opposite direction. It requires important elements like the antenna, RF amplifier, tuner, detector and the audio amplifier. In receivers, the antennas are used to captures the radio waves. The RF amplifiers work to strengthen the weak signals. The tuners are used to extract only desired frequencies from the gamut of waves working at different frequencies. The detector processes and identifies the audio information running at the frequencies and amplifier strengthens the weak signals so that it can be heard clearly.

Let’s discuss some of the important aforementioned elements.

Antennas

Antennas are the device used to transmit radio waves into space. It can be in many different sizes including a satellite dish or the commonly seen long, stiff wires. In a radio studio, the voice or sounds from the microphones are converted into electrical energy and then transmitted through the tall metal antennas. The radio waves are the electromagnetic radiation which gets created because of the movement of electrons in the electric current along the antenna. Similarly, when someone turns their radio on, they send radio waves through the metal antenna, which again causes the movement of electrons, then the generation of electric current, turning into sounds which can be heard. The size of the antenna is dependent upon the type of signal that is being received or sent.
Amplifiers
As mentioned earlier, amplifiers are beneficial in amplifying the singular waveform without affecting or altering the wave shape and frequencies. There are many different types of amplifiers.

Radio signals at the point of origin are generally very weak and might not be potent enough to be broadcasted. It is the job of the radio frequency amplifiers to amplify and power up these frequencies to become strong enough to be picked up for transmission and receiving. It does so by identifying and magnifying the distortions in the signal even further. Even though in this process, the electrical signals are changed far from their original form, the RF amplifiers concentrate on ensuring the signals are replicated as closely as possible.

2.2.2 Microphones and Antennas in Radio production
In Unit 1, you read about the different types of microphones. Let’s learn how the wireless microphone and antennas work together in radio production. In wireless microphones, signals emanating from dynamic and condenser microphones are converted into low-power FM signals and transmitted in a more or less a circular pattern using either an internal or an external antenna. The internal antenna is within the microphones case while the external antenna is usually a short wire that is attached underneath the transmitting unit. Under ideal conditions, that is, if there are no obstacles like metal objects present, a wireless microphone can consistently transmit over more than a 300 metre radius. If there are obstacles, the range is reduced to about 75 meters.

Interference Problems
If there are obstacles like solid metal objects between the radio frequency (RF) microphones and the radio receiver, it results in a situation of multi-path reception caused due to a part of the radio signal being reflected off the solid surfaces. This results in interface problems. The problem becomes acute especially if the individual the microphone is attached on starts moving around. In such situations, his or her audio starts fading in and fading out. The way to avoid the problem is to select different frequencies. This is possible as pretty much all radio frequency microphones transmit their signals at a higher frequency than standard FM radio bands. Typically, the band on which RF microphones transmit are either the very high frequency (VHF) range or the ultra-high frequency (UHF) range. Most of the time audio engineers prefer the UHF range as it is less packed than the VHF range.

In addition, although radio stations are on different frequencies, nearby radio stations produce what is known as harmonic or secondary signals that can be picked by a wireless microphone receiver if the signal is strong enough. A wireless FM microphone can only be dependable if its radio frequency signal is as strong as any interfering signal.
Nowadays, a huge range of different frequencies and digital subset frequencies are possible. There are some complicated productions that employ about a hundred different microphones and microphone frequencies in a single production.

**Wireless Microphone Receiving Antennas**

A good signal from an RF microphone is of little value unless it can be received without multi-path or other types of interference. One of the most useful ways to remove interference is with the proper placement of the receiving antenna(s).

There are two kinds of wireless microphone receivers.

Non-diversity receivers use a single antenna mounted on the back of the receiver. This type is most prone to multi-path problems, particularly if the talent moves around.

Two antennas are used in diversity receivers. Since the two antennas can be placed some distance apart, it is assumed that any time one antenna is not picking up a clear signal the other one will certainly pick up the signal. To keep the signals from interfering with each other’s electronic circuitry within the receiver, the receiver can immediately select the stronger and clearer of the two signals.

The receiver should be placed so that, as the talent moves around, no solid object, especially a metal object, can come between the receiver and the wireless microphone.

The angle of the receiving antenna sometimes has to be adjusted to bring it in line with the angle of the transmitting antenna on the microphone. For example, if a long wire looped around the belt line is used on the microphone transmitter you may have to turn the receiving antenna.

The RF microphone and the receiver should be kept in proximity to each other. One should be conscious that such things as neon and fluorescent lights, the high-intensity display of a video monitor, electric or gasoline powered vehicles and lighting dimmer boards can interfere with the signal.

**2.2.3 Modulation: AM And FM**

It is well known that Radio waves are electro-magnetic (EM) waves. The electrical and magnetic waves both together form the EM waves. Radio waves are similar to water waves as they travel like ripples in the water back and forth. There is an analogy between radio waves and light waves, as they both travel in a straight line at the same speed of 30,000,000 metres per second.

Humans are able to hear any sound that is caused by vibrations in the air. Human ear can hear the sounds between the range of 20Hz to 20,000Hz (Hz is the SI unit of frequency of sound -Hertz). Higher the pitch of the sound, higher the frequency; lower the pitch, lower the frequency. A shrill voice will have higher frequency while a deep voice will have lower frequency.
Modulation

Modulation means that the radio signals (the audio carrying signals) are topped with a carrier signal. Modulation helps the radio signal to travel over long distances. Since the frequency of radio signals is low, the carrier signal is added which has a constant waveform i.e. constant amplitude and frequency. Modulation is therefore, the process of ‘mounting’ the audio signal to a carrier wave.

Some commonly used terms in radio transmission are FM and AM. The most important methods of transmission are:

1. Amplitude Modulation (AM)

   The first successful radio transmission through Amplitude Modulation was carried out in mid 1870s. AM is one of kinds transmission that creates a signal with constant frequency irrespective of the radio frequency at which the broadcast is done. The amplitude (strength) of the wave only changes according to the strength of the broadcast signal. In such transmission, the varying modulating signals alter the amplitude of the carrier from a transmitter. The range of AM is lower as it starts from 525 to 1705 kilohertz.

   **Advantages of AM**

   The design of AM receiver is simple and hence they are easy to produce. It can be detected easily even with ordinary radio sets. All shortwave broadcasts use AM for transmission.

   **Disadvantage of AM**

   AM transmission is inefficient as it gets disturbed by electrical storms or frequency disturbances. Another drawback of AM signal is that it occupies more frequency space thereby getting more susceptible to electrical noise.

2. Frequency Modulation (FM)

   FM is synonymous to radio in colloquial language. FM gained popularity between 1970s-80s where many broadcast companies switched from AM to FM. It is the most widely used transmission technique these days. FM is able to transmit all types of sound without any disturbances unlike AM which is unable to transmit high frequency sound therefore most music broadcasts use FM. Frequency modulation means that the frequency of carrier wave is modified proportionally according to the amplitude of the signal received by the transmitter. The quality of this transmission is quite better in comparison to AM but the reach of FM is limited to particular geographical area. Quality comes at a cost, so the equipment and transmitters used for setting up FM is costly. The frequency band of FM ranges between 88 to 108 MHz.

   **Advantage of FM:** It is immune to the both electrical and static noise and therefore the quality of sound is great. FM receivers don’t react to AM signals and...
have a capture effect. Between two or more similar frequency FM signals, only strong signals would be picked up and rest would be ignored. Most FM broadcast channels use large deviation as with higher deviation, the quality of broadcast improves. One big advantage of FM over AM is that the signal doesn’t get distorted in unfavourable weather conditions.

**Disadvantage of FM:** it acquires huge amount of signal space.

### Check Your Progress

1. What are the elements involved in the functioning of a radio transmitter?
2. Which band of RF microphones is usually preferred by audio engineers?
3. State the reason for analogy between radio waves and light waves.
4. What is the range of AM?

### 2.3 RECORDING TECHNIQUES AND EDITING CONSOLES

In this section, you will learn about the important recording techniques and editing consoles. You will learn about the history of recording and formats in Unit 13. But let’s discuss some of the pivotal recording techniques in this section.

#### 2.3.1 High Fidelity, Stereo and Multi-track Recording Techniques

With the advent of electronic recording systems in the sound recording field, there was also the rise of several new developments like that of microphones and the recording capabilities. Later on there was also the introduction of new techniques of recording which solved several problems of recording hitherto difficult category of sounds.

Hi-fi or high fidelity system is the term used to refer to higher quality audio in comparison to the inferior sound reproduction that was heard in inexpensive audio equipment until the late 1940s. The main characteristic of the hi-fi system is that it was considered by audiophiles to represent a sound system that had the least amount of distortion and noise and the frequency response is quite accurate. In the decades before 1940s, the amplifiers and radios were made using vacuum tubes, which further led the way for competition in the most accurate sound reproduction systems including the introduction of vinyl records. These had lesser distortions and noise compared to vacuum tubes. The term ‘hi-fi’ was being used to describe higher quality of sound reproduction. The monoaural sounds and mono-channel recording system was common before this time. This involved the use of one speaker; there was no bifurcation in the source of the sound and it came mixed together through one channel. Later in the 1950s and early 1960s, these hi-fi systems were replaced by the stereo system which with its debut made the use of two speakers for the sound reproduction and had even crisper sound reproduction.
Stereophony and Multi-Track Recording Technique

Stereophony or stereophonic techniques is the concept of recording sound with a dual pickup providing a right channel and a left channel. This is also referred to as multitrack, multichannel or separation recording. Earlier, monophonic recording, which is still commercially used today, used a single horn (yesteryear’s microphone) connected to a diaphragm-driven stylus that cut a groove on a wax cylinder. The single horn is now replaced by several microphones with individual controls, but the recording is still monophonic in many cases. Figure 2.1 explains the two concepts beautifully.

Fig. 2.1 Monophonic and Stereophonic Recording.
(A) Monophonic recording involves merging the outputs of several microphones by a summing network and recording on a single-track tape.
(B) Stereophonic recording use a set of microphones and the output of each microphone is recorded on a separate track of the tape. Later in a mix down session the signals of the several tracks are combined.
The stereo requirement of dual pickup can be in the form of two separated microphones or two elements with unique attributes having an electrical network that is mounted close together. Research indicated that individual mikes were needed for weaker instruments to be heard alongside stronger instruments. These were properly placed in the stereo field by proportioning them between the left and right channels. This began the trend of using more than two microphones for stereo recording.

Today, we can say that recording techniques have matured at an ideal time for the modern musician and musical directors. People are more interested in novelty effects than in the traditional quality per se. Special effects and novel distinctive sound has given rise to a new generation of music as well as new life to old music.

**Flexibility**

Multitrack offers a lot of flexibility like the option of recording, if required, one instrument or soloist at a time and introducing special effects as the production progresses. Thus, each element can be recorded separately and then put together later by mixing the pieces. This is depicted in Figure 2.1 A, where output signals from several microphones are passed through a summing network that produces a single output, which is fed into the single-track recorder for monophonic recording. This can be further processed for artificial stereophonic recording and reproduction by distributing the signals wholly or partially between two tracks. Stereophonic recording works differently, as shown in Figure 2.1 B. A single track of a multitrack recorder records the output signal of each microphone. Various permutations and combinations may be incorporated in this type of arrangement. For example, you can have several microphones recording the bank of *tabla* that can be later premixed and recorded on a single track. In these types of cases, however, you will need to sacrifice on the flexibility of mix down.

Another aspect of the flexibility of multitrack recording is that after the individual parts of a musical composition are recorded. The recordings can then be mixed down to mono, stereo, or other multichannel form for release.

**Advantages of multitrack**

We have just now discussed the overall advantage of multitrack techniques and flexibility. We can see further potential for saving in terms of space and time like, depending on the availability of the artists, recording can be spaced out and scheduled on separate days and times. Tapes can be shipped to other locations, national or international, to record other artists who are unable to visit the main recording studio.

Separation recording provides more control over the levels that can be set for each instrument. The equalization for each track can be set to perfection after a few trials. Integration of special effects can be done at any time up to the mixing stage. The preferred amount of reverberation can be injected any time. Artists,
multitrack also provides a noise advantage when recording is done in separate sessions. There are technical challenges in the single session mix and record system also referred to as a premix session. Various instruments need to be adjusted along with the levels before the recording. Based on the requirements of the source, some levels will be set high and some will be set low and the signal-to-noise ratio will be set and fixed for each channel. The recording is done as a final mix with no possibility of major adjustments in between. On the other hand, the standard practice in separation type recording is to set the maximum level for all channels. This way the best signal-to-noise ratio on the original tape can be assured. The channels can be adjusted downward till the desired balance is achieved during the multichannel mix down process. Thus, a considerable noise advantage can be realized.

Finally, the bandwidth of selective channels can be adjusted without compromising on the quality of the sound of the instruments. Cutting the low-frequency energy of certain instruments does not affect its sound performance. Same is the case with high-frequencies. The end objective is to provide the clients with what they want and stereophony is the demand because of the quality it provides along with the flexibility, savings and other advantages.

Disadvantages of multitrack

First and foremost is the noise buildup with the increase in the number of tracks being combined; this happens despite the advantage gained in the signal-to-noise ratio. When two tracks are mixed together, assuming that each has the same noise level, the combined track will have a noise factor 3dB higher than either of the original tracks. So, when 16 tracks are combined, the noise level is 15 dB higher than any single track. Now, if one track has a noise level of 80 dB, the resultant noise level of 16 tracks will be 68 dB. The table below shows some commonly used track configurations with their corresponding noise buildup figures:

<table>
<thead>
<tr>
<th>Number of tracks</th>
<th>Multitrack noise buildup. above noise of one track (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3.01</td>
</tr>
<tr>
<td>4</td>
<td>6.02</td>
</tr>
<tr>
<td>8</td>
<td>9.03</td>
</tr>
<tr>
<td>16</td>
<td>12.04</td>
</tr>
<tr>
<td>32</td>
<td>15.80</td>
</tr>
<tr>
<td>48</td>
<td>16.81</td>
</tr>
</tbody>
</table>

The total usable range of audio level is the dynamic range of a system. This usable range lies within the lower extreme of noise and the upper extreme, which
is the full undistorted level. The width of each track is determined by the number of tracks on a tape. The more the tracks the narrower the width which results in a lower reproduced signal level. An increased noise and a decreased reproduced level results in narrower dynamic range.

More crosstalk between adjacent tracks happens when the spacing of tracks on a tape is less. The enormity of the issue is realized during recording. The distance between two microphones determines the amount of crosstalk. Like in the case of two adjacent tracks having the simultaneous recording of two musical instruments crosstalk may be acceptable if they are playing the same number. However, if the same two tracks have material that are not related to each other, then the crosstalk will become evident.

Active involvement of the musical director in both recording and mix down is highly desirable to negate the issue of artistic responsibility. The mix down technique is such that it can be done by the recording engineer. It is a tedious activity involving the basic creative steps in a production like detailed comparison of tracks that is time intensive, recording pickups and overdubs. The musical director finds it convenient to let the recording engineer perform this step paying occasional visits to check. The end result may not be up to the quality standards that the musical director would be able to produce by giving full attention. In the premix recording, the completed product is created as the recording session ends and the musical director remains on site maintaining complete charge of the activities throughout till the end.

During a music composition, very often we find that the artists respond to each other, which produces a desirable effect to the music. In many separate recording sessions, the artists may not meet at all thus, losing this type of spontaneous interaction.

Another factor to be considered is the wear and tear of the original tape as it run and rerun many times. Repeated contact with the player head degrades the quality of the tape, especially at the outer edges. This issue does not arise in a premix situation. One way to circumvent the degradation problem is to record the sounds least affected by loss in high frequency response, on the outside tracks.

**Track Separation**

A lot of effort and attention is required to maintain a decent inter-track separation. A good difference would be between 15 and 20 dB as this provides enough leeway to establish relative dominance in the mix down. The following methods can be used to achieve the desired separation:

- Adjust the acoustics of the studio or place of recording
- Space out the artists
- Use good microphone placement and directivity
- Use physical barriers
• Use gating techniques
• Use contact transducers or electrical instruments

Multichannel — The Future

The techniques and advantages of multichannel recording give it a long life span. Moreover, there seems to be a trend to move away from artificialities, especially, when they occur during separation recording in some areas.

Automation

As in many of our day-to-day business as well as personal lives, automation plays an important role in supporting and helping us. Similarly, automation has invaded the audio/video space taking over the roles of several different tasks. If you visualize an average recording console, it contains numerous knobs, switches, buttons and meters. All these components are important but becomes a problem for the operator who has limits to his/her resources. Automation control takes care of adjustment of pot settings and equalization in a mix down. This allows the operator to devote himself/herself to the more creative aspects thus, increasing quality as well as productivity. Automation is expected to play a larger role in the future.

2.3.2 Creating the Stereo Effect

The stereo effect can be created through several ways in music production.

First, there is synthesized stereo, where stereo is simulated electronically. Here, a monaural (one channel, non-stereo) sound is electronically processed to create the effect of a two-channel, stereo signal.

A slight bit of reverb (reverberation, or echo) adds to the effect. Even though this is not true stereo, when reproduced through stereo speakers, the sound will be perceived as having more dimension than monaural sound.

The elaborate audio board below can easily accomplish this.

True stereo is only possible if the original sound is recorded with two microphones, or a microphone with two sound-sensing elements.

This process is extremely simple when the output of a stereo microphone is recorded on two audio tracks and the two tracks are later reproduced with two speakers. Things get much more complex when you want to mix in narration, music and visual effects.

Usually in productions a monophonic (non-stereo) recording of narration is mixed into a background of stereo music or on-location stereo sound. The narration (or primary dialogue in a dramatic production) is typically placed ‘centre stage’ and the stereo track adds a left-to-right stereo dimension.

Multi-Track Recording

In the past, recorders were employed that could record audio from 8 to more than 40 analogue tracks on a single piece of one-inch audiotape. Nowadays, audiotapes have been largely replaced by computer hard drives that record audio digitally.
Recording of materials on hard drives makes it easier for producers to use as it becomes much easier to find the segments of a production that are required.

Recording the different sources of sound on different audio tracks allows producers to place the tracks in any left-to-right sound perspective. A lot of the songs that are popular today employ sounds because of the ‘mix’ created by recording engineers. Compared to the popular contemporary music of today, classical music is usually recorded with only one tactically placed stereo or surround sound microphone. In classical music recordings, the task of sound mix and balance are the job of the conductor rather than an audio engineer.

Two methods of stereo micro-phoning are used namely, the X-Y and the M-S approaches. Each of the methods has advantages and disadvantages.

2.3.3 Audio Control Devices: Boards, Consoles and Mixers

Audio signals are usually controlled in a music studio or a production facility that contains an advanced audio console, which is similar to what one would find in a music production studio. Audio consoles basically help in the following:

(i) Adjusting the volume levels for the audio sources.
(ii) Mixing and balancing different audio sources achieve the best possible blend.
(iii) Amplify incoming signals
(iv) Relay the combined effect to a device for recording or transmission.
(v) Manipulate characteristics of audio like frequency, reverberation, placement of stereo sources, and so on.

Cues are essentially employed to find the most suitable starting point for pre-recorded music. Usually, a speaker with lower quality is used for cue audio so as to make sure it is not confused with programme audio.

Although audio consoles and mixers can control a huge range of audio sources, these audio sources can be classified into two chief groups:

- Microphone-level inputs
- Line-level inputs

Microphone-level inputs take care of the exceedingly low voltages in microphones, while line-level inputs take care of the outputs of amplified sources of audio, such as CD players. In an audio console, all audio sources become line-level and are taken care of accordingly.

Using Multiple Microphones in the Studio

Radio station studios require numerous microphones. Since the use of many microphones can result in confusion, the person operating the audio in the studio should note down or mark which microphone is associated with microphone on the audio console. In the studio, the different microphone cables are connected to three-prong XRL or Cannon connector receptacles located in the studio wall.
Before recording of a programme begins, it is important to make sure all the microphones are working properly. If this is not done during pre-production, one can expect surprises when one starts the recording. For example, a microphone of a guest is switched on during recording and there is no audio or very faint audio coming from the microphone. This problem may result in the halting of the recording while the microphone is fixed. There are other reasons why a microphone needs to be checked during pre-production to make sure it is working properly. The strength of people’s voices varies and this may put audio levels completely out of sync. Therefore, before production, it is a good idea to check the volume levels of each person who has a microphone and adjust accordingly. It should be noted that even after checking and adjusting the audio levels of each person, one needs to constantly monitor the audio levels during a recording. For example, during discussion programs, people have a tendency to speak loudly to disagree with someone. Thus, one needs to constantly readjust volume levels in a microphone. It is also important to keep spare microphones in the studio for use if a regularly microphone stops working during recording.

**Audio Mixer Controls**

Audio mixers employ two sorts of controls, i.e., selector switches and faders.

- **Selector Switches**: The function of selector switches is that it allows a user to direct audio sources into a particular audio channel.

- **Faders**: Faders (volume control) also known as attenuates, gain controls, or pots can be either linear or rotary in design. Linear faders are also referred to as vertical faders and slide faders.

**Level Control and Mixing**

Audio mixing goes beyond just watching a VU meter. The total subjective effect as heard through the speakers or earphones should be used to assess the final effect.

For instance, if an announcer’s voice and the background music are both set at 0dB, then music will get in the way of the announcer’s words. Using your ear as a guide, you will possibly want to let the music peak at around 15dB and the voice peak at 0dB to provide the desired effect.

Since both music and voices have different frequency characteristics (and you will recollect that unlike VU meters, our ears are not equally sensitive to all frequencies), you will need to use your ear as a guide.

During long breaks in narration you will perhaps want to increase the level of the music to some extent and then bring it down just before narration starts again.

In selecting music to go behind (under) narration, instrumental music is always favoured. If the music has lyrics sung by a vocalist they would have to be much lower so as not to compete with the narrator’s words.
Check Your Progress
5. What is the standard practice of level setting in separation type of recording?
6. State the only condition in which true stereo is possible.
7. What do microphone-level inputs and line-level inputs take care of?

2.4 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. Radio transmitters are the devices which are used to send radio signals for broadcast. This requires certain important elements to work: power, oscillator, modulator, amplifier and antenna.
2. The band on which RF microphones transmit are either the very high frequency (VHF) range or the ultra-high frequency (UHF) range. Most of the time audio engineers prefer the UHF range as it is less packed than the VHF range.
3. There is an analogy between radio waves and light waves, as they both travel in a straight line at the same speed of 30,00,00,000 metres per second.
4. The range of AM is lower as it starts from 525 to 1705 kilohertz.
5. The standard practice in separation type recording is to set the maximum level for all channels. This way the best signal-to-noise ratio on the original tape can be assured. The channels can be adjusted downward till the desired balance is achieved during the multichannel mix down process. Thus, a considerable noise advantage can be realized.
6. True stereo is only possible if the original sound is recorded with two microphones, or a microphone with sound-sensing elements.
7. Microphone-level inputs take care of the exceedingly low voltages in microphones, while line-level inputs take care of the outputs of amplified sources of audio, such as CD players.

2.5 SUMMARY

- Radio communication system is made up of two very important elements: radio transmitters and radio receivers.
- Radio transmitters are the devices which are used to send radio signals for broadcast. This requires certain important elements to work: power, oscillator, modulator, amplifier and antenna.
- Radio receivers work in the totally opposite direction. It requires important elements like the antenna, RF amplifier, tuner, detector and the audio amplifier.
Antennas are the device used to transmit radio waves into space. It can be in many different sizes including a satellite dish or the commonly seen long, stiff wires. In a radio studio, the voice or sounds from the microphones are converted into electrical energy and then transmitted through the tall metal antennas.

Amplifiers are beneficial in amplifying the singular waveform without affecting or altering the wave shape and frequencies. There are many different types of amplifiers.

In wireless microphones, signals emanating from dynamic and condenser microphones are converted into low-power FM signals and transmitted in a more or less a circular pattern using either an internal or an external antenna.

If there are obstacles like solid metal objects between the radio frequency (RF) microphones and the radio receiver, it results in a situation of multi-path reception caused due to a part of the radio signal being reflected off the solid surfaces. This results in interface problems. The problem becomes acute especially if the individual the microphone is attached on starts moving around. In such situations, his or her audio starts fading in and fading out. The way to avoid the problem is to select different frequencies.

A good signal from an RF microphone is of little value unless it can be received without multi-path or other types of interference. One of the most useful ways to remove interference is with the proper placement of the receiving antenna(s).

It is well known that Radio waves are electro-magnetic (EM) waves. The electrical and magnetic waves both together form the EM waves.

Modulation means that the radio signals (the audio carrying signals) are topped with a carrier signal. Modulation helps the radio signal to travel over long distances. Since the frequency of radio signals is low, the carrier signal is added which has a constant waveform i.e. constant amplitude and frequency. Modulation is therefore, the process of ‘mounting’ the audio signal to a carrier wave.

AM is one of kinds transmission that creates a signal with constant frequency irrespective of the radio frequency at which the broadcast is done. The amplitude (strength) of the wave only changes according to the strength of the broadcast signal.

FM is synonymous to radio in colloquial language. FM gained popularity between 1970s-80s where many broadcast companies switched from AM to FM. It is the most widely used transmission technique these days. FM is able to transmit all types of sound without any disturbances unlike AM which is unable to transmit high frequency sound therefore most music broadcasts use FM.
Hifi or high fidelity system is the term used to refer to higher quality audio in comparison to the inferior sound reproduction that was heard in inexpensive audio equipment until the late 1940s. The main characteristic of the hifi system is that it was considered by audiophiles to represent a sound system that had the least amount of distortion and noise and the frequency response is quite accurate.

The monaural sounds and mono-channel recording system was common before this time. This involved the use of one speaker, there was no bifurcation in the source of the sound and it came mixed together through one channel. Later in the 1950s and early 1960s, these hi-fi systems were replaced by the stereo system which with its debut made the use of two speakers for the sound reproduction and had even crisper sound reproduction.

Stereophony or stereophonic techniques is the concept of recording sound with a dual pickup providing a right channel and a left channel. This is also referred to as multitrack, multichannel or separation recording.

Multitrack offers a lot of flexibility like the option of recording, if required, one instrument or soloist at a time and introducing special effects as the production progresses. Thus, each element can be recorded separately and then put together later by mixing the pieces.

Audio signals are usually controlled in a music studio or a production facility that contains an advanced audio console, which is similar to what one would find in a music production studio.

Audio mixers employ two sorts of controls, i.e., selector switches and faders.

Audio mixing goes beyond just watching a VU meter. The total subjective effect as heard through the speakers or earphones should be used to assess the final effect.

### 2.6 KEY WORDS

- **Radio transmitters**: These are the devices which are used to send radio signals for broadcast.
- **Antennas**: These are devices used to transmit radio waves into space.
- **Modulation**: It means that the radio signals (the audio carrying signals) are topped with a carrier signal. Modulation helps the radio signal to travel over long distances.
- **Stereophony or stereophonic techniques**: It refers to the concept of recording sound with a dual pickup providing a right channel and a left channel. This is also referred to as multitrack, multichannel or separation recording.
2.7 SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions

1. Briefly explain the concepts of transmitters, antennas, receivers and amplifiers.
2. How is the stereo effect created?
3. What are the uses of audio consoles?
4. Write a short note on the use of multiple microphones in studio.
5. What are the two types of audio mixer controls?
6. What is level control and mixing?

Long Answer Questions

1. Explain the important aspects of wireless microphones and antennas in radio production.
2. Describe the concept of modulation in radio production.
3. Discuss the technique of stereophony and multi-track recording.

2.8 FURTHER READINGS

UNIT 3 RADIO FORMATS: WRITING AND PRODUCTION SKILLS

Structure

3.0 Introduction
3.1 Objectives
3.2 Formats of Radio Programmes
3.3 Writing Skills for Radio Formats
3.4 Radio Production Process and Techniques
3.5 Answers to Check Your Progress Questions
3.6 Summary
3.7 Key Words
3.8 Self Assessment Questions and Exercises
3.9 Further Readings

3.0 INTRODUCTION

In terms of radio production, 'programme' basically means the various meaningful sounds produced by human beings or recorded sounds used to fill the airtime to be audible. In radio, the speaker or the source of the sound remains invisible. This is why radio is known as the 'blind medium.' Since radio is meant for the ears only, one has to use words and phrases that would reflect meanings clearly through preciseness in linguistics usage. The various types of radio programmes are known as programme format, which includes a variety comprising news bulletins, newsreels, documentaries, radio features, radio plays, radio talks music programmes, discussions and news programmes.

In this unit, you will study about the various formats of radio programmes and the writing and production skills required for these different formats.

3.1 OBJECTIVES

After going through this unit, you will be able to:

- Explain the different types of radio formats
- Discuss news bulletins, newsreels, documentaries, radio features and others
- Describe outside broadcast programmes
- Discuss the writing skills for different radio formats
3.2 FORMATS OF RADIO PROGRAMMES

Different radio programme formats can well be understood by comparing them with different formats of news in print media in general and a newspaper in particular. You must have noticed when you go through a newspaper that a series of news items are presented in such a way that they catch your attention. The news items range from the serious ‘hard’ news, the ‘soft’ news, news from neighbouring and distant countries abroad or regional news and then news features and entertainment news are all placed in a way which suits the mood and nature of the news item. All of these news items have a distinct presentation style. Some have graphs; some come with display of figures and with some photos.

Similarly, a radio station also broadcasts different types of programmes known as formats. These may include news bulletins, discussion shows, phone-in music request shows, radio features, and so on.

When we decide on the format of a programme, it is very important that we are aware about our target audience. We cannot make a programme on urban problems for rural population and vice versa. Hence, it is important to know the following characteristics of our audience before we prepare a programme:

(a) People
   - The total population
   - The sex ratio
   - Levels of literacy and illiteracy
   - Religious denomination
   - Primary employment of the region
   - Poverty and Income levels

(b) Languages spoken

(c) Number of schools and colleges

(d) Number of children in school

(e) Health facilities available in the area

(f) Power Supply

(g) Television and Radio Stations Available

(h) Road and transport facilities

A producer of a radio programme should be aware of all these facts of a region before he or she decides on the time slot and the language to be used for a particular programme. Therefore it can be said that formats of radio programmes are primarily dependent upon the choices and the needs of the audience.

Certain factors need to be taken into account in all radio formats. In any area or region, different communities live together. They have different socio-
cultural and religious beliefs and life styles. In India especially, radio plays a
significant role in the lives of the people. Irrespective of there being plenty of rich
people and highly developed cities, majority of our people are poor and a large
number of them cannot read or write. So radio serves as the medium that can
inform, educate and entertain them.

Radio formats can be classified into two broad groups:

1. Spoken word programmes which include news bulletins, talks,
discussions, interviews, educational programmes for schools and
colleges, specific audience programmes aimed at women, children,
rural and urban listeners, drama, radio features and documentaries.
2. Music programmes which include disc jockey programmes, musical
performances of all types and variety programmes.

So, in this way, radio programmes can be of various types.

You must have heard of some programmes on the radio. You must also
know the names of some of the radio stations operating in your area. When you
tune into a radio station, you would be familiar with the timings of programmes you
want to listen to being mentioned. These are known as announcements.
Announcements are traditionally made by people who are known as announcers.
These days, radio jockey (RJ) is a very popular term used for announcers because
commercial radio channels prefer to call them by this name.

A radio format has some basic elements. It can be divided into three parts:
(a) Spoken word or human voice
(b) Music
(c) Sound effects

Let’s discuss some of the important types of radio programmes

Spoken Word Programmes

Let us go through some of the spoken word programmes.

1. News Bulletins

All India Radio or Aakashvani broadcasts news bulletins every hour of the day in
English and other regional languages. The duration of major bulletins is 15 minutes.
Summaries of news stories are presented in these bulletins in order of importance
and interest value. In these bulletins national and international happenings are given
prominence while regional and local news are accommodated if time permits.
Human interest stories and sports complete the major bulletins. The language,
structure and presentation of these bulletins is formal.

2. Newsreels

This format is usually of 15 minutes duration and spot reports, comments, interviews
and extracts from speeches are presented in it. It is much more expensive and
complex format than the news bulletin and needs more efforts like well-written link narrations and skilled editing.

3. Documentaries/Radio Features

Documentaries or radio features are usually factual, informational in character and sometimes educational in intent. Techniques of talks and drama are used in these with a view to tell the story of events, past, present or those likely to happen in future. The biography of a great leader, or merely the interpretation of the world around us or people and culture unfamiliar to us or even social, political, economic or cultural problems—all these can be covered under this format. In fact, any subject of interest is open for a feature writer.

What can induce life in a documentary/feature is the use of a narrator along with the voices of real people or actors interspersed with background effects and music.

4. Radio Plays

Radio drama is a story told through sound alone. Dialogues, voices of people, background or mood effect, musical effect, atmospheric effects and the like constitute this sound.

Radio drama is no different than a stage drama except that you cannot see the actors. You can only hear them. Like a stage drama, radio drama also thrives on conflict, uses characters and has a beginning, middle and an end. In a radio drama, sounds suggest movement and progress—generally to a crisis or climax. The voices of the characters have to be distinguished from each other, or the producer may risk the confusion of the listeners.

In a radio drama, at the most three to four characters are advisable otherwise the listeners may get confused.

5. Radio Talks

This format resembles a chat with a friend who is addressing the listener alone in an informal manner. The words in a radio talk are kept simple and familiar, yet descriptive and powerful with short sentences of independent clauses. Radio talks have no definite structure and are interesting and informative.

6. Radio Interview

Like other media including the newspaper, magazine, radio or television, radio interview is an effective technique of drawing information. Journalism is basically about asking right questions and getting the required answers. This technique is used extensively and in various ways in radio particularly because radio is all-audio medium. Interviews may be of different duration, content and purpose.

First of all, there are full-fledged interview programmes, the duration of which may range from 10 minutes to 50 minutes or even 60 minutes depending upon the topic and the person being interviewed. Most of such interviews are centred on a controversial issue or celebrities.
Secondly, interviews are used in various radio programmes like documentaries. These interviews are brief, question specific and few. The purpose is to get a very brief and accurate answer.

Thirdly, there are many interviews or interview-based programmes in the field of news and current affairs. Nowadays, phone-in programmes have become quite popular wherein live interviews are conducted with either listeners or an expert. With more refined technology, these interviews have been made more interactive encouraging the listeners to take part in a discussion or share their views on a common forum.

In another type of interview-based programmes, ordinary people or people with knowledge are just asked one or two questions on some current topic to gather public opinion. For instance, when the general budget or the railway budget is presented in the Parliament, people representing radio approach the general public about their opinion. They remain anonymous. Such interviews are called 'vox pop' which is a Latin phrase meaning 'voice of people'. You have to be very inquisitive, well informed and persevering to be a radio interviewer with sound general awareness and communication skills.

7. Radio Discussions

Discussions can be effective in resolving issues and making people aware of the various dimensions of an issue. Any discussion involves more than two or three people and then ideas can be derived to arrive at some inference. In radio, this technique allows people to have various points of view on matters of public concern. Radio discussions are produced in relation to controversial social or economic issues. So when experts meet and discuss such issues, people get an idea of different points of view. Usually, radio discussions are of a longer duration on radio as compared to TV, around 15 to 50 minutes. A well informed journalist or a senior radio announcer who is well versed with the topic acts as the moderator of the discussions and two or three experts in that particular field are invited to take part and discuss that issue for approximately 50 minutes. The moderator conducts the discussion, introduces the topic and the participants and ensures that sufficient time is given to every participant to express his/her opinions.

8. Phone-in Programmes

Phone-in programmes are another format of radio programming. In such interactive programmes, the caller calls up the anchor and talk about whatever topic is the subject of the discussion. In such programmes, it is important to advertise in advance so that callers have advance notice of when to call. In the beginning, the format was used primarily in call-in music request shows. Nowadays, the range of the format has expanded, and includes programmes on health, programmes discussing government policies, rural broadcasts, and so on.
Music Programmes

In radio, music programmes are far more popular than spoken word programmes. Music is enjoyed because of its rhythm, melodies and harmonies and for the relaxation that it provides. Unity and form are a must in music programmes. What is advisable from experts here is that disc jockey (DJ) programmes of ‘pop’ or ‘disco’ or, for that matter, those of groovy music should not be mixed with classical or light classical music. The genres of music programmes should be strictly kept separated.

Outside Broadcast Production of News, Sporting and Mega Events

Outside Broadcast (OB) stands for a programme produced outside the station and studio. A Van housing the equipment for broadcast is called the Outside Broadcast Van (OBV). This kind of broadcast is related to covering and recording an event right from the place where it is happening. Every production activity and even some of the post production activities occur outside a conventional studio. Earlier OB production was limited to sporting and mega events, but these days it is also used in news programmes. The press conferences of VIPs or people in news are covered through these vans and are telecast live.

It is of utmost importance that before the OB van goes from the station to the location, it is ensured by the producer of the programme that the van is fully equipped and functional. It should reach the required location well before the event starts. The van is usually stationed at a suitable place from where there is convenient access to the field staff as well as the main station. If goes to the location and finds a suitable place for the van so that an effective coverage of the event can be ensured. This is also referred to as field plan just like chalking out the floor plan in studio production.

There are various kinds of outside recordings. Some of them are the following:

(i) (ENG) Electronic News Gathering
(ii) (DNG) Digital News Gathering
(iii) (EEP) Electronic Field Production
(iv) (RFP) Remote Field Production

Any of these can be used to record scheduled or unscheduled events for use in the broadcast station. However, each of them is used in different ways to accomplish a common objective. For instance, in ENG, a camcorder is used to cover events and that recording can be used for news production in the station. The DNG makes use of satellite up-link facility to relay field news events to the satellite. From the satellite, the field news event are downloaded and used by the radio station. On the other hand, remote field production consists of all the equipment that a production may require and thus acts as a complete studio in the field.
A radio signal begins in the studio and ends in the radio set of listeners. The material that is recorded beforehand are played in the continuity studio. The audio can be recorded on tapes, CDs, or on the hard drive of computers. The signals are then sent to the lines room. From there they are routed to the transmission hall. From the transmission hall, the signals are transmitted using microwaves through space.

In the case of reporting on sports and other mega events, commentators are linked to the station from outside. This is dependent on the number of available telephone lines. The proximity of the commentary site to the station is also a determining factor. The linkage can be established in the following ways as well:

1. **By Cable**: The cable linkage method is used for cases when an event is occurring within the grounds of the station but outside the studio. This is a direct link from the studio to scene or from the scene to the studio.

2. **By Microwave Link-Sat**: In this method, signals are transmitted from the event using the satellite uplink. The use of the method is also dependent on how close the event is from the station. If it is far away, it is possible that a microwave would not be able to cover the long distance. However, if the event is within the coverage area of the radio station, the microwaves will be able to transmit no matter how long the distance.

3. **By Telephone Lines**: In this method, the broadcast equipment is connected to a telephone line that directly transmits to the studio. Even if the area has no telephone coverage, microwave equipment can be employed from the location to the carrier room of NITEL which could direct the signals through its trunk to the broadcast station.

Most outside broadcasts on radio also contain either sports or ceremonial commentaries. Both types of commentaries function exclusively depending on the availability of resources and time involved. These are essentially of four types:

I. **Delayed Broadcast**: Refers to a situation when an event is recorded from the beginning to the end and is transmitted at a later date. Usually this is done in a situation when the scene of the event cannot be broadcasted live.

II. **Closed Circuit**: This is employed during a sport situation where the duration of the event is not known, for example a tennis match. The entire event is covered and edited to fit into a broadcast at a later date.

III. **Live Broadcast**: In such situations, the entire event is carried live just as the event is taking place. Commentaries are recorded from the spot. This is done for cricket and football matches.

IV. **Relayed Outside Broadcast**: In such situations, the radio station relays a broadcast from a sister station for its listeners.

Time frame is a vital factor in spite of the OB technique. There are some programmes on radio stations that last for a longer period than others. For example,
events like India’s Independence Day or Republic Day celebration may be three
to four hours long while a sports event like a badminton game lasts no more than
an hour or an hour and a half. The commentary position is determined on the
arrival of the crew at the venue of the event. However, in standard stadia, standard
cubicles are already in place. Here the commentators advise engineers on the
number of cables or microphones to be used and how they should be placed.
Thereafter, the team checks possible escape routes in the case of uncalled for
incidents that are situation specific. The announcer usually introduces the
commentators who equip themselves with portable and small radio sets to monitor
their output on air. This is very significant and enables them to rectify anomalies in
the commentary if any. The commentators work in shifts to avoid being
overstressed. They generally sign off when the event ends. Outside Broadcasting
requires efficient planning with efficient personnel to handle the assignment because
it involves efficient use of person and equipment. The people as well as the
equipment ought to be in good condition, and the people ought to be experts in
handling the production equipments in order to achieve the desired result. At the
scene of the event, cables should be arranged in such a way that disturbance and
damage can be preempted and prevented.

Check Your Progress
1. What are the three parts in which a radio format can be divided?
2. Name the type of radio programmes which are usually factual, informational
   in character and sometime seduction in intent.
3. List the different kinds of outside recordings.
4. State the important factor despite the method of outside broadcasting.

3.3 WRITING SKILLS FOR RADIO FORMATS

Media writing is a term that has come into current use due to a large number of
jobs in the media industry that require good skills in writing content for various
media. It is necessary to look at the origin and development of writing in order to
understand the necessity and requirement of writing for media. Media writing is
distinct from creative and academic writings because media writing is an activity
that has more to do with information, persuasion, propaganda and entertainment.
It involves writing in a simple language and uses many other forms of signification
like audio, visuals and animation to communicate and therefore constitutes a typical
mixture of different codes.

In print media, everything is written down or printed and they exist on pages
of a newspaper or magazine. They can be retained forever and can be read at any
time more than once. With reference to a radio, you hear programmes as they are
broadcast. You can hear them only once. Of course, you may say that you can
Similarly, what you hear on radio is heard only once and then forgotten in a majority of cases. In our daily conversations, we do not use the words and expressions found in a newspaper editorial or a feature article. This happens because those words and expressions are neither common nor easy to understand. On the contrary, your daily conversation comprises simple words, sentences and familiar expressions. The person whom you are speaking to is also taken into account as an important aspect. Your gestures and movements amplify your speech. Even if you are not able to see the announcer, you feel that the person is speaking to you. You may not say anything but you may feel a sense of familiarity with that person. In most cases, what you hear on radio is written down or scripted. It is spoken and heard only once.

The script forms the most important part of production. Hence, writing is essential. We write what type of sound would be required at a given situation and what would follow. Sound is the entire means of communication in radio and are effective in the construction of mental images. Sounds are unique in creating an appropriate environment for the listener. The creative use of various writing and production techniques can construct entire worlds in the human mind. Many techniques are used to create an environment with sound.

Language: The primary objective of language lies in communicating ideas and information to be easily understood. Selecting and using words and combining them into meaningful sentences are important for good production.

Words: Words are main tools for the expression of thoughts, ideas, and, emotions, irrespective of the medium. They are endowed with meaning and power and thus need to be used appropriately. Use realistic words. Informal rather than formal words are preferred.

Sentences: Sentences are the principal units of organized thought. The clarity, simplicity, conversational style and conciseness are keys to construct effective sentences.

Spoken Language Writing

First of all, in the case of radio, you listen to a person without being able to see them. The person speaks from an earlier written script. You are made to feel as though you are in conversation with the person.

The person sounds informal and can be easily understood. The language or the words used in a radio script can be called the spoken word as against the written word or the printed word used in the print media. The spoken word is written for auditory impact, whereas the printed word is written for visual impact.
The main features of the spoken word are as follows:

(i) Irrespective of being written, it is spoken.
(ii) It is written for the ear and not the eye.
(iii) It is not repeated.
(iv) It is conversational and should therefore sound so with the following qualities:
   (a) It should contain simple words.
   (b) The sentences should be brief and accurate.
   (c) A sentence should not contain multiple ideas.
   (d) Irrespective of there being innumerable listeners, the written content should pertain to only one listener.
   (e) Selected words should be clear and not ambiguous.
   (f) Words should be so impactful as to create ideas in the form of mental images for the listeners.
   (g) Abbreviations should be avoided. An abbreviation, if used, should be expanded.
   (h) Large numbers in a script can be approximated to the nearest whole number.
   (i) While referring to more than one person, avoid using ‘he’ or ‘she’. The listeners may be perplexed.

Writing for Programmes

The basic component of a radio script is the spoken word. It is this spoken word equipped with certain variations of vocal sounds, speech style and grammar that creates an image of the matter described by it in the minds of the listeners.

The first principle to remember when writing for radio is that the target audiences are listeners and not viewers. Writing the spoken words is extremely difficult as it demands writing and speaking simultaneously. A writer of radio scripts may not be a good speaker himself, but he has to keep in mind that the script he is writing is meant for reading or narrating. Hence, the natural flow of sentences is determined by the structure of the sentences, their order and selection of words that should be clear and unambiguous. This is important as the listener cannot rewind the programme when it is ongoing.

Radio programmes are meant for listeners, hence they come first. Knowing ‘who one is writing for’ gives an opportunity to the writer to decide about the language and style he is going to adopt. For a variety of radio programmes, the target listener group could be children, women, farmers or students. Whatever the group may be, the script must approach the audience directly. For instance, instead of writing ‘listeners who want to reply...’, a better option would be ‘if you want to reply...’.
The script should be a narrative, i.e., whatever one wants to say must be in a form that directly addresses the audience. Thus, it is important to write in a conversational language. The best way of doing this is to speak aloud and write down what you hear.

It is best to avoid too many clauses and in the script as they hamper the natural flow of the language and can create confusion while reading that may result in errors. Also, punctuations should be inserted at the correct places as this helps in getting correct pauses at appropriate places.

Our speed of reading varies across different languages. For English the speed of reading is generalized at 140-180 words per minute, but for Hindi the number of words per minute rests at 160-200. Hence, when writing a script this criteria becomes very important. It is advisable to use one side of a page only if it is printed as a hard copy. This is easy to slide and does not produce a ruffling sound when being handled in the studio. Microphones are extremely sensitive and can catch the least audible sound. Double spacing is preferred throughout the script so that if any necessary changes are incorporated, the copy is clear and easy to read. Sometimes wide margins are kept for any notes, instructions or for pronunciation of difficult words. Also, some presenters mark their copies for stresses, pauses etc., hence double-spacing and margins are of great help.

If the script is lengthy and requires another or more pages, then it is advisable to complete the paragraph or sentence on one page before proceeding to the other. A sentence is never split between two pages. Each page is marked with a number, preferably in bold letters, for example, PAGE THREE, or PAGE 3, to avoid any confusion.

Usually abbreviations are avoided, but in case of a commonly known abbreviation, it should be written giving space between each letter for example, Y. W. C. A.

For all formal presentations a script is a must, however for informal talk programmes, chats on FM, running commentaries or other spontaneous programmes on music, etc., scripted notes are required containing names, anecdotes, important announcements and instructions. This type of script may be in a form of an orderly outline that serves as an aide-memoire. When any programme is on air, there is hardly any time to think and phrase sentences. Scripts save the presenter from the stress of remembering everything in a required order and gives him an opportunity to say exactly what he wants to say. In other words, a script provides the facility of not leaving out anything important and completing the programme well in time. Besides this, a script provides us with more time to think thoroughly with the desired expressions presenting a well designed and well linked programme.

In broadcasting, a listener has a choice of switching the radio off if he finds it boring. To catch the attention of listeners and to hold him, the beginning of the
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script has to be interesting and powerful. In print, it is possible for the reader to move to the next story or topic if he finds it interesting or he can just look back to rethink over a point, but in a radio programme this is not possible. This explains why it is required to structure expressions and thoughts in a script for a radio. Once the interest is built from an impressive beginning, the scriptwriter can easily put factual information in the middle of the script. If the facts are linked appropriately, the interest of the listener also moves to the next fact. Simple and short sentences make even difficult ideas easy to understand. Linking one idea, fact or story with another with phrases like, ‘...and now in sports news we have...’ or ‘let us have a look at...’ makes listening easier. This change to a new point is known as sign-posting.

Repetition of the same words in sentences is bound to irritate listeners. If it is necessary to refer to the same point repeatedly, it should be replaced by any other suitable word or phrase in adjacent sentences. The script should end with a repeat of the main points so that the theme of the programme stays in the minds of listeners.

Fig. 3.1  Script for a Radio Programme

Source: http://www.google.co.in/search
Writing for Radio Commercials

Advertisements for print, radio and television are commissioned by a client. The client wants to sell the product through a message, which is conceptualized and written by a writer. Generally, the duration of an advertisement or commercial is about 20 to 60 seconds. Writing a powerful message or information compressed in such a small time slot is a difficult but challenging task. The making of a commercial requires specialized camera work and scripting. The writer has a very limited time to capture the audience. Short and catchy sentences are required to grab the attention of viewers. Short and catchy sentences are required to grab the attention of viewers. The number of words for a 30 second commercial is generally not more than 30 to 40 words as a major chunk of time is kept for music and visuals. The standard way of structuring a television commercial is to keep in mind the formula that instructs ‘to say, to explain and to repeat’. The lead sentence in a commercial must have a punch line to attract viewers. The format of a commercial script is almost the same as in other visual media, i.e., a A/V split form. After grabbing the attention of the viewer, the next sentence can have some additional details. A commercial must end with the repletion of the message so that it remains in the minds of viewers. The formula for writing scripts for public service announcements, abbreviated as PSAs is the same but the objective of such a broadcast is public welfare.

Radio commercial is a hard segment. Even though the copywriters do not have to worry about the visuals, they do have to make the most of the auditory sensation to make the most of the commercial. Generally, commercials are a distraction for the listeners, and more often than not they switch to other channels during this time. But presenting the argument that it pays the bills for keeping the radio working is not a right for making an average commercial. The following guidelines should be kept in mind while designing commercials for the radio. The price point, call to action and important information all needs to be squeezed in those thirty seconds. The first line must be the most eye catching, the writers must read aloud their scripts before it goes to production since audio is the most important aspects and the script needs to be as lean as possible.

Illustrating Copy with Sound Effects

A standard radio format covers copy or scripts such as radio news, radio advertising and promotional copy, radio public service copy, audio drama.

Writers use the radio format for any production that can be interpreted only through sound (the human voice, sound effects, music, silence). In a standard radio format, the audio source, such as the human voice (designated as ANNCR for announcer, TALENT, or a character name) SFX (for sound effects), MUSIC (for a music cue) appears on the left, followed by a colon and either copy for talent to interpret (in upper and lower case) or CUES (in all caps) for production personnel. Fully scripted radio promotions are often featured by the most production-intensive copy.
Radio Script Format Conventions:

1. One side of a page only (if printed as hard copy)
2. Double-space all copy
3. Type instructions for sound effects and music in ALL CAPS.
4. Underline music cues.
5. Type talent instructions in parentheses. (Some copywriters will capitalize instructions to talent, many keep capitalizing for control booth/production personnel only. This is the preferred standard and the standard I ask you to use. Upper and lower case for talent; all caps for control room.)
6. Only one story or spot on a printed page. (People still use paper in some radio stations and advertising agencies.)
7. Type audio source (Speaker, Music, SFX) in all caps.
8. Copy data appears at the top of the page. Minimal copy data includes: a story tag (if news copy) or the client’s name (if ad copy), author of the spot, length, date.
9. If copy is lengthy and needs multiple pages. You should never split a sentence between two pages, type MORE in all caps and in parenthesis, and center at the bottom of the first page, begin next page with copy data in the upper left hand corner and ‘PAGE TWO’ in all caps in the upper right hand corner.
10. If delivering copy as hard copy and there is not time to reprint, correct copy by blacking out problems and neatly hand printing or typing in the correction. Electronic delivery must be clean and error-free.
11. Avoid abbreviations except for Mr., Mrs., Dr., Ms.
12. If initials are to be read as initials, type in capital letters separated by hyphens. Y-W-C-A
13. If initials are to be read as an acronym, write initials in a solid combination of letters. MADD
14. Avoid A.M. and P.M. Write out the time of day.
15. Keep it conversational. Use contractions. Avoid clichés and overworked superlatives.
16. Avoid question leads that invite audiences to mentally argue with you.
17. Simplify numbers: 50 cents, 5 thousand, one-third, 8-point-8 percent, under 90 thousand.

In the sample radio script, you’ll see announcer copy, sound effects cues, a music cue and a tag. This script is for ad copy but news copy looks very similar only more simple because news rarely has sound effects or music cues included in the copy.
News Writing

News received from various sources is scanned, processed, edited and reduced into spoken words in the news room. It is distributed to various language units in the form of ‘pools’. Pools are classified as morning, afternoon, evening and night pools. A morning pool serves as a source material of news for bulletins that are broadcast before afternoon. Similarly, other pools are also used accordingly. The news editor is mainly responsible for the smooth presentation of a bulletin. He selects the stories for his bulletin and places them on a rundown sheet according to their order of broadcast. He then assigns stories to reporters after briefing them about the angle of approach. Some reports are taken ‘live’ during the transmission and some are recorded. Recordings are also done on phone and are cued. The news editor, after making a selection of the stories for his bulletin, allocates the stories to assistant news editors and newsreaders/ translators for translation, if required, and editing. In the meanwhile, the audio editor edits the recordings provided by reporters and stringers. These audio clippings, known as voice casts, are cued and the cues are reported to the news editor who places them according to their order in the rundown sheet. If the recordings or the voice casts are found unsuitable for the broadcast due to their poor audio quality, then the text of such reports is recorded in the studio. Such recordings are known as voiceovers.

Live voice casts from reporters, personalities and various people, known as vox populi, are also marked on the rundown sheet. After setting everything in order, a broadcast copy is prepared that is passed on to the reader for rehearsals.

There are various types of bulletins besides the main bulletins, such as employment bulletin, slow speed bulletin, sports news bulletin, bulletins for foreign countries, etc. Some of them are of short duration and some are full-fledged bulletins containing news, interviews, reports and even newspaper reviews. Such bulletins are news programmes in the form of a capsule. Short bulletins are usually of five minutes duration. They do not contain reports, interviews and are not elaborated. For a bulletin of five minutes duration, where there is no music, report, etc., the editor has to keep in mind the word limit. Generally, the standard word limit is 900 words for a five minute bulletin but the number of words is usually a little less, say 800 words, as rest of the time left is meant for the change-over and the signature tune. This time is known as ‘handling time’. A signature tune is played in the beginning and at the end of each programme which is of about 30 seconds.

The names of the members of the editorial team and the newsreader are given at the top of the broadcast copy along with the date and time of the broadcast. The bulletin opens with the main headlines followed by the news in detail. Each news story is defined by a slug. The components of such a lengthy, elaborate main bulletin are voice casts, interviews and reviews. There are several breaks and
music in between changing overs. The texts of the recorded reports are always given in the broadcast copy.

The following is an example of a script of a news bulletin of All India Radio.

SRH/DKG:SC/HP
ALL INDIA RADIO
NEWS SERVICES DIVISION
ENGLISH MIDDAY-1400 HRS.

SIGNATURE TUNE

3.4 RADIO PRODUCTION PROCESS AND TECHNIQUES

A radio programme has to be produced skillfully for it to create an impact. Radio production encompasses a wide domain. Frequent technological change leads to subsequent change in radio production techniques, the basics remaining unaltered. Excellent ideas, well-written scripts and the outstanding voices will not be of any use if the programme is uninteresting on account of not being produced properly.

Thinking Audio

When there are intervals in the transmission of news, certain audio inputs are used to fill up those gaps. For instance, when transferring a call to a field reporter, there may be some music that is used to maintain the continuity of the news as well as break the monotony and carry on with smooth flow of news to the audience. These may be in the form of other sounds as well. The term thinking audio can be interpreted in two ways. One, when the sound effects inspire a certain pattern of
thinking in you and the second way is when the audio is used in place of a meaningful pause. Most inspirational and motivational lectures use thinking audio to create a positive environment. But in journalism, thinking audio is mostly associated with a long pause filled with an audio which is conducive to the mood of the programme. This kind of audio can be used in between two news stories, amidst a story to denote a shift in the mood or viewpoint. Thinking audio plays a significant role in radio plays in which it can be as important as a character himself.

Radio Feature Production

Generally, in terms of speech style, journalists and producers may be most familiar with radio news broadcasting and news bulletins; however, radio’s speech output is mostly in the form of features, interviews and, in essence, programming similar to the content readers of any magazine or newspaper familiar with the audio form.

Starting out on a Feature

A feature emerges through a logical order:

- Decide on the primary idea underlying the feature.
- Keep a record of the idea and analyse other related areas that the same idea could possibly produce.
- Select a story or an angle giving a proper dimension to the piece.
- Take into account an individual appropriate for contributing to the piece effectively.

Preparing a radio feature is similar to connecting pieces of a jigsaw puzzle, beginning with the initial idea, adding elements and removing the oversized pieces.

Feature from the Listener’s Perspective

Before the idea is developed, some important questions need to be considered with regard to the work planned that will economize on time and effort in the long run and determine the course of the entire project:

- Is the idea worthy of being made into a feature?
- Has it been done earlier?
- Is there an alternative angle to the subject not previously taken into account?
- Who is the target audience and will they be interested in listening at all?
- What are the possible barriers to any likely production?
- Is the feature appropriate in relation to the intended broadcast media?
- Is the subject large enough?

If most of these questions have a positive answer, the next stage of the feature comes into play.
Write a Draft Script

Some broadcasters feel that they will face most situations with the help of their personality and a formal script makes them sound either less exciting or less spontaneous. However, generally the reverse takes place. A script plays an important role in any feature or audio of any length to give it cohesion and intelligence and to ensure that the story doesn’t dissolve. A script is to be considered as a safety net or an intended plan of action (Plan A). The script may be deviated from according to the events to present a better production. Walking through a script may benefit a script meeting or an individual broadcaster in the following way:

- Outline the idea by writing an initial script
- Sequentially order the points of the piece
- Ensure that the opening is interesting and attracts the listeners’ attention
- Use simple language and short sentences
- Maintain simplicity

A basic outline will not only help in developing the next stage but will also be more valuable and maintain the impact of the piece centred on the main idea.

Production of the Feature

If more than one person works on the initial script it helps in making all minds concentrate on the subject associated with the intended feature and result in a logical conclusion. Thus, one must:

- Assimilate all the material, audio, written and/or verbal anecdotes.
- Determine the impact of the research and material on the initial idea.
- Be prepared to change or rewrite the initial script.
- Decide on the audio insert format from original recorded sound, library audio, and re-creations.
- Cast a narrator, a voice for the piece that will be the listeners’ “constant guide” to the feature.
- Decide on the duration of the piece, and ensure a natural and reasoned conclusion to it.

Listening to the completed audio from a listeners’ perspective will be useful. Someone who has not been previously involved in the production can also be made to listen to the audio and opinions may be considered.

Final Test

The three C’s test is essential for any idea to be considered as a feature:

- Clear
- Concise
- Correct
5. State the first principle to remember when writing for radio is that the target audiences are listeners and not viewers.

6. What is generalized speed of reading in Hindi and English?

7. What does find in a sample radio script?

8. Define the term ‘thinking audio’ in journalism.

3.5 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. A radio format has some basic elements. It can be divided into three parts: spoken word or human voice, music and sound effects.

2. Documentaries or radio features are the type of radio programmes which are usually factual, informational in character and sometime seduction in intent.

3. There are various kinds of outside recordings, some of them are the following:
   (i) Electronic News Gathering
   (ii) Digital News Gathering
   (iii) Electronic Field Gathering
   (iv) Remote Field Gathering

4. Time frame is an important factor despite the method of outside broadcasting.

5. The first principle to remember when writing for radio is that the target audiences are listeners and not viewers.

6. For English, the speed of reading is generalized at 140-180 words per minute, but for Hindi the number of words per minute rests at 160-200.

7. In the sample radio script, you’ll see announcer copy, sound effects cues, a music cue and a tag.

8. The term ‘thinking audio’ in journalism is mostly associated with a long pause filled with an audio which is conducive to the mood of the programme.

3.6 SUMMARY

- In terms of radio production, ‘programme’ basically means the various meaningful sounds produced by human beings or recorded sounds used to fill the airtime to be audible.
• Different radio programme formats can well be understood by comparing them with different formats of news in print media in general and a newspaper in particular. A radio station also broadcasts different types of programmes.

• Announcements are traditionally made by people who are known as announcers.

• All India Radio or Aakashvani broadcasts news bulletins every hour of the day in English and other regional languages.

• Discussions can be effective in resolving issues and making people aware of the various dimensions of an issue.

• Outside Broadcast (OB) stands for a programme produced outside the station and studio.

• Outside Broadcasting requires efficient planning with efficient personnel to handle the assignment because it involves efficient use of person and equipment.

• The basic component of a radio script is the spoken word. It is this spoken word equipped with certain variations of vocal sounds, speech style and grammar that creates an image of the matter described by it in the minds of the listeners.

• News received from various sources is scanned, processed, edited and reduced into spoken words in the news room. It is distributed to various language units in the form of “pools”. Pools are classified as morning, afternoon, evening and night pools. A morning pool serves as a source material of news for bulletins that are broadcast before afternoon. Similarly, other pools are also used accordingly.

• Advertisements for print, radio and television are commissioned by a client. The client wants to sell the product through a message, which is conceptualized and written by a writer. Generally, the duration of an advertisement or commercial is about 20 to 60 seconds.

• Standard radio format will cover various types of copy or scripts such as radio news, radio advertising and promotional copy, radio public service copy, audio drama.

• Radio production encompasses a wide domain. Frequent technological change leads to subsequent change in radio production techniques, the basic remaining unaltered.

• The term-thinking audio can be interpreted in two ways. One, when the sound effects inspire a certain pattern of thinking in you and the second way is when the audio is used in place of a meaningful pause.
Generally, in terms of speech style, journalists and producers may be most familiar with radio news broadcasting and news bulletins; however, radio's speech output is mostly in the form of features, interviews and, in essence, programming similar to the content readers of any magazine or newspaper familiar with the audio form.

3.7 KEY WORDS

- Radio jockey (RJ): This is a very popular term used for announcers as commercial radio channels prefer to call them by this name.
- Phone-in Programmes: It is also known as interactive programming where the listener and the presenter talk to each other.
- Outside Broadcast (OB): Stands for a programme produced outside the station and studio.

3.8 SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions

1. List the characteristics of the audience which must be known before preparing a radio programme.
2. What are the different types of radio interviews?
3. What are the techniques used to create an environment with sound?
4. How does script form the most important form of production?
5. List the characteristics of the spoken word.
6. Write a short note on writing for radio commercials.

Long Answer Questions

1. What do you understand by the format of a radio programme? Why is it necessary? Give reasons for your answer.
2. Describe the different types of spoken word programmes.
3. Explain the outside broadcast production of news, sporting and mega events.
4. Discuss spoken language writing with respect to radio programmes.
5. Explain radio script format conventions and news writing.
6. Examine the radio production process and techniques.
3.9 FURTHER READINGS


UNIT 4 SPECIAL AUDIENCE PROGRAMMES ON RADIO

Structure
4.0 Introduction
4.1 Objectives
4.2 Different Radio Programmes for Specific Audiences
4.2.1 Programmes for Children
4.2.2 Programmes For Women
4.2.3 Programme for Youth
4.2.4 Programmes for Industrial Workers
4.2.5 Programmes for Senior Citizens
4.2.6 Programmes for Defense Forces
4.2.7 Special Programmes for Rural Folk
4.3 Answer to Check Your Progress Questions
4.4 Summary
4.5 Key Words
4.6 Self Assessment Questions and Exercises
4.7 Further Readings

4.0 INTRODUCTION

Radio has always produced a bouquet of programmes for a variety of audiences like children, armed forces, women, youth, farmers, small and medium scale industrial workers, senior citizens etc. Special audience programmes cater to the needs of people from different backgrounds. As the interests and communication needs differ, the programmes are scripted accordingly. Programmes produced for masses are based on general interest areas like current affairs, politics, society, literature, economics, science etc. Still there are some segments of audience whose communication needs are not met by such broadcasts. To produce a programme for special audience the target audience must be identified first. It is important to understand and map the communication needs of the audience group like children, women, youth etc. to plan the nature of the programme. A deep demographic (age, region, gender, income, etc.), socio-economic and psychological research needs to be done to touch the right chord with the audience. For example, a programme designed for farmers would not have the presenter talking about brands in English rather the presenter must talk in a calm and composed manner about agriculture, crop, life of farmers, their interests. A programme on women would talk about their challenges in life, motherhood, their hobbies and interests. In this unit, you will learn about special audience programmes on radio.
4.1 OBJECTIVES

After going through this, you will be able to:

- Discuss the radio programme for children and women
- Recall radio programmes for youth and senior citizens
- Describe radio programmes for rural folk, industrial workers and defense personnel

4.2 DIFFERENT RADIO PROGRAMMES FOR SPECIFIC AUDIENCES

In this section, you will learn about the varied types of radio programmes and their nature based on the type of audience it seeks to cater.

4.2.1 Programmes for Children

Children have a big stake in shaping the country’s future. In India, 39% of the total population constitutes of children and statistics say that about 44% of them suffer from malnutrition. Children, their needs and challenges demand more media attention to fight for the cause of child labour, malnutrition, infant mortality, education for all etc. The radio medium, thus, has a very instrumental role to play in their development. Radio must adopt a tri-fold approach – to help direct children on the right path, to facilitate free spirited thinking, and to focus on their issues and challenges. The programmes for children are divided into two categories according to the age-groups – one is between 5 to 7 years and other is 8 to 15 years. The content and style for younger age group is designed keeping in view their short attention span and their interest. The broadcasts are done in story-telling method to make understanding better which include short stories from Panchtantra etc., short plays, features, rhymes, choral songs. Programmes also try to stress on health, hygiene, cleanliness and good habits. Smartphones have swallowed all other mediums, so children listening to radio in cities is a rare sight but in villages, radio is definitely a potent medium of infotainment. Children’s Day on 14th November is also celebrated as Bal Diwas hosting a myriad of programmes like special activities and shows for invited audience in the studio or interviews.

Programmes designed for grown up children is more participatory, and discussion oriented. The broadcasts include group activities like group singing, quizzes, science experiments, music tutorials, travelogues etc., that interest this segment of audience. The programmes produced for city children and rural children are different as the language and background is different. Generally, the programmes for rural children are recorded by the team visiting the area to focus on their specific needs and demands. These children need motivation to improve their educational and literacy status and become respectable citizens of the nation. It is
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not always important to include children in the programmes but the content must be designed for them. The presenter must have a soft, versatile voice with a passion to communicate with the children. These radio broadcasts for children have to be creatively designed as the children must develop spirit of enquiry and quest for knowledge.

4.2.2 Programmes For Women

Broadcasting media sticks to a general policy regarding women based programmes that the programmes designed for general audience too must include gender equity and women empowerment. Most discussions will have women as panelists to maintain gender parity and reflect unbiased opinion and wider spectrum of viewpoint. Most women oriented programmes are broadcast at a time when they are relatively free from their household chores between 12 noon to 2 pm generally. The programmes are meticulously designed to cater to specific needs and interest of women. The broadcasts are a combination of both information and entertainment. Over the time, there has been a huge shift in the content of these broadcasts as they used to focus more on cookery, embroidery, child rearing, sewing, issues at home and household tips and tricks but now the focus is more on women health issues like menstruation, reproductive concerns, work-home balance, marriages, legal rights, gender equality. The women are at the helm of each task and this has stepped up the need for better content for broadcasts. The proactive role of women in all fields is also reflected in the broadcasts as the target audience (the women of today’s times) is more aware and independent.

Women juggle between home and work and play an important role in decision making at all levels. A feeling of empowerment needs to be instilled in the women through these broadcasts. All special schemes and facilities like Pradhan Mantri Matritva Vandana Yojna (for maternity benefit) are communicated through such programmes. Programmes are sometimes based on success stories of women as who are idols in various fields and their experiences inspire and have a great impact on the lives of ordinary women. Important issues like girl education, women empowerment, women rights are changing the social value system, thereby creating a separate niche for women and giving them a medium to voice their opinion. To effectively connect with the target group of women, the broadcasters have a united opinion that women must have access to radio-microphone or smartphones to voice their opinions on issues and topics that are of concern. Some ordinary women have become role models for others as they’ve voiced their views on various issues. The Deccan Development Society (DDS) has done some exceptional work in bringing rural women to the studio where they connect with the other rural women with similar hopes, demands and concerns.

The general broadcasts must sensitize both men and women on gender equality. A new concept of listening club is growing up fast which helps in encouraging listening and promoting listener’s participation. The club members can also be instrumental in planning, presentation and production of the programmes.
The broadcasts can also be divided among various slots to cater to home-makers and working women.

4.2.3 Programme for Youth

It is said that by 2020, youth will constitute 34% of India’s population. 45 million young voters were added in the 2019 Lok Sabha Elections. The youth is a reservoir of untapped energy and this energy needs to be channelized in the right direction. The youth want to voice their opinions and express their concerns for which special programmes for youth are the best platform. In 1969, the then Prime Minister Indira Gandhi realized that the unrest amongst the young people can be positively channelized by giving them a medium to voice their concerns. In 1969, Yuv Vani – Voice of Youth was inaugurated at All India Radio, Delhi.

The programmes for the youth are designed for an age group between 15-30 years. Young people want to rise to the occasion and address issues that concern them and the society they live in. The youth is high spirited and adventurous, and this essence must be captured in the programme to connect with them. The broadcasts help them to reconnect with the historical and cultural roots of the country and understand a better world view. The programmes aim to instill scientific temper and involve them in nation-building. Focusing on educational value that directs youth towards the right path is the need of the hour. There are many issues and concerns that can be dealt with in such programmes like career counseling, health issues, drug abuse, gaming, future prospects, etc. Channels like Yuv Vani also provide a platform for budding radio jockeys and presenters who wish to carve out a career in the media and entertainment industry. Yuv Vani had been a pioneer career milestone in the lives of many established presenters, anchors and artists. It was stopped after a three decade run amidst requests to resume the service again.

With the rise of community radio, youth have found another way to voice their opinion and views. The local radio stations give ample opportunity to youngsters as presenters, participants and listeners. Local stations reach out to the target audience in the rural and semi-urban areas more effectively.

4.2.4 Programmes for Industrial Workers

Programmes for industrial workers aim to create awareness among the community about various schemes and benefits launched for them exclusively. The focus of these programmes is a distinctive target group of organized and unorganized labour. The programmes are designed to sensitize the audience on various regulations and rights like Payment of Wages Act, Factories Act, Industrial Disputes Act etc. It is important to also aware them regarding health hazards at workplace, safety precautions to avoid untoward accidents. Information on welfare schemes for women and children of workers can also be shared through this medium. The programmes can be centered around topics like adult education, stepping up the
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productivity at workplace, safety advice, tips and tricks at work, guidance for equipment handling etc. Since this segment of the listeners are cut-off from the world, so information regarding new benchmarks in industrial sector, programmes for skill upgradation, small and medium scale industries in India and abroad can be aired. The presenter must have knowledge about the sector and must be able to effectively connect with the listeners. All India Radio airs programmes like Shramiko ke Liye, Udyog Mandal, Kaamkaro ke liye etc.

It is important to involve trade unions, their leaders and workers to make the programme participatory in nature. Also, these trade unions help to advise the producers on the demand of the community and the nature of programmes that must be designed. The programmes also intertwine musical element to entertain the listeners by playing regional or folk songs. The unorganized sector has always been left aloof so there is a need to also reach out to this segment of audience and create content for them as well.

4.2.5 Programmes for Senior Citizens

Special programmes for senior citizens are not very common, but recently there has been a rise in such programmes. Broadcast for senior citizens is a recent concept as the family ties are loosening leading to isolation of the elderly. The cultural transition is giving rise to nuclear family structure and parallel the number of old age homes are also increasing. This sudden shift from joint family is giving rise to loneliness among senior citizens. A need to entertain this segment has been realized and radio is trying to add colour to their lives. The programmes designed for this audience are talks, discussions based on the memories of yesteryears like Annu Kapoor’s radio show – Suhana Safar. Old songs are reminiscential in nature bringing back many memories. Some programmes also try to involve people of this age group which gives them a voice. Information about special schemes, family welfare, pension schemes, gratuity benefits, medical facilities, health camps, welfare activities, religious gatherings and other activities is communicated through such broadcasts. The programmes can also be based on their challenges with life, bonding with grandchildren, maintaining healthy lifestyle and balanced diet.

4.2.6 Programmes for Defense Forces

All India Radio airs special programmes for armed personnel like a song request show ‘Sainik Bhaiyon ke liye’ where postcards with messages and songs are sent to radio station. The officers and jawans of armed forces are posted at remote locations and hail for various backgrounds having no access to entertainment. This audience is culturally and linguistically diverse, so several stations of AIR produce entertainment programmes for this community. The content also covers information about get-togethers, any breakthrough in country’s defense policies, functions organized by various units to make them aware about their sector.
4.2.7 Special Programmes for Rural Folk

Radio is a medium which reaches the remotest farmer in the village. The rural development has shown a great progression. There are many channels catering specifically the rural folk like the Anna FM caters to programs on how to improve agriculture. These programmes inform and educate farmers about the latest fertilizers, seeds and so on. The Anna FM 90.4 also airs programs on environment, health and rural development. There should be a nationwide campaign to show the importance of community media in general and community radio in particular and the support the cause actively especially in the most under-developed and neglected areas. In rural areas, radio also acts like the most effective medium of broadcast as it not only costs less but has the most connectivity. Additionally, during times of emergency, like natural disasters including floods, earthquakes and cyclones, it acts like the best medium for spreading critical information.

Check Your Progress
1. How are radio shows categorized for children?
2. When was Yuv Vani inaugurated?
3. Mention some of the topics on which radio programmes are centered for industrial workers.

4.3 ANSWER TO CHECK YOUR PROGRESS QUESTIONS

1. The programmes for children are divided into two categories according to the age-groups – one is between 5 to 7 years and other is 8 to 15 years.
2. In 1969, Yuv Vani – Voice of Youth was inaugurated at All India Radio, Delhi.
3. The programmes can be centered around topics like adult education, stepping up the productivity at workplace, safety advice, tips and tricks at work, guidance for equipment handling etc.

4.4 SUMMARY

- Radio has always produced a bouquet of programmes for a variety of audiences like children, armed forces, women, youth, farmers, small and medium scale industrial workers, senior citizens etc. Special audience programmes cater to the needs of people from different backgrounds.
- As the interests and communication needs differ, the programmes are scripted accordingly. Programmes produced for masses are based on general interest areas like current affairs, politics, society, literature,
economics, science etc. Still there are some segments of audience whose communication needs are not met by such broadcasts. To produce a programme for special audience the target audience must be identified first.

- The radio medium has a very instrumental role to play in their development. Radio must adopt a tri-fold approach – to help direct children on the right path, to facilitate free spirited thinking, and to focus on their issues and challenges. The programmes for children are divided into two categories according to the age-groups – one is between 5 to 7 years and other is 8 to 15 years.
- The content and style for younger age group is designed keeping in view their short attention span and their interest.
- Programmes designed for grown up children is more participatory, and discussion oriented. The broadcasts include group activities like group singing, quizzes, science experiments, music tutorials, travelogues etc., that interest this segment of audience.
- Broadcasting media sticks to a general policy regarding women based programmes that the programmes designed for general audience too must include gender equity and women empowerment. Most discussions will have women as panelists to maintain gender parity and reflect unbiased opinion and wider spectrum of viewpoint.
- Over the time, there has been a huge shift in the content of these broadcasts as they used to focus more on cookery, embroidery, child rearing, sewing, issues at home and household tips and tricks but now the focus is more on women health issues like menstruation, reproductive concerns, work-home balance, marriages, legal rights, gender equality.
- The youth is a reservoir of untapped energy and this energy needs to be channelized in the right direction. The youth want to voice their opinions and express their concerns for which special programmes for youth are the best platform.
- In 1969, the then Prime Minister Indira Gandhi realized that the unrest amongst the young people can be positively channelized by giving them a medium to voice their concerns. In 1969, Yuv Vani – Voice of Youth was inaugurated at All India Radio, Delhi.
- The broadcasts help the youth to reconnect with the historical and cultural roots of the country and understand a better world view. The programmes aim to instill scientific temper and involve them in nation building. Focusing on educational value that directs youth towards the right path is the need of the hour. There are many issues and concerns that can be dealt with in such programmes like career counseling, health issues, drug abuse, gaming, future prospects, etc.
• Programmes for industrial workers aim to create awareness among the community about various schemes and benefits launched for them exclusively. The focus of these programmes is a distinctive target group of organized and unorganized labour. The programmes are designed to sensitize the audience on various regulations and rights like Payment of Wages Act, Factories Act, Industrial Disputes Act etc. It is important to involve trade unions, their leaders and workers to make the programme participatory in nature.

• Special programmes for senior citizens are not very common, but recently there has been a rise in such programmes. Broadcast for senior citizens is a recent concept as the family ties are loosening leading to isolation of the elderly. The cultural transition is giving rise to nuclear family structure and parallel the number of old age homes are also increasing. This sudden shift from joint family is giving rise to loneliness among senior citizens.

• All India Radio airs special programmes for armed personnel like a song request show ‘Sainik Bhaiyon ke liye’ where postcards with messages and songs are sent to radio station. The officers and jawans of armed forces are posted at remote locations and hail for various backgrounds having no access to entertainment. This audience is culturally and linguistically diverse, so several stations of AIR produce entertainment programmes for this community.

• Radio is a medium which reaches the remotest farmer in the village. The rural development has shown a great progression with the Like Anna FM caters to programs on how to improve agriculture. These programs inform and educate farmers about the latest fertilizers, seeds and so on.

• In rural areas, radio also acts like the most effective medium of broadcast as it not only costs less but has the most connectivity. Additionally, during times of emergency, like natural disasters including floods, earthquakes and cyclones, it acts like the best medium for spreading critical information.

4.5 KEY WORDS

• Anna FM: It was the first campus radio in the country commissioned by Anna University in 2004.

• Panchtantra: It is an ancient Sanskrit text including animal fables and stories each with a different moral.

• Yuv Vani: It is radio service of AIR which was started in 1973 in Kashmir with youth in focus.
4.6 SELF ASSESSMENT QUESTIONS AND EXERCISES

NOTES

Short Answer Questions
1. Write a short note on radio programmes for industrial workers.
2. How are radio shows useful for rural folk?
3. Briefly explain radio shows for defense personnel.

Long Answer Questions
1. Discuss how radio programmes are made for different age groups including children, youth, and senior citizens.
2. Describe radio programmes for women.

4.7 FURTHER READINGS


UNIT 5 NEWS WRITING AND PRESENTATION

Structure
5.0 Introduction
5.1 Objectives
5.2 News Writing: An Introduction
   5.2.1 News Writing in a Public Service Broadcasting Organization and Radio
   5.2.2 Principles of News Writing
   5.2.3 News Writing for Public Service Broadcasting v/s Private FM Radio
5.3 Answers to Check Your Progress Questions
5.4 Summary
5.5 Key Words
5.6 Self Assessment Questions and Exercises
5.7 Further Readings

5.0 INTRODUCTION

News is a report of the recent happenings and news writing is a style used for news reporting in print as well as on radio and television. While writing news stories, reporters and editors must think about their target readers and listeners. A news story must adhere to some important qualities such as accuracy, clarity, balance and transparency, objectivity, attribution and style.

In this unit, you will study about the various elements of news writing and principles of news writing. In addition to this, you will also learn about the fundamentals of news writing in a public service broadcasting organization and radio.

5.1 OBJECTIVES

After going through this unit, you will be able to:
- Describe the elements of news writing
- Discuss the principles of news writing
- Understand the basics of news writing for public service broadcasting v/s Private FM Radio
5.2 NEWS WRITING: AN INTRODUCTION

News writing for print is focused on literate people but news writing for radio focuses on masses. Even the under-developed regions use radio to keep themselves abreast with the current information with their handy portable transistors. Satellite broadcasting too have revolutionized the radio industry transmission less broadcasts.

Every news writer irrespective of the medium must have good command over the language. The writer must have willingness for research to frame report with clarity. They should be able to handle pressure and work under strict deadlines.

5.2.1 News Writing In a Public Service Broadcasting Organization and Radio

News writer must stick to the following key points while writing for the radio:

1. **Timeliness:** Radio has always been the first medium to break the news to the audience. News value for broadcasters is of utmost importance. In print media, the news reaches the readers on daily basis while in broadcast the news is relayed on hourly basis. The news writers have to be on their toes in the broadcast media and leave no opportunity to transmit any news report that has an element of awe.

2. **Short & Concise:** Broadcast mediums are tend to select and gather stories which do not need much scope for explanation rather are self-explanatory. Simplicity and conciseness is very important while drafting a news report. Presenters get very less time between 30 seconds to 2 minutes to explain the story.

3. **Audio element:** News stories which leave an indelible mark on the listeners must be retained by the broadcasters. For instance, the audio of swearing in ceremony of the Prime Minister has a more long lasting and dramatic impact than its explanation by the presenter.

5.2.2 Principles of News Writing

It is well known that 5Ws and 1H drive news writing for the print media while the four C’s – Correctness, Clarity, Conciseness and Colour form the basis for news writing for the broadcast medium. 5W stands for Who, What, When, Where and Why, while 1H stands for How.

**Accuracy:** The first duty of a journalist working either for print or broadcast is to ensure accuracy and correctness of the news report. However, there are strict norms and rules for writing news for the radio but the accurate account of events must be written.

**Immediacy:** It is another important principle of news writing. The newscasters must aim to relay the news as soon as they get it. The radio news must be up-to-date till the last minute of broadcast and use present tense for verbs as the incident is ongoing parallel with the news broadcast. This can be effectively
done by omitting the element of time from the news story for the events happening on the same day as the broadcast might happen in the night when event would have wrapped up. For example: Prime Minister Narendra Modi visits the Memorial of War ahead of the oath taking ceremony.

**Conversational style:** Radio news must be written only for the ear and not the eye. The News writing must be in an interactive style which brings the listener closer to the medium and the presenter. The writing style must be simple, direct, avoiding jargons or any complexity as the medium doesn’t give that much flexibility. The strength of this medium rests on the sense of hearing and therefore the news must be short, lively and elegant.

**Tight phrasing:** It is not easy to master the art of tight phrasing in the broadcasting world. Wasting words is a sin as the time available for news broadcast is too less. The most tedious job for a news writer is to condense and simplify the sentences without losing the essence of the news.

5.2.3 **News Writing for Public Service Broadcasting v/s Private FM Radio**

News airing rights are only with public service broadcaster – All India Radio. The private FM channels have been fighting hard to get into the periphery of news but the government is not ready to give that leverage of playing with the format of news as this might reduce the importance of Prasar Bharati’s flagship content. The FM broadcasters wish to have flexibility of content and duration to create their own structure and format of news but there are restrictions from the government. There are many private FM channels like Radio Mirchi 98.3FM in Delhi/NCR whose ownership is managed by Times Group can easily source news from their other channels across different media like Times Now. However, after much speculation, Prasar Bharati has permitted FM radio stations to broadcast AIR news free of cost till 31st May 2019 on a trial basis.

Prasar Bharti’s Guidelines for Private Broadcasters:

- The FM channels who wish to carry the news even after this timeline will first have to register with News Services Division.
- Private FM radio stations may broadcast news bulletins either in Hindi or English.
- AIR news must be carried without any alteration and must even broadcast the commercial advertisements in toto.
- FM channels must give due credit to All India Radio for sourcing the news.
- FM channels must either broadcast the news simultaneously with AIR or deferred live by not more than 30 minutes. In case of deferred live, an announcement must precede the broadcast.

The private broadcasters are not welcoming the idea of restriction on the news content.
Check Your Progress

1. List the basic qualities of a news writer.
2. Who are the primarily end users of print news and radio news?
3. What are the important points to consider while drafting a news report?
4. What should be the style of a radio news?
5. What does tight phrasing mean?

5.3 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. Every news writer irrespective of the medium must have good command over the language. The writer must have willingness for research to frame report with clarity. They should be able to handle pressure and work under strict deadlines.
2. News writing for print is primarily focused on literate people. However, news writing for radio focuses on masses.
3. Simplicity and conciseness are the important points to consider while drafting a news report.
4. A radio news writing must be written in interactive style which brings the listener closer to the medium and the presenter.
5. Tight phrasing is the most tedious job for a news writer which means to condense and simplify the sentences without losing the essence of the news.

5.4 SUMMARY

- News writing for print is focused on literate people but news writing for radio focuses on masses. Even the under-developed regions use radio to keep themselves abreast with the current information with their handy portable transistors.
- The news writer must have good command over the language. The writer must have willingness for research to frame report with clarity. They should be able to handle pressure and work under strict deadlines.
- In print media, the news reaches the readers on daily basis while in broadcast the news is relayed on hourly basis.
- Simplicity and conciseness is very important while drafting a news report.
- News stories which leave an indelible mark on the listeners must be retained by the broadcasters. For instance, the audio of swearing in ceremony of the...
Prime Minister has a more long lasting and dramatic impact than its explanation by the presenter.

- It is well known that 5Ws and 1H drive news writing for the print media while the four C’s – Correctness, Clarity, Conciseness and Colour form the basis for news writing for the broadcast medium.
- The first duty of a journalist working either for print or broadcast is to ensure accuracy and correctness of the news report.
- Immediacy is another important principle of news writing. The radio news must be up-to-date till the last minute of broadcast and use present tense for verbs as the incident is ongoing parallel with the news broadcast.
- Immediacy can be effectively achieved by omitting the element of time from the news story for the events happening on the same day as the broadcast might happen in the night when event would have wrapped up.
- The News writing must be in an interactive style which brings the listener closer to the medium and the presenter. The writing style must be simple, direct, avoiding jargons or any complexity as the medium doesn’t give that much flexibility.
- The most tedious job for a news writer is to condense and simplify the sentences without losing the essence of the news.
- The private FM channels have been fighting hard to get into the periphery of news but the government is not ready to give that leverage of playing with the format of news as this might reduce the importance of Prasar Bharati’s flagship content.
- The FM broadcasters wish to have flexibility of content and duration to create their own structure and format of news but there are restrictions from the government.
- There are many private FM channels like Radio Mirchi 98.3 FM in Delhi/NCR whose ownership is managed by Times Group can easily source news from their other channels across different media like Times Now.

5.5 KEY WORDS

- **Public Service Broadcasting:** It refers to the television and radio programmes that are broadcast to provide information, advice, or entertainment to the public without trying to make a profit.
- **Flagship Content:** It refers to the resource content, what people ‘go out’ to find out what they really need to know about in your niche.
- **Prasar Bharati:** It is India’s largest public broadcasting agency. It is a statutory autonomous body set up by an Act of Parliament and comprises the Doordarshan Television Network and All India Radio, which were earlier media units of the Ministry of Information and Broadcasting.
5.6 SELF ASSESSMENT QUESTIONS AND EXERCISES

NOTES

Short Answer Questions
1. What does 5W and 1H mean?
2. Why it is important to be short and concise in news writing?
3. What are the four C’s of broadcast writing?
4. What are Prasar Bharati’s guidelines for private broadcasters?

Long Answer Questions
1. Discuss the principles of news writing.
2. Analyse the key points required for writing radio news.
3. Compare and contrast the news writing for public service broadcasting and private FM radio.

5.7 FURTHER READINGS


UNIT 6  PRINCIPLES OF NEWS PRESENTATION

Structure

6.0 Introduction
6.1 Objectives
6.2 News Features
6.3 Professionals and Freelance Stringers Reporting for Radio
   6.3.1 Disaster Coverage
6.4 News Bulletins
6.5 Answers to Check Your Progress Questions
6.6 Summary
6.7 Key Words
6.8 Self Assessment Questions and Exercises
6.9 Further Readings

6.0 INTRODUCTION

In the previous unit, you studied about the techniques and principles of news writing in a public service broadcasting organization in contrast with private radio. In this unit, you will study about the different principles of news presentation and news features.

There are various elements that need to be considered while preparing a radio report such as pace, headlines, news flashes and others. For instance, when we listen to a radio news bulletin, the headlines are crispy and catchy which the reader can retain and recollect in his mind. In addition, correct pronunciation, voice modulation and enunciation play a vital role in radio commentary or news bulletin.

In this unit, you will study about the various methods of preparing radio bulletins. You will also learn about the elements of news feature and reporting by reporters and stringers.

6.1 OBJECTIVES

After going thorough this unit, you will be able to:

- Understand the concept and elements of news feature
- Discuss the professionals and freelance stringers reporting for radio
- Describe the usefulness and significance of community radio and reach of radio
6.2 NEWS FEATURES

News is divided into two categories: Hard News and Soft News. Hard News is the one which is the most important and airs at the top of the hour (in print, mostly the front page news is hard news). Hard news is essentially the news of the day. Soft News is the news which is not time sensitive and includes articles, human interest stories, features etc.

Features are stories with in-depth analysis and includes writer’s viewpoint, expert opinions to make it a good read. Features may or may not be on current issue but they focus on a single aspect of the story. For example, a feature about Shah Rukh Khan on his birthday might only talk about his family life or his movie career.

Radio News Features are very interesting to listen to as they are light hearted and focus on one single theme/issue. These two to four minute broadcasts could be based on a current issue or any evergreen topic. These features consist of interviews, sound bites from people related to the theme to give an in-depth view.

Important elements in a News Feature include:
- A well-researched theme/topic or issue
- A good lead or intro
- Main body of the narrative
- Expert interviews and sound bites
- A conclusion or wrap up

The features are produced in a way that they stand out from news or other radio programmes and have element of interest for the listeners. The topic must reflect its own personality and character and the scriptwriter must keep this in mind.

Choosing the Topic: It is not easy to pick a topic for radio news feature, as the audience is varied. The features are generally based on current issues or topics that interest the audience thereby offering a scope for ample discussion. The topic may or may not interest the feature writer but it is important to delve into the topic and undergo research. Good research will lead to complete facts which will form the basis of reliability and integrity among the listeners. It might be easy to collect information in today’s times with a reservoir of information available online but it is essential to check the credibility of the facts. Information must be sourced from reputable sources both primary sources (first hand source like interviews) and secondary sources (second hand sources like newspapers).
Drafting the introduction: A brief introduction or ‘hook’ helps to give a short overview about the issue and not reveal everything in not more than two sentences. The feature’s hook makes the listener tune in to listen to the full feature.

Drafting the Body: The main detailing of the story or issue is included in the body of the feature with the inclusion of 5Ws and 1H. As you have learnt in the previous unit, 5Ws – who, what, where, when and why and 1H – how. If all these are holistically embedded in the feature then all aspects would be covered making it a wholesome production.

Drafting the Conclusion: The end of the feature should be logical and gradual without abruptly breaking the flow of the information. A wrap up would include a recap of the whole feature or summary of the feature. A nice saying or quotation based on the story may be included for an interesting conclusion.

**Personality and character of the feature**

The tone of the feature is instrumental in deciding the response of the listeners. The writer of the feature is expected to pay attention to set the tone appropriately that gives a character to the production. For example, if the story is about old age homes, the tone would be emotional and sad, while if the story is about kids in a zoo, the tone would be happy and cheerful.

**Style of writing a feature**

The writing styles for radio news feature and any print article is quite distinct. The level of formality in both the mediums is different, newspaper writing is formal while radio writing is informal. The radio news feature must be conversational and simply written. The communication between radio presenter and the listeners is quite intense as the presenter directly interacts with the listener. It is advised to avoid long sentences to cut down the complexity in reception. The audience and the format of the programme is also very important as it might be a challenge to craft a programme for young audience as their demands and expectations are high as compared to farmers or elderly who have lower expectations. The format of radio features in both public service broadcaster and private is different. The average duration of a feature in public broadcast is upto 4 minutes while in 24 hour news stations the duration might be less than a minute.

### 6.3 PROFESSIONALS AND FREELANCE STRINGERS REPORTING FOR RADIO

One of the greatest human resource for any media organization is a Reporter. Reporters are assigned beats specific to their area of interest for example political, sports, finance, lifestyle, education, Bollywood etc. across all mediums, the job and characteristics of a reporter remain the same. They work on general assignments...
or special assignments and the best reporters are the ones who are responsible to
dig out the news from departments and corporations like police, hospitals etc.
Reporters try to find their niche by specializing in a type of story or field of interest
like sports, politics or any other. Reporters are expected to work on all aspects of
the story for which they might need to carry their own recording equipment like
camera, voice recorders, lapel mics etc.

These days the organization try to cut down on the expense by reducing the
number of professionals going on a single assignment. Earlier for one assignment
atleast three personnel used to be deputed – a reporter, a camera person and an
intern or support. Reporters usually collect information and head back to the office
to file the report on their desktop. The report is later sent to the editor for necessary
checks. Whenever there is paucity of time, the story is also sent through phone so
that the deadlines are met conveniently.

With the advent of technology, times have changed as now only a reporter
is deputed for a job and is expected to multitask as a cameraperson as well. The
concept of MOJO – Mobile Journalist is being adopted where the mobile becomes
the camera, voice recorder. MOJOs are efficient in even disseminating the news
or story, as the story is also filed on the go on mobile and sent to the headquarters
for further work. Reporters are sometimes pressed for time and are not able to go
for certain assignments due to other engagements, here the stringers come handy.
Stingers are part time correspondents who report from distant areas. They are
either students, freelancers, non-professionals, commoners who contribute news
stories about their locality, community, college etc.

Reporters are brave individuals who learn to work under stressful and
extreme circumstances like floods, earthquakes, terror attacks and other natural
and unnatural calamities. There are no specific working hours as they may have to
report at the wee hours, unscheduled time but with high energy and spirit. Reporters
must learn the tact of interacting with all kinds of people and must be patient too as
sometimes hours and days of hardwork might just be unproductive. For radio,
since the news is only for the ears, there are some reasonable restrictions while
news gathering.

It’s not easy to enter the realm of reporting if one is a fresh graduate, it
requires perseverance and hard work. However, any graduate from any stream
can venture into this profession. Employers look for candidates who have nose
for news and can write flawlessly with correct language, grammar and sense.
Basic computer skills and know-how of technology is a must these days to sustain
in the profession. Any prior writing experience as a blogger, content curator, and
feature writer is counted. Media searches for people who are curious, resourceful
and competitive. Reporters don’t get offered fancy salaries and packages in the
starting.

Stringers on the other hand receive salary according to the successful
completion of the assignment. They fill up for a regular reporter whenever needed
this also gives them flexibility. They cruise through the area – day and night in search of news and report noteworthy affairs to the office. Stringers are not bound by the organization and work on their own pace.

Writing for radio news is challenging as there is no visual for reference and only audio helps to communicate with the listeners. Visual words are used more in radio which can spark up imagination in the listeners.

### 6.3.1 Disaster Coverage

Radio reaches the remotest of the regions easily with its vast network and convenient accessibility. Disasters can strike anywhere without any notice or warning. There have been many natural disasters and situations where radio acted as a medium to spread information and update the people affected by the disaster about the developments like relief work. Radio has been a well-known medium to reach the areas with difficult conditions. When Tsunami struck in 2004, the Indian subcontinent, people in Andaman were connected with the outside world with the help of radio and received all necessary information. During disasters like in recent times with cyclone Fani and the Chennai Floods, success of wireless emergency system relies on pre-selected and clear frequencies.

The broadcasters become a bridge between the government and people. They help in issuing emergency and based on warnings from special departments like Meteorological dept, Government help, relief camps etc. at the time of crisis or disasters, broadcasters can be instrumental in spreading important information to the beneficiaries. At the time of earthquakes, floods, rains, landslides, radio comes to rescue. During Kedarnath rains and flash floods, radio helped the locals in spreading awareness among tourists and this also motivated locals to help in relief work.

Community radio is again very helpful in relaying information to the community stuck in disaster or crisis situation. Sometimes commercial broadcast stations doesn’t reach the public due to technical or linguistic barriers but community radio does.

### Check Your Progress

1. What is the difference between hard news and soft news?
2. What do you mean by features?
3. List the characteristics of Radio News Features.
4. What is a MOJO in journalism?

### 6.4 NEWS BULLETINS

Items that are broadcast on radio could include either a news bulletin or current affairs programme. On-air time has to be used effectively.
Three types of material help in composing radio news:

(i) Written stories that are scripted
(ii) Recorded or live voice reports from journalists
(iii) Recorded sound termed as actuality. Actuality in radio refers to the sound of someone speaking. A short segment of the actuality is referred to as a grab. Grabs are like quotes in newspapers and consists of a segment of a speech or an interview. In some nations grabs are also known as inserts.

It is important to remember the criteria for news: whether it is new, unusual, interesting, significant and about people. Each of these criteria helps you in deciding what stories are to be included in your bulletin and where they should be placed within duration of 5, 10 or 15 minutes. News must be organized in decreasing order of importance.

Balance of the bulletin and its pace essentially needs to be considered while structuring a report.

1. Balance

Generally, listeners look forward to a balance of items. Some news about politics, sports and some about the ordinary people. Certainly, the format of the station greatly determines the actual mix of stories and their tone and pace of delivery. For instance, serious national broadcasters often opt for more serious stories, delivered in a more calculated style. On the other hand, youth-oriented music station bulletins broadcast stories about popular culture.

Irrespective of the station format, positioning of stories in order in the bulletin will indicate the importance of the story to your listeners. However, reordering of stories may take place to bring about a balance.

2. Pace

The length and tone of a story must be appropriate as it appears to the listeners. This is also known as pace.

Some stories progress at a faster pace. The report of occurrence of a fire, for instance, will usually be written briefly, to convey simple ideas. It quickens the pace.

On the contrary, a story concerning political controversy may demand longer sentences using terminology, expressing ideas that are more complex. The story may need to be slightly longer. This slows down the pace.

Too many long complicated stories will slow down the pace of the whole bulletin as a result of which the listeners' attention will be distracted. Moreover, a number of short and sharp stories may leave the listeners confused as they will not be able to keep the pace of changing stories. The best sort of bulletins are characterized by a consistent pace right through their entire period for sustaining
listener interest; there may be some break in betweens to allow listeners to catch their breath or the pace of the bulletin may increase to recapture listener interest.

3. Structuring the bulletin

Bulletins that are broadcast are the equal of a page or newspaper. The difference being that in radio and television the announcer is more limited. Since all the elements of a news bulletin are placed in a chronological order so that they are used in the most efficient manner.

4. Starting the bulletin

The starting of the bulletin is the most vital part of any radio bulletin. It decides whether listeners will stay tuned or not. Likewise, the introduction forms the most important part of a news story, the lead item is the most important in the bulletin. If there is an alternative between two stories of equal importance for your bulletin lead, the more dramatic one ought to be selected. In case a lead story is dull, it needs to be rewritten to evoke interest in the listeners. Sentences should be kept short, and the ideas should be clear and simple. The bulletin is judged on the basis of the content and presentation of the lead story.

5. Headlines

Once the sequencing of stories has been decided, you should write some headlines for the bulletin. Headlines of major stories should be prioritized. This is usually demanded for longer bulletins.

Headlines guide the listeners in deciding whether the bulletin is worth listening or not. Hence, the headlines should be written in a compact and catchy manner so as to attract the listener’s attention. Headlines for dramatic stories must be written so as to hint at the drama without divulging all the details to sustain the listeners’ interest.

Headlines written about announcements or humorous stories should sound puzzling or baffling so as to keep the listeners glued to the story until it reaches its end. Such headlines are sometimes called teasers because they tease the listeners’ interest.

6. Closing stories

Closing stories and lead stories are almost equally important. They are also known as tail-enders. As many listeners do not maintain their attention throughout the bulletin, the best stories must not be kept for the end. Humorous stories make the most appropriate tail-enders. Such types of stories should be written in an informal style as opposed to other stories. However, the tail-ender must be in accordance with the context of the story and thus must pertain to that particular mood.
7. Closing Headlines

When bulletins are longer in duration, the closing headline can contain a reminder or recapitulation of stories that were read out at the beginning of the bulletin. Thus, unlike opening headlines, which should attract your listeners to listen to the bulletin, closing headlines serve as a recapitulation of the sequence of news for listeners who may have tuned in late.

8. Actuality

As you have studied before actuality refers to the sound of someone speaking while a short segment of the actuality is referred to as a grab. Short grabs are an invaluable part of a news bulletin. Many a time a grab can help move a story along better than any sentence written by a reporter. For example, if a story is about a protest, a short grab of the protesters shouting slogans is far more effective at describe a protest rather than any words that a reporter may be able to write. Grabs can also help add variety to the pacing of the bulletin; they are also useful since they allow news readers to take a break from speaking for a few seconds. All grabs need to be introduced by the newsreader stating clearly who is speaking and about what issue.

They often serve as an opportunity to let people within your community speak on the radio. People like listening to their own voice on radio occasionally, or the voices of people they are familiar with.

All grabs need to be short and well edited. The grab also needs to conform to the pace of the bulletin; using a dull voice may decrease the pace of the bulletin and may result in listeners switching off the programme.

9. Music

Since music causes distractions and destroys any variation in pace within the bulletin, it should not be used as background to a news bulletin. Music should only be used for introducing a special segment within a bulletin or perhaps to separate out stories within a bulletin; such types of short musical interludes are known as music insert stabs or stings.

The opening theme music of a bulletin should be short and striking; the theme should end before the newsreader starts speaking or should fade out in the background when the newsreader starts speaking. Any stabs within the bulletin should echo the opening theme as a link throughout the bulletin. Too many stabs would irritate the listener and dilute the essence of the programme and thus should be avoided.

A closing theme can be used at the end of the bulletin, however, it should be different from the opening theme.
10. Timing Your Bulletin

Time on radio is never sufficient for all the stories a journalist would like to include, so the timing of your bulletin is very important. The accurate time of each item depends on the following:

(i) How long is the whole bulletin  
(ii) How many items you need to include  
(iii) How many grabs of actuality you want to use

These three considerations need to be balanced. If the bulletin is long; say more than 20 minutes; then there is time to properly treat about 20-25 stories accentuated by several short grabs. If the bulletin is shorter, say 5 minutes, there is only time for a few stories with only one or two item of actuality.

Stories that are not that vital may be read at the end of the bulletin as briefs. Briefs are stories that are no more than a few sentences long. They are not designed to tell the whole news, simply to create an awareness among people regarding something that has happened. The inclusion of briefs also has its purpose in increasing the pace of the bulletin if the other stories are voluminous.

11. Special bulletins

So far, we have been speaking mainly about regular news bulletins. Special bulletins also need to be considered.

News flashes

An urgent story that is broken while the news is being read out is known as a news flash. News flashes may include information about a natural disaster or the death of an important leader or celebrity. The news flash should only focus on stories of high importance.

The newscaster should have the story at the earliest in order to decide where to use it in the bulletin. A programme on the radio not related to the news can be interrupted with a newsflash if it is a very important piece of news, but one needs to notify people in the studio that a newsflash is coming up. A newsflash can be introduced with a newscaster interrupting the regular programming with words like, ‘Now for some breaking news that is coming in………’

The story in a newsflash should be read clearly in the usual manner. One may repeat the story for reemphasis if there are only a few sentences to be read. The newsflash should conclude with lines such as ‘those are all the details at the moment. Tune in to our bulletin at nine for more details.’

12. Weekend bulletins

Weekend news bulletins may be required to be dealt with in a slightly different manner from weekday bulletins because of the availability of fewer stories. You
will be required to re-assess newsworthiness on weekends, perhaps running stories which you would refrain from using at other times.

13. Practical techniques

Several practical techniques make the task of preparing news bulletins convenient and more specialized. Using these techniques will help you overcome many inconveniences possibly encountered by inexperienced journalists.

14. Ranking stories

Ranking the stories in an appropriate order is one of the major difficulties in bulletin preparation. However, the following steps can be taken to solve this problem:

The first step is to read all the stories that have been filed by reporters. Then go through them again, making three lists (or selecting the stories on to three piles). These categories should be the following:

(i) Vital stories which need to be used
(ii) Stories which can be used but are not important,
(iii) Stories which won’t be used under any circumstances

It should be noted that several stories on a similar theme can be combined using words such as meanwhile, on the subject of, and so on. However, numerous stories should not be combined together because that will lead to chaotic content.

15. Reading rate

Reading rate forms a very significant part of the bulletin. Once the newsreader knows, how long it takes him to read one line of a particular type, he can time his bulletin accordingly by counting lines rather than by timing himself each time for practice.

Reading rates are calculated in words per second (wps) and usually range from 2 words per second (wps) for slower readers to 3.5 wps for rapid readers. Knowing your average reading rate will help you calculate the time you will require to read each story. It would be advisable to count only the number of lines.

Add up the time taken to read all the stories which will give you the total time that will be consumed in reading the bulletin. When one is adding the total reading time for a news bulletin, one should add a few seconds to the reading time for every story to take into account pauses.

16. Script

Many newsrooms use computers to produce news stories which a news reader can print out or even read directly from a screen. If a script has been printed, make sure that all changes have been made before printing the script.
Start a new paragraph for each sentence. In case, several deletions have been made then the scripted should be typed again and in double-space. Each story should be typed on a separate sheet as this will make it easier to find stories if you want to drop or insert them during the bulletin. Use good-quality paper which will not making rustling sounds on being moved.

Refrain from turning a phrase from one line to the next and certainly never hyphenate words from one line to the next.

Never staple the pages of your bulletin together. The sheets must be pulled aside without creating any noise as you read them. Stack the stories neatly on one side after you have read them.

Whether you work in radio or television, if your news stories and bulletins are well prepared and organized, work will become simpler and the audience will be more satisfied.

Check Your Progress
5. What are the three types of materials used in composing radio news?
6. What does the term ‘actuality’ mean?
7. What is a news flash?
8. How to calculate reading rate?

6.5 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. Hard News is the one which is the most important and airs at the top of the hour (in print, mostly the front page news is hard news). Hard news is essentially the news of the day. Soft News is the news which is not time sensitive and includes articles, human interest stories, features etc.

2. Features are stories with in-depth analysis and includes writer’s viewpoint, expert opinions to make it a good read.

3. Radio News Features are very interesting to listen to as they are light hearted and focus on one single theme/issue. These 2-4 minute broadcasts could be based on a current issue or on any evergreen topic. These features consist of interviews, sound bites from people related to the theme to give an in-depth view.

4. MOJO is referred to as Mobile Journalist. MOJO is being adopted where the mobile becomes the camera, voice recorder. MOJOs are efficient in even disseminating the news or story, as the story is also filed on the go on mobile and sent to the headquarters for further work.
5. The three types of materials that help in composing radio news include
   (i) Written stories that are scripted
   (ii) Recorded or live voice reports from journalists
   (iii) Recorded sound termed as ‘actuality’.

6. Actuality in radio refers to the sound of someone speaking. A short segment of the actuality is referred to as a grab. Grabs are like quotes in newspapers and consists of a segment of a speech or an interview. In some nations, grabs are also known as inserts.

7. An urgent story that is broken while the news is being read out is known as a news flash. News flashes may include information about a natural disaster or the death of an important leader or celebrity. The news flash should only focus on stories of high importance.

8. Reading rates are calculated in words per second (wps) and usually range from 2 words per second (wps) for slower readers to 3.5 wps for rapid readers.

6.6 SUMMARY

- News is divided into two categories: Hard News and Soft News. Hard News is the one which is the most important and airs at the top of the hour (in print, mostly the front page news is hard news). Soft News is the news which is not time-sensitive and includes articles, human interest stories, features, etc.
- Features are stories with in-depth analysis and include the writer’s viewpoint, expert opinions to make it a good read.
- Radio News Features are very interesting to listen to as they are light-hearted and focus on one single theme/issue.
- Some important elements of a news feature include a well-researched theme, expert interviews, a good lead, the body of the narrative, and sound bites.
- The main detailing of the story or issue is included in the body of the feature with the inclusion of 5Ws and 1H. It is essential to mention the 5Ws – who, what, where, when and why along with 1H – how.
- Balance of the bulletin and its pace essentially needs to be considered while structuring a report.
- The format of radio features in both public service broadcaster and private is different.
- There are three types of materials that help in composing radio news, namely scripted written stories, recorded or live voice reports from journalists, and recorded sound that is termed as ‘actuality’.
The length and tone of a story must be appropriate as it appears to the listeners. This is also known as pace.

A story concerning political controversy may demand longer sentences using terminology, expressing ideas that are more complex. The story may need to be slightly longer. This slows down the pace.

The starting of the bulletin is the most vital part of any radio bulletin. It decides whether listeners will stay tuned or not. Likewise, the introduction forms the most important part of a news story, the lead item is the most important in the bulletin.

Once the sequencing of stories has been decided, you should write some headlines for the bulletin. Headlines of major stories should be prioritized. This is usually demanded for longer bulletins.

The headlines should be written in a compact and catchy manner so as to attract the listener’s attention. Headlines for dramatic stories must be written so as to hint at the drama without divulging all the details to sustain the listeners’ interest.

Headlines written about announcements or humorous stories should sound puzzling or baffling so as to keep the listeners glued to the story until it reaches its end. Such headlines are sometimes called teasers because they tease the listeners’ interest.

Closing stories and lead stories are almost equally important. They are also known as tail-enders. As many listeners do not maintain their attention throughout the bulletin, the best stories must not be kept for the end.

When bulletins are longer in duration, the closing headline can contain a reminder or recapitulation of stories that were read out at the beginning of the bulletin.

Actuality refers to the sound of someone speaking while a short segment of the actuality is referred to as a grab.

Grabs can also help add variety to the pacing of the bulletin; they are also useful since they allow news readers to take a break from speaking for a few seconds. All grabs need to be introduced by the newsreader stating clearly who is speaking and about what issue.

Music should only be used for introducing a special segment within a bulletin or perhaps to separate out stories within a bulletin; such types of short musical interludes are known as music insert stabs or stings.

The opening theme music of a bulletin should be short and striking; the theme should end before the newsreader starts speaking or should fade out in the background when the newsreader starts speaking.

Time on radio is never sufficient for all the stories a journalist would like to include, so the timing of your bulletin is very important.
An urgent story that is broken while the news is being read out is known as a news flash. News flashes may include information about a natural disaster or the death of an important leader or celebrity. The news flash should only focus on stories of high importance.

Weekend news bulletins may be required to be dealt with in a slightly different manner from weekday bulletins because of the availability of fewer stories. You will be required to re-assess newsworthiness on weekends, perhaps running stories which you would refrain from using at other times.

Several practical techniques make the task of preparing news bulletins convenient and more specialized. Using these techniques will help you overcome many inconveniences possibly encountered by inexperienced journalists.

Ranking the stories in an appropriate order is one of the major difficulties in bulletin preparation.

Reading rate forms a very significant part of the bulletin. Once the newsreader knows, how long it takes him to read one line of a particular type, he can time his bulletin accordingly by counting lines rather than by timing himself each time for practice.

Many newsrooms use computers to produce news stories which a news reader can print out or even read directly from a screen. If a script has been printed, make sure that all changes have been made before printing the script.

Whether you work in radio or television, if your news stories and bulletins are well prepared and organized, work will become simpler and the audience will be more satisfied.

6.7 KEY WORDS

- **Closing headlines:** It refers to the recapitulation of the sequence of news for listeners who may have tuned in late.
- **Phonation:** It refers to the process by which vocal cords produce sounds through vibrations.
- **Dissimilation:** It refers to the process by which one of the similar or identical sounds in a word becomes less like the other.
- **Feature writing:** It is a type of soft news. It allows the creative writers to write feature articles in an inventive and compelling way.
6.8 SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions
1. Mention the important elements of a news feature.
2. What should be the style of writing a feature?
3. What are the duties of a reporter?
4. What does a stringer do?
5. Briefly discuss the structuring and starting of the bulletin.

Long Answer Questions
1. What points should be considered while writing a news feature? Discuss.
2. Why radio is considered as a well-known medium to reach the areas with difficult conditions? Discuss.
3. Analyse the features of news bulletin in detail.

6.9 FURTHER READINGS


UNIT 7 PRODUCTION MANAGEMENT AT RADIO STATIONS

Structure
7.0 Introduction
7.1 Objectives
7.2 Principles of Production Planning and Course of Production
7.2.1 Production and Economic Production Management
7.2.2 Management of Personnel, Financial and Technical Resources
7.3 Answers to Check Your Progress Questions
7.4 Summary
7.5 Key Words
7.6 Self Assessment Questions and Exercises
7.7 Further Readings

7.0 INTRODUCTION

Planning a programme requires an understanding of the requisites of the medium. Radio is an aural medium and as such emphasis in planning and production must be on voice and sound which would enable listeners to appreciate or understand the message the programme seeks to convey. The language used in the programme must be the ‘spoken language’ with an informal and natural style. It should be simple and understandable, having short and simple sentences.

The ultimate goal of a good radio programme is to disseminate appropriate information on a relevant theme. The planning efforts must be directed towards this so that the message conveyed produces the desired impact.

7.1 OBJECTIVES

After going through this unit, you will be able to:
- Describe the concept of production and economic production management
- Explain the principles of production planning and course of production
- Discuss the management of personnel, financial and technical resources

7.2 PRINCIPLES OF PRODUCTION PLANNING AND COURSE OF PRODUCTION

From the production angle, radio is a preferred medium than television. For example, it requires a performer and a producer who may also be a recordist and
Production Management at Radio Stations

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Self-Instructional Material

an ‘effects’ person. As against this, a TV production (tele-production) would require a costumes person, a make-up person, two or three cameras and cameramen, a dolly man to assist the cameraman in moving the cameras, a scene designer, a carpenter, several lights and light men, several monitoring I sets, engineers, a producer, a performer, etc. The cost of radio production is much less than that of TV production. Since the cost and time required to produce a programme are much less, radio can produce a wide variety of programmes. It can also afford to experiment with new and innovative programmes.

It costs much less to set up a radio station as compared to a TV station. Not only the capital cost, but recurring expenses to run a radio service are far less. A large number of people can afford a radio set but not a TV set.

There are three stages in programme production process, i.e., pre-production, production and post-production. While planning is required at every stage, extensive planning is required at the pre-production stage when the programme is conceived and all the necessary preparations made. Without proper planning, any interesting theme or creative idea may not make the desired impact. Planning is an on-going activity.

Now let us study about the course of radio programme production. Whatever we do, there has to be a clear plan. In the case of radio production also, there is a well-accepted process of production which is carried out in three stages. Let us list them out.

a) Pre-production
b) Production and
c) Post-production

Pre-production

As the title suggests, this is the first stage before the actual production.

i) An idea is born: This phase includes how a programme is born as an idea and its conceptualization. The topic or subject matter is decided.

ii) Plan of action: After the topic is decided, a plan of action is worked out. Here the format of the programme is determined i.e. whether the programme is a talk, discussion, interview, drama, documentary etc. Once that is clear, the right person for writing the script and the performers are decided. The plan of action would also determine the equipment for outside recordings that are required. The time and venue of the recording are also worked out.

iii) Examining the script: The script is examined to make it suitable for broadcast. It is examined according to the principles of writing for radio or in other words ‘for the ear’.

iv) Paper work: If people who are not working in the radio station are involved for writing or providing voice for the programmes, they have to be invited
with an agreement to accept the job or assignment. This type of agreement is referred to as a contract. Similarly, permission is often required to interview certain people if the programme is based on such interviews. Therefore, as you can see, there is a lot of paper work at the pre-production stage.

v) Testing the voices: Rehearsing the voices of speakers is also part of this stage.

Production
This is the actual process of recording and editing a radio programme. Proper studios, microphones and computers are required to record and edit the programme.

Most of the radio stations have a separate room in the studio complex for rehearsal known as Reader Over Room (ROR). This is the first stage of rehearsal without microphone. The second stage of rehearsal is inside the studios with microphones. The demand for ROR and the studio is usually during working days, particularly during daytime is high.

The producer has to plan the ROR studio bookings in such a way that she has adequate time to do the rehearsals and recordings. Recording during non-peak-hours and holidays will enable the producer to devote more time to rehearsals and recording. There would be no need for postproduction, if the producer and the artistes devote adequate time and attention to these two aspects of production.

Recording is the responsibility of the producer. It is, therefore, necessary for him/her to check the studio recorder, studio clock, the magnetic tape to be used sufficiently in advance so that there is no hassle at the time of recording.

Post-production
Writing to inform people involved in the production is a major activity during this phase. The programme has to be given publicity both on radio and in other media. This is done to ensure that people know about the programmes and also listen to them. The announcements for the presentation of the programme are also written and provided for the actual broadcast of the programme. There are many things, which can happen in post-production. Common tasks include:

- editing recorded audio clip
- adding sound effects, music, etc.
- adding filter if required
- mixing of all tracks
- exporting file

In most cases however, post-production is a time-consuming job taking longer than the actual production.
You have already learnt about the elements of radio production, let’s recapitulate the concept briefly here. The following includes the elements of radio production:

- **Human voice or spoken word:** The mainstay in any radio programme is the human voice. Think of the voice of an announcer or newscaster on radio. You often find them very pleasant and nice to listen to. That is because of the quality of their voice and the proper use of it. There are two aspects of the use of human voice in radio production. Firstly, there has to be a well-written script to be spoken and then someone has to speak or read it before a microphone in a studio.

- **Music:** Music is the soul of radio. It is used in different ways on radio. Film songs and classical music programmes are independent programmes on radio. Music is also used as signature tunes or theme music of various radio programmes.
  
  Let us see what music does to any programme.
  
  - Music adds colour and life to any spoken word programme.
  - Music can break monotony.
  - Music is used to give the desired effect of happy or unhappy situations, fear or joy.
  - Music can suggest scenes and locations. For example, you have to create a bright early morning situation. This can be done by playing a pleasing note on the flute along with the sound of chirping of birds.

- **Sound effects:** Sound effects in a radio programme give meaning and sense of location. It adds realism to a programme and helps a listener to use imagination.
  
  Think of a crowded market or temple. If you are creating that scene in a radio programme, you do not have to go to a crowded market or temple to record. Well, you can record those sounds and use them. But in most cases, you use sound effects which are already recorded. Sound effects can be used in two ways:
  
  - spot effects or effects that are created as we speak and
  - recorded sound effects.
  
  If you are recording a radio programme in which someone knocks at the door, you can make a knocking sound either on a door or a wooden partition. Or you want to show that someone is pouring water from a bottle into a glass; here again you can use the actual sounds produced on the spot. But if you want a lion roaring or a dog barking, you probably cannot bring a lion or a dog to the studio! Here we use recorded sounds which are kept on tapes or discs. Almost all sounds are available on CDs which you can try and use. There are also certain types of computer software available for this.
You can also create sound effects. You can use two coconut shells to produce the sound effects of the sounds of horses’ hooves. Take a piece of cellophane paper or aluminium wrapper and crush them in front of a microphone. Record the sound and hear. It will sound as if fire is raging. You can think and create many such sound effects.

7.2.1 Production and Economic Production Management

According to Elwood Spencer Buffa, ‘Production management deals with decision-making related to production processes so that the resulting goods or service is produced according to specification, in the amount and by the schedule demanded and at minimum cost.’

Production management means planning, organizing, directing and controlling of production activities. It deals with converting raw materials into finished goods or products. It brings together the 6M’s i.e. men, money, machines, materials, methods and markets to satisfy the wants of the people.

Production management takes into account the decision-making regarding the quality, quantity, cost, etc. of production. It translates management principles to production.

The main objective of production management is to produce goods and services of the right quality, right quantity, at the right time and at minimum cost. Now, the question is how this applies to radio production? The radio stations need to maintain the quality and also the number of programmes relaying from the station. There should be consistency in everyday schedules so that the listeners don’t lose interest.

This will in return improve the efficiency. An efficient organization can face competition effectively. So, production management ensures full or optimum utilization of available production capacity.

Broadcasters previously experienced in operating only private or temporary stations frequently underestimate both the amounts that must be set aside for, and indeed the sheer diversity of, operating costs.

Costs are usually set out under departmental headings like Programming News, Sales, General Overheads, Administration, Technology, Commercial Production, Marketing, Research, Training and financial costs such as bank charges, interest, taxation and depreciation.

As a typical example, the list of detailed costs under programming might include salaries for full and part time, Employers National Insurance contributions, Contract presenters, freelance contributors, Music purchased, Acquired programming Consumables, Jingles, on-air branding Newspapers, magazines, internet Research Weather, traffic and news services etc.

Outside-broadcast costs can include Competitions, Prizes, Vehicle costs, Expenses and Training. It is customary to show in the cost budget the entire
Expenditure on areas such as sponsored competitions, promotions and commercial production even though they may be often directly charged to outside sponsors and clients. The balancing, and ideally greater, income against these headings may then be shown correctly in the station’s income projections.

Economic production management is not separate from production management. It can be said that economic production management is a related field and promotes the economical use of resources for efficient operations and management.

7.2.2 Management of Personnel, Financial and Technical Resources

At a radio station, there are a lot of people who work behind the production of a programme. The station manager is the most important person who is in charge of the radio station and its personnel.

If one is in control of the station, one must be aware of everything that happens in the station and have agreed to (or sometimes dictated) the activities of all your colleagues. There can be people who have different temperaments and interests and might not go well with that of the station manager’s. It sometimes gets tough to manage all along and the programme schedules simultaneously.

But if as manager you are not aware of how your colleagues work, how they are making their decisions and the processes they use, you could find yourself in deep trouble when something goes wrong, or one or two colleagues are suddenly taken ill or leave their job. You generally only find out how well-controlled a station is when something goes wrong. A good station manager is in control of their station without becoming a ‘controlling influence’ or ‘control freak.’

The administration work forms the top of the list – completing project monitoring and evaluation forms for funders, generating and processing invoices, keeping track of bills and so on. Many radio stations employ a part-time administrator long before they employ a full-time project manager. Once up and running, full-time radio stations will typically employ staff with responsibilities broadly as follows:

- Station/Project manager
- Administrator
- Radio trainer
- Community development/outreach worker
- Volunteer support worker
- Technician
- IT manager and trainer
- Business development worker

Usually those roles will be combined into a smaller number of positions, so one person might be employed as technician and volunteer support worker.
Alternatively, two or three part-time employees with different roles could replace one full-time specialist. You can also consider using freelancers for some roles that are ‘seasonal’ such as training.

It is important to hire personnel with good technical know-how to keep the radio station going in case of any emergency situation like weather disturbances or technical faults. A radio station has a 24X7 technical support to assist the transmission at all times. The listeners do not like hanging in between the relay if there is a breakdown, they would quickly switch to other options. Therefore, the transmission has to be seamless.

There are many financial tasks which are to be handled at the radio station, including:

- Reviewing and overseeing financial processes
- Drafting of contracts
- Managing the inventory and resources
- Planning the budget and implementing it
- Regularizing and updating operations related documents for radio

The onus of the financial, technical and personnel management varies as per the organizational structure of different radio stations. For example, the radio stations might have different management positions such as:

- Station manager in charge of all the activities at the station including the management of everyday activities like following the budget, hiring, firing, training of personnel, scheduling, meeting corporate objectives, etc.
- Operations manager answers to the Station manager and works closely on the daily scheduling and programming concerns. He oversees the work of the announcers and producers.
- Next in line is the Programme manager who is in charge of the single broadcast and all aspects related to it.
- Sales manager is responsible for the revenue generation and is involved with finding advertisers and getting contracts.
- The Office manager is usually responsible for handling matters related to salaries, bills, taxes, legal matters and other finance and administrative duties.
- The Chief Engineer is the manager for all the technical matters at the studio involving the maintenance and proper working of the equipment, the music editing, recording, sound effects, music programming, etc.
Check Your Progress

1. At which stage of production is extensive planning required?
2. What happens in a Reader Over Room (ROR)?
3. What are the two ways in which sound effects can be used?
4. State the objective of production management.

7.3 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. While planning is required at every stage, extensive planning is required at the pre-production stage when the programme is conceived and all the necessary preparations made.
2. Most of the radio stations have a separate room in the studio complex for rehearsal known as Reader Over Room (ROR). This is the first stage of rehearsal without microphone.
3. Sound effects can be used in two ways:
   a. spot effects or effects that are created as we speak and
   b. recorded sound effects.
4. The main objective of production management is to produce goods and services of the right quality, right quantity, at the right time and at minimum cost.

7.4 SUMMARY

- Planning a programme requires an understanding of the requisites of the medium. Radio is an aural medium and as such emphasis in planning and production must be on voice and sound which would enable listeners to appreciate or understand the message the programme seeks to convey.
- The ultimate goal of a good radio programme is to disseminate appropriate information on a relevant theme. The planning efforts must be directed towards this so that the message conveyed produces the desired impact.
- The cost of radio production is much less than that of TV production. Since the cost and time required to produce a programme are much less, radio can produce a wide variety of programmes. It can also afford to experiment with new and innovative programmes.
• There are three stages in programme production process, i.e., pre-
production, production and post-production. While planning is required at
every stage, extensive planning is required at the pre-production stage when
the programme is conceived and all the necessary preparations made.

• Pre-production, as the title suggests, this is the first stage before the actual
production. Production is the actual process of recording and editing a
radio programme. Proper studios, microphones and computers are required
to record and edit the programme.

• Elements of Radio Production: Human voice or spoken word, Music, and
Sound effects.

• Production management means planning, organizing, directing and controlling
of production activities. It deals with converting raw materials into finished
goods or products. It brings together the 6M’s i.e. men, money, machines,
materials, methods and markets to satisfy the wants of the people.

• The main objective of production management is to produce goods and
services of the right quality, right quantity, at the right time and at minimum
cost. Now, the question is how this applies to radio production? The radio
stations need to maintain the quality and also the number of programmes
relaying from the station. There should be consistency in everyday schedules
so that the listeners don’t lose interest.

• At a radio station, there are a lot of people who work behind the production
of a programme. The station manager is the most important person who is
incharge of the radio station and its personnel.

• The administration work forms the top of the list – completing project
monitoring and evaluation forms for funders, generating and processing
invoices, keeping track of bills and so on. Many radio stations employ a
part-time administrator long before they employ a full-time project manager.

• The onus of the financial, technical and personnel management varies as per
the organizational structure of different radio stations. For example, the radio
stations might have different management positions such as: Station manager,
Operations manager, Programme manager, Sales manager, Office manager,
and Chief Engineer.

7.5 KEY WORDS

• Production: In the context of radio production, this is the actual process of
recording and editing a radio programme.

• Reader Over Room: It refers to the separate room in the studio complex
for rehearsal. This is the first stage of rehearsal without microphone.

• Production management: It means planning, organizing, directing and
controlling of production activities.
7.6 SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions

1. Why is TV production costlier than radio production?
2. List some of the tasks which can happen in post-production at radio stations.
3. Write a short note on sound effects in radio programmes.
4. What is the concept of production and economic production management?
5. What are the different managerial positions at radio stations?

Long Answer Questions

1. Describe the course of production of radio programmes.
2. Explain the elements of radio production.
3. Discuss the management of personnel, financial and technical resources at radio stations.

7.7 FURTHER READINGS

UNIT 8  BUDGETARY PLANNING AND CONTROL

8.0 INTRODUCTION

Budgetary planning is the process of constructing a budget and then utilizing it to control the operations of a business. The purpose of budgetary planning is to mitigate the risk that an organization’s financial results will be worse than expected. The first step in budgetary planning is to construct a budget.

The most important advantage of a budgetary control is to enable management to conduct business in the most efficient manner because budgets are prepared to get the effective utilisation of resources and the realisation of objectives as efficiently as possible.

8.1 OBJECTIVES

After going through this unit, you will be able to:

- Discuss the process of budgetary planning and control
- Differentiate between direct and indirect costs
- Describe the concept of human resource development
- Explain the fixed and variable factors in planning subject
- Understand the conducive production conditions
8.2 INTRODUCTION TO BUDGETARY PLANNING AND CONTROL

A budget is a financial statement of the planned expenditure for a project, programme or portfolio in a given period of time. It forms a baseline of each activity and helps to coordinate various activities of the organization in a documented manner. Budgets are necessary to highlight the financial implications of activities, to define the resources required to achieve these activities and to provide a means of measuring, viewing and controlling the obtained results, in comparison with the activities. Budgets are useful because they enhance both communication and co-ordination in an organization.

A successful budget is driven by an effective budgetary planning and control. These are the key tools for any manager to monitor organizational functions and activities.

Budgetary planning is the process of constructing a budget involving various activities. It also gives an opportunity to control the operation of a business. The main purpose of budgetary planning is to mitigate the risk that an organization’s financial results will be worse than expected.

A budgetary control is a process to set the financial and performance goals of the organization. It is a helpful technique which compares actual end results with the budgeted ones and adjust the performance, if required.

Budgetary planning and control add various advantages as it compels the management to think for the future by setting out detailed plans for achieving the desired targets. It clearly defines area of responsibilities of each department of the organization, motivating employees to participate in setting up budget and achieving the desired results.

8.2.1 Direct and Indirect Costs

For budgetary planning and accounting purpose, there are two different heads of costs involved:

a. Direct Cost: These are the costs traceable to the production of a specific good or service. It may be a product, department or project. This includes items such as software, equipment and raw materials.

b. Indirect Cost: These are the cost necessary to keep the business in operation. These include items such as cleaning supplies, utilities, office equipment rental, desktop computers and cell phones.

Setting up a radio station and operating in India starts with the planning, both procedural and budgeting. It is important to understand the various processes involved in obtaining the frequency, licensing requirements, purchasing necessary equipment and software, setting up a studio, etc. In this case direct and indirect
Budgetary Planning
and Control

NOTES

Check Your Progress

1. Why are budgets necessary?
2. What are the direct and indirect costs involved in setting up a radio station?

8.3 HUMAN RESOURCE DEVELOPMENT (HRD)

Human Resource Development is the emphasis on training, education and other types of development for employees after they are hired in an organization. It is basically a framework for helping employees develop their personal and organizational skills, knowledge, and abilities. HRD is an integral part of any successful organization. The main objective of Human Resource Development is to develop the most superior workforce so that the organization and individual employees can accomplish their respective goals and targets.

Few main advantages of Human Resource Development are mentioned below:

- Makes employees more competent as it helps to develop skills, knowledge and right attitude.
- Improves co-ordination and overall participation of the employees.
- Creates an environment of mutual respect and develops trust within the employees.
- Makes employees more focussed and determined towards their respective duties and responsibilities.
- Resources are effectively utilized and goals are achieved in more satisfied manner.

Radio Industry offers various challenging profiles and in this competitive environment where radio stations are growing so fast, they need good and valuable resources to be on the top of the list. Here, Human Resource person would come into picture and would need to understand the psyche of the industry professional. Key profiles generally offered in a media industry are account director, key account manager, producer, copywriter, marketing researcher, creative director, media planner, corporate communication, creative director, etc.

Basic characteristics sought in a media professional include ability to handle pressure, strong presence of mind, street smart, flexible and can adapt various situations, extrovert, politically correct, dynamic, etc.
To summarize the above, the role of a HR manager becomes extremely important in a dynamic industry like Radio. From identifying to recruitment, and to provide necessary trainings and developing his expertise as per the job requirement, HR has a very crucial role to play to keep to motivation level up and increase the job satisfaction in this highly creative and demanding industry like Radio.

8.4 FIXED AND VARIABLE FACTORS IN PLANNING

Planning is the result of combined efforts involving both fixed and variable factors.

A fixed factor is one, whose quantity cannot readily be changed in response to desired changes in output or market conditions. Its quantity remains the same, whether the level of output is more or less or sometimes even zero. Infrastructure and buildings, land, plant and machinery, plants and key managerial are some common examples of fixed factors. A variable factor, on the other hand, is one whose quantity may be changed in response to a change in the output. Raw materials, labour, power, etc. are examples of variable factors. Such factors are required depending on the output from time to time.

With regards to fixed and variable costs in planning while preparing a budget, it can be further broken into two main areas:

(a) Long Term (Multi-year costs incurred once every several years)
(b) Short Term (Annual, ongoing costs)

Categories for the broadcast budget may include:

(a) Set up Cost: These are studio equipment, computers and hard drives, cameras and accessories, audio gear and accessories, AV connectors and adapters, etc. These are big expenses, but the heart of any broadcast program.

(b) Software: These are video and audio editing, graphics, etc. Ideally, this should be updated every 3-4 years.

(c) Continuous Repairs: It varies depending on quality and age of the gears.

(d) Online hosting (Paid subscriptions for hosting videos, ISP for the website, domain names, if any, etc.)

(e) Publicity: Copying costs, swag, etc. to promote programs and recruit employees

(f) Others: Travel, trainings, certifications, sudden damages, etc.
8.4.1 Conducive Production Conditions

The producer is the person who heads the team of writers, sound effects men, and actors. The producer is the person who conceives a program, plans a program, and then makes all the arrangements to materialize what they have thought of. If something is appreciated from the listeners, the credit goes to the producer and if something fails and gathers criticism instead; again the producer is held responsible for the act. Hence, a producer needs to be street smart, politically correct, exceptional, and extraordinary.

Radio industry is a creative industry and hence require lot of freedom to the employees in terms of open mind set and space. A cluttered work environment where desks are laden with paperwork and cubicles are just a few inches apart can make it challenging for employees to get any work done without tidying up their area. Lack of personal space can also start conflict between co-workers and stress them out even more than they should be.

Harness the power of technology to streamline interdepartmental communications, improve cash flow management, and eliminate any bottlenecks that is restricting the business from scaling. Technologies, like vacation tracking software and team collaboration tools, cost money and involve a learning curve, which is why a lot of entrepreneurs and business owners are avoiding the transition to modern technologies.

Creating a conducive environment for a radio station is very essential for success or failure in India. Favourable policies should be formulated to create conducive environment so that radio industry becomes more corporatized and that more institutional and banking finance is available to the industry.

Check Your Progress

3. State the main objective of human resource development.
4. What are the basic characteristics sought in a media professional?

8.5 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. Budgets are necessary to highlight the financial implications of activities, to define the resources required to achieve these activities and to provide a means of measuring, viewing and controlling the obtained results, in comparison with the activities.

2. In setting up a radio station, direct and indirect cost would involve transmission and studio equipment, station and office space rentals, infrastructure costs, licensee fees, royalties, administrative costs, desktops and laptops, etc.
3. The main objective of Human Resource Development is to develop the most superior workforce so that the organization and individual employees can accomplish their respective goals and targets.

4. Basic characteristics sought in a media professional include ability to handle pressure, strong presence of mind, street smart, flexible and can adapt various situations, extrovert, politically correct, dynamic, etc.

8.6 SUMMARY

- A budget is a financial statement of the planned expenditure for a project, programme or portfolio in a given period of time. It forms a baseline of each activity and helps to coordinate various activities of the organization in a documented manner.

- Budgets are necessary to highlight the financial implications of activities, to define the resources required to achieve these activities and to provide a means of measuring, viewing and controlling the obtained results, in comparison with the activities.

- A successful budget is driven by an effective budgetary planning and control. These are the key tools for any manager to monitor organizational functions and activities.

- Budgetary planning is the process of constructing a budget involving various activities. It also gives an opportunity to control the operation of a business. Main purpose of budgetary planning is to mitigate the risk that an organization’s financial results will be worse than expected.

- A budgetary control is a process to set the financial and performance goals of the organization. It is a helpful technique which compares actual end results with the budgeted ones and adjust the performance, if required.

- Setting up a radio station and operating in India starts with the planning, both procedural and budgeting. It is important to understand the various processes involved in obtaining the frequency, licensing requirements, purchasing necessary equipment and software, setting up a studio, etc.

- Human Resource Development is the emphasis on training, education and other types of development for employees after they are hired in an organization. It is basically a framework for helping employees develop their personal and organizational skills, knowledge, and abilities.

- Radio Industry offers various challenging profiles and in this competitive environment where radio stations growing so fast, they need good and valuable resources to be on the top of the list.

- Basic characteristics sought in a media professional include ability to handle pressure, strong presence of mind, street smart, flexible and can adapt various situations, extrovert, politically correct, dynamic, etc.
• A fixed factor is one, whose quantity cannot readily be changed in response to desired changes in output or market conditions. Its quantity remains the same, whether the level of output is more or less or sometimes even zero.

• A variable factor, on the other hand, is one whose quantity may be changed in response to a change in the output. Raw materials, labour, power, etc. are examples of variable factors. Such factors are required depending on the output from time to time.

• Radio industry is a creative industry and hence require lot of freedom to the employees in terms of open mind set and space. A cluttered work environment where desks are laden with paperwork and cubicles are just a few inches apart can make it challenging for employees to get any work done without tidying up their area.

• Creating a conducive environment for a radio station is very essential for success or failure in India. Favourable policies to create conducive environment so that Radio industry becomes more corporatized and that more institutional and banking finance is available to the industry.

8.7 KEY WORDS

• Budgetary planning: It is the process of constructing a budget involving various activities. It also gives an opportunity to control the operation of a business.

• Budgetary Control: It is a process to set the financial and performance goals of the organization. It is a helpful technique which compares actual end results with the budgeted ones and adjust the performance, if required.

8.8 SELF-ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions
1. Differentiate between budgetary planning and control.
2. State the advantages of human resource development.
3. Differentiate between fixed factor and available factor.

Long Answer Questions
1. Describe the procedure for budgetary planning and control.
2. Discuss the categories of broadcast budget.
3. Write a detailed note on conducive production conditions.
8.9 FURTHER READINGS


9.0 INTRODUCTION

Although the future of radio has been doubted many times throughout its history, it is still in existence. The inherent portability of the medium gives it an advantage over other types of media that require an individual’s full attention, such as television or print. The simplicity of radio has leant itself to a variety of uses.

In this unit we will discuss the innovative developments in radio communication that we have observed over the years. We will also discuss the information service programmes on radio.

9.1 OBJECTIVES

After going through this unit, you will be able to:

- Describe the transitional shift in radio and digital media
- Discuss the innovative developments in radio communication
- Understand the various information service programmes on radio
9.2 INNOVATIVE DEVELOPMENTS AND
INFORMATION SERVICE PROGRAMMES IN
RADIO COMMUNICATION

With the emergence of digital media, the radio broadcasts have entered a transitional phase. The intervention of new technologies and platforms has created a huge shift in the radio broadcasting scenario. Radio advertising has a big potential. They have a great reach and therefore the advertisers rely on this medium to reach out to audience. Radio spots are run on radio channels to market products, services and boost sales. While even the political parties take support of radio ads and air their campaigns and jingles to reach out to their target. The radio spots are cheap as compared to television ads, so they can be run repeatedly to boost remembrance.

The FM broadcasting is a new trend along with community radio. There has been a huge change in the broadcasting and the way it reaches the listeners.

Community radio

Community radio is a type of radio service that offers a third model of radio broadcasting beyond commercial and public service. Community stations can serve geographic communities and communities of interest. They broadcast content that is popular to a local/specific audience but which may often be overlooked by commercial or mass-media broadcasters.

Community radio stations are operated, owned, and driven by the communities they serve. Community radio is not-for profit and provides a mechanism for facilitating individuals, groups, and communities to tell their own diverse stories, to share experiences, and in a media rich world to become active creators and contributors of media. In India, the campaign to legitimize community radio began in the mid-1990s, soon after the Supreme Court of India ruled in its judgment of February 1995 that “airwaves are public property”. This came as an inspiration to groups across the country, but to begin with, only educational (campus) radio stations were allowed, under somewhat stringent conditions.

On 16 November 2006, the government of India notified new Community Radio Guidelines which permit NGOs and other civil society organizations to own and operate community radio stations. About 4,000 community radio licenses are on offer across India, according to government sources. By 30 November 2008, the ministry of Information and broadcasting, government of India, had received 297 applications for community radio licenses, including 141 from NGOs and other civil society organizations, 105 from educational institutions and 51 for ‘farm radio’ stations to be run by agricultural universities and agricultural extension centers (‘Krishi Vigyan Kendras’). Of these, 107 community radio stations have been cleared for licensing through the issue of Letters of Intent.
The license entitles them to operate a 100 watt (ERP) radio station, with a coverage area of approximately 12 kilometers radius. A maximum antenna height of 30 meters is allowed. Community radio stations are expected to produce at least 50 per cent of their programmes locally, as far as possible in the local language or dialect. The stress is on developmental programming, though there is no explicit ban on entertainment.

Campus Radio Station

Campus radio (also known as college radio, university radio or student radio) is a type of radio station that is run by the students of a college, university or other educational institution. Programming may be exclusively by students, or may include programmers from the wider community in which the station is based. Sometimes campus stations are operated for the purpose of training professional radio personnel, sometimes with the aim of broadcasting educational programming, while other stations exist to provide an alternative to commercial or government broadcasters.

Anna FM is India’s first campus ‘community’ radio, launched on 1 February 2004, which is run by Education and Multimedia Research Centre (EMRC), and all programmes are produced by the students of Media Sciences at Anna University.

Internet Radio

Internet radio has been around since the late 1990s. Traditional radio broadcasters have used the Internet to simulcast their programming. But, Internet radio is undergoing a revolution that will expand its reach from your desktop computer to access broadcasts anywhere, anytime, and expand its programming from traditional broadcasters to individuals, organizations and government.

Radio broadcasting began in the early ’20s, but it wasn’t until the introduction of the transistor radio in 1954 that radio became available in mobile situations. Internet radio is in much the same place. Until the 21st century, the only way to obtain radio broadcasts over the Internet was through your PC. That will soon change, as wireless connectivity will feed Internet broadcasts to car radios, PDAs and cell phones. The next generation of wireless devices will greatly expand the reach and convenience of Internet radio. In comparison to traditional radio, Internet radio is not limited to audio. An Internet radio broadcast can be accompanied by photos or graphics, text and links, as well as interactivity, such as message boards and chat rooms. This advancement allows a listener to do more than listen.

Most of the radio channels in India have an online channel as well.

Satellite Radio Station

In the satellite radio category a satellite bounces the transmitted radio frequency off of the satellite and out to the millions of satellite radio listeners around the world. Most satellite radio plans are based on your use, like for a business, marine use, navigational systems, and more.
Furthermore, the way that satellite radio works is that it offers you commercial free programming or limited commercials. Depending on the network you choose, you have news, sports, comedy, talk, and music channels from which you can choose.

While XM radio has two satellites, “Rock” and “Roll”, Sirius radio has three satellites that allow one satellite to be positioned over the United States at all times. These send the signal to the ground repeaters or to the antennas directly.

**Digital Audio Broadcasting (DAB)**

Digital Audio Broadcasting (DAB) is a digital radio technology for broadcasting radio stations, used in several countries, particularly in Europe. As of 2006, approximately 1,000 stations worldwide broadcast in the DAB format.

The DAB standard was initiated as a European research project in the 1980s, and the BBC launched the first DAB digital radio in 1995. DAB receivers have been available in many countries since the end of the nineties. DAB may offer more radio programmes over a specific spectrum than analogue FM radio. DAB is more robust with regard to noise and multipath fading for mobile listening, but DAB reception quality degrades rapidly when the signal strength is not strong, whereas FM reception quality degrades slowly.

Traditionally radio programmes were broadcast on different frequencies via FM and AM, and the radio had to be tuned into each frequency. This used up a comparatively large amount of spectrum for a relatively small number of stations, limiting listening choice. DAB is a digital radio broadcasting system that through the application of multiplexing and compression combines multiple audio streams onto a relatively narrow band centered on a single broadcast frequency called a DAB ensemble.

### Check Your Progress

1. What is a community radio?
2. What is campus radio also known as?
3. How was the DAB standard initiated?
4. What is the difference between XM radio and Sirius radio?

### 9.3 Answers to Check Your Progress Questions

1. Community radio is a type of radio service that offers a third model of radio broadcasting beyond commercial and public service. Community stations can serve geographic communities and communities of interest.
2. Campus radio is also known as college radio, university radio or student radio.

3. The DAB standard was initiated as a European research project in the 1980s, and the BBC launched the first DAB digital radio in 1995.

4. While XM radio has two satellites, “Rock” and “Roll”, Sirius radio has three satellites that allow one satellite to be positioned over the United States at all times.

9.4 SUMMARY

• With the emergence of digital media, the radio broadcasts have entered a transitional phase. The intervention of new technologies and platforms has created a huge shift in the radio broadcasting scenario. Radio advertising has a big potential.

• While even the political parties take support of radio ads and air their campaigns and jingles to reach out to their target. The radio spots are cheap as compared to television ads, so they can be run repeatedly to boost remembrance.

• Community radio is a type of radio service that offers a third model of radio broadcasting beyond commercial and public service. Community stations can serve geographic communities and communities of interest.

• Community radio stations are operated, owned, and driven by the communities they serve. Community radio is not-for-profit and provides a mechanism for facilitating individuals, groups, and communities to tell their own diverse stories, to share experiences, and in a media-rich world to become active creators and contributors of media.

• Campus radio (also known as college radio, university radio or student radio) is a type of radio station that is run by the students of a college, university or other educational institution.

• Anna FM is India’s first campus ‘community’ radio, launched on 1 February 2004, which is run by Education and Multimedia Research Centre (EMRC), and all programmes are produced by the students of Media Sciences at Anna University.

• Internet radio has been around since the late 1990s. Traditional radio broadcasters have used the Internet to simulcast their programming. But, Internet radio is undergoing a revolution that will expand its reach from your desktop computer to access broadcasts anywhere, anytime; and expand its programming from traditional broadcasters to individuals, organizations and government.
• In the satellite radio category a satellite bounces the transmitted radio frequency off of the satellite and out to the millions of satellite radio listeners around the world. Most satellite radio plans are based on your use, like for a business, marine use, navigational systems, and more.

• While XM radio has two satellites, “Rock” and “Roll”, Sirius radio has three satellites that allow one satellite to be positioned over the United States at all times. These send the signal to the ground repeaters or to the antennas directly.

• Digital Audio Broadcasting (DAB) is a digital radio technology for broadcasting radio stations, used in several countries, particularly in Europe. As of 2006, approximately 1,000 stations worldwide broadcast in the DAB format.

• Traditionally radio programmes were broadcast on different frequencies via FM and AM, and the radio had to be tuned into each frequency. This used up a comparatively large amount of spectrum for a relatively small number of stations, limiting listening choice.

• DAB is a digital radio broadcasting system that through the application of multiplexing and compression combines multiple audio streams onto a relatively narrow band centered on a single broadcast frequency called a DAB ensemble.

9.5 KEY WORDS

• Digital Audio Broadcasting (DAB): It is a digital radio technology for broadcasting radio stations, used in several countries, particularly in Europe.

• Internet radio: It is a digital audio service transmitted via the Internet. Broadcasting on the Internet is usually referred to as webcasting since it is not transmitted broadly through wireless means.

9.6 SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions

1. Write a short note on the campaign to legitimize community radio.

2. What is Anna FM? When was it launched?

Long Answer Questions

1. Analyse the changes that have taken place in the FM broadcasting scenario.

2. Discuss the Digital Audio Broadcasting (DAB) standard.
9.7 FURTHER READINGS


UNIT 10 DIFFERENT TYPES OF SERVICES OF RADIO

Structure
10.0 Introduction
10.1 Objectives
10.2 Community, Local and Campus Radio
10.3 All India Radio Services
10.4 Private FM Radio Stations
10.5 Answers to Check Your Progress Questions
10.6 Summary
10.7 Key Words
10.8 Self Assessment Questions and Exercises
10.9 Further Readings

10.0 INTRODUCTION

In the previous unit, you learnt about the innovative developments in radio communication and information service programmes. There, you studied the concept of community/local and campus radios. In this unit, the concentration will be on the history of community/local radio specifically in India and the different services of the All India Radio. The unit will further discuss the entry of private radio stations in our country and their status.

10.1 OBJECTIVES

After going through this unit, you will be able to:

- Describe the concept of community/local and campus radio
- Explain the different All India Radio services
- Discuss the private FM radio stations

10.2 COMMUNITY, LOCAL AND CAMPUS RADIO

In this section, you will learn about two important types of radio services; community/local and campus radio.

As you have learnt in the previous unit, an interesting development in recent years has been the setting up of local radio stations in different regions of the country. The Verghese Committee (1978) recommended a franchise system for promoting local radio for education and development. The need for local/community radio, using FM radio technology, was discussed and accepted during the second plan...
Different Types of Services of Radio

The first experiment in local community radio with FM facilities was conducted in Nagercoil. The experiment was launched on October 30, 1984. In a paper presented at a workshop in Ahmedabad, the station director of Nagercoil local radio stations observed, ‘Local Radio should identify with the interests of the local population (and) the heart of the people should beat in every pulse of the programme broadcast.’ Other experiments have been carried out in rural areas of Bangalore and Hyderabad.

Several NGOs used local radio to further their development activities. Chetana (Kolkata) and Ravi Bharati (Patna), for instance, record their programmes on adult education, in the field using local talents. The communication division of UNESCO actively supports such endeavours in India and other countries. Community radio has perhaps been most successful in South Africa where religious and social action groups use low-cost radio stations involving local communities in promoting development at the grassroots level.

As per the 2002, ‘Policy Guidelines for setting up Community Radio Stations in India’:

An organization desirous of operating a Community Radio Station (CRS) must be able to satisfy and adhere to the following principles: a) It should be explicitly constituted as a ‘non-profit’ organisation and should have a proven record of at least three years of service to the local community, (b) The CRS to be operated by it should be designed to serve a specific well-defined local community, (c) It should have an ownership and management structure that is reflective of the community that the CRS seeks to serve, (d) Programmes for broadcast should be relevant to the educational, developmental, social and cultural needs of the community, (e) It must be a Legal Entity i.e. it should be registered (under the registration of Societies Act or any other such act relevant to the purpose).

Generally, the financial needs of most of the community radio stations are through their own parent organizations, NGOs, government research institutes and private educational institutions.

As reported in the 2015 article on Scroll, the possible advantage of community radio mentions that:

‘The AIR broadcast is only in 20-30 popular languages with just 47 stations in a country of 1.2 billion people,’ said an official on the screening committee of the ministry of information and broadcasting. ‘The AIR broadcast can’t compete with the power of a community radio because it is neither in the language that each region speaks nor carries the local news which actually matters to them.’

Community radio stations are not only important but perhaps one of the best medium for catering people of the remote communities who have unique languages and dialects.
Another benefit of the community radio is that the focus of the shows and production is not based on trends or what has the most selling value, but rather is on the upliftment of the community and a discussion on what is important to them.

There are many community radios running in the country today including the Apno Radio (Rajasthan) which concentrates on women empowerment; Radio Udaan (Punjab) for the visually impaired, Vasundhara Vahini (Maharashtra) for agriculture related concerns, and many more.

**Campus Radio**

You have already learnt about campus radio in the previous unit. The Government of India opened up FM radio in 2002 and 17 Campus Radio Stations came up in quick succession in different parts of the country. These included university campuses such as Indira Gandhi National Open University (IGNOU) Jamia Milia Islamia, Pune and Annamalai universities and national campuses like Film and Television Institute of India (FTII), SR Film and Television Institute (SRFTI) and Indian Institute of Mass Communication (IIMC). Interestingly, Ministry of Information and Broadcasting runs all these three institutes.

**School Broadcasts**

The metros and other centres broadcast programmes for schools. There are more than 7 lakh schools in India. Of these, only 20,000 schools own radio sets. Of these 20,000, only 40 per cent school switch on their radio sets more or less regularly. A handful of these schools show broadcasts on their time tables.

Like few professionals make good teachers, few teachers make good broadcasters. Therefore, quality of programmes is uneven. It is the AIR that shoulders the responsibility of these broadcasts, not the educationists. AIR draws up programmes on the advice of consultative panels for school broadcasts, comprising six members at each station. The consultative panels have representation from State Education Department, principals of schools and AIR.

Teachers are not on the panels, but work on the Subjects Committees that are supposed to assist the panels. AIR sets up these panels and educationists are invited to serve on them for a fixed period.

**Benefits of Campus and School Radio**

Let’s first look at the advantages of campus radio:

- It is useful for students to showcase their creativity and thereby increase their confidence.
- It acts as a communication tool for international as well as immigrant students by acting as a guide to the community it is set in.
- It helps universities make their multi-media classes more interaction and practical.
Different Types of Services of Radio

NOTES

- It aids the students in the colleges to feel connected to the campus and the identity that is being promoted.
- It can also help promote local businesses, thereby helping the students get acquainted with the local economy and be stronger as a community.

Now, let’s briefly look at the benefits of school radio:

- **Voice**: School radios provide students a platform where they can voice their opinion and issues about matters related to their school and life in general.
- **Confidence**: School is a really transformative age for children as they go through a critical part of growing up. By proving such a medium, school children gain confidence, face their fears and build a unique identity of their own.
- **Teamwork**: Organizing and running the radio station will impart a great many learning skills to the students in school. They will learn to work together in teams and the manner in which to divide, manage and deliver such assigned duties to present a coordinated programme.
- **Skills**: School radio will also allow the students to learn not only speaking, but also listening skills which will help them even later on in life. Further, the students will also be able to pick up other related crucial skills of writing, editing, interviewing, and much more.

10.3 ALL INDIA RADIO SERVICES

Some of the services of AIR are the following:

The National Service

The centrally-planned national Service (also called the primary service) began during the Second World War when news bulletins began to be broadcasted from Delhi. The news services division in All India Radio plans and presents the news and current affairs programmes. On the other hand, programmes of music, plays, talks and features are planned by the Director General and produced at regional centres. To boost the commercial revenue of AIR, commercials were allowed on the primary channel from April 1982, and on over 55 selected stations from January 28, 1985.

The Regional Services

The purpose of All India Radio’s regional services is to provide content for major linguistic and cultural groups residing in a particular region. All states and Union Territories serve the groups that dwell within their territory. Except for the news and other national programmes that are broadcasted and relayed to regional centres from Delhi, each regional station produces and broadcasts programs directed
towards farmers, workers, children and so on, within their areas. The national programmes are broadcasted over short-wave transmitters that allow regional stations to relay them in their area.

In March 1995, AIR had 105 regional stations, with an average of four to five stations in each State. While Madhya Pradesh had as many as 11 stations, Uttar Pradesh had 10 stations, Andhra Pradesh, Rajasthan, Karnataka and Maharashtra had eight. The seven states of North-East were well served with four stations in Arunachal Pradesh, three stations in Assam, two each in Meghalaya and Mizoram, and one each in Nagaland and Tripura.

The Vividh Bharati Service

On October 2, 1957 the Vividh Bharati services were started on AIR to provide ‘light entertainment’ to listeners. Its main competitor at that time was Radio Ceylon, now known as Sri Lanka Broadcasting Corporation, which had begun directing a commercial service to India on powerful short-wave transmitters. Earlier, film songs had been banned by the then Minister for Information and Broadcasting Dr. B. V. Keskar since he considered film songs to be cheap and vulgar. All India Radio introduced commercials on this service in 1967, and sponsored programmes in May 1970. Up to 1986, the revenue from commercials was almost ₹200 million per annum; in 1989 this revenue rose to ₹360 million. In the 1990s, the revenue was on average ₹370 million per annum. By 2004-2005 AIR’s revenues reached ₹1.58 billion.

When the service began, it comprised of a five hour programme daily of which 60 per cent was devoted to film music. The rest was used up by devotional music, poetry recitals, short-plays, and so on. Initially, a daily five hour programme was beamed and 60 per cent of the time was devoted to film music. By the 1990s, the service had been extended to 12 hours and 45 minutes, with an extra hour and quarter added on Sundays and on holidays. Aside from a small number of request programmes that are produced at regional centres, most of the content for the Vividh Bharati services are produced in Mumbai. Nowadays, the proportion of film music heard on the service has remained at 60 per cent with classical music taking up about 20 per cent of the time. The rest of the time is used to relay news bulletins and other programmes.

In cities where transmitters are located, the Vividh Bharati service can only be heard on medium-wave, while in rural areas, the service can only be picked up on short-wave. Vividh Bharati programmes are broadcast on two short-wave transmitters in Mumbai and Chennai, and on low-power medium-wave transmitters.

All India Radio and its numerous regional stations have lost listeners to the Vividh Bharati Service whose popularity now exceeds over 250 million people. Many scholars have opined that Vividh Bharati should have been a service that was completely independent of All India Radio, producing its own programmes so as to provide a real alternative option for listeners who did not want to listen to the national and regional service.
In 1978, the Verghese committee was of the opinion that the service had ceased to be a variety programme and had become essentially a ‘repetitive film-disc programme.’ It proposed that the Vividh Bharati service should be reviewed so as to ‘develop a genuine radio-originated light-entertainment programme inclusive of film music which could become a vehicle for much experimentation and innovation.’ This statement is found in a document of Publications Division, Ministry of Information and Broadcasting titled as *Akash Bharati*.

**External Service**

Before going any further on this, it is imperative to know about diplomacy on the air. Radio Moscow, Radio Beijing, the BBC, the VOA, Radio Deutsche Welle, Sri Lanka Broadcasting Corporation (SLBC) which was called Radio Ceylon during the yesteryears, Radio Netherlands, Radio Vatican, South African Broadcasting Corporation (SABC), the Australian Broadcasting Corporation (ABC), and several other national broadcasting networks beam their programmes round the clock across frontiers. Short wave and long wave broadcasting has made it possible to beam programmes across frontiers to different parts of the world. Broadcasting today is regarded as ‘part of the normal apparatus of diplomacy.’

AIR inaugurated its External Services Division in 1939 with a broadcast in Pushtu. With this, India too joined the game of diplomacy on the air. Today, this Division broadcasts in 27 languages to 108 countries. Of these languages, 17 are foreign and remaining eight are Indian. In such sensitive areas where we feel our point of view will matter and where people of Indian origin have been residing, we beam news bulletins round the clock. According to an official document of Audience Research unit of AIR, ‘To project the Indian point of view on world affairs and acquaint overseas listeners with development in India, along with information on various facets of Indian life, thought and culture’ is the primary objective of these broadcasts.’

A similar stand is taken by a UNESCO report that states, preferably the objectives of international broadcasts are (i) to present best culture and ideas of the broadcasting country (ii) to present world news objectively (iii) to explain the broadcasting country’s perspective on important world problems and to encourage international understanding. The boom originated in 1975 in Japan and few years later spread to Europe and the United States.

The voice of India has slight chance of being heard as more than 80 countries around the world have been vying for the overseas listeners’ attention in 148 languages on 4450 short wave frequencies. Listener’s letters are the only way for AIR to get a feedback. Pakistan, Bangladesh, Afghanistan, the Arab states and Western Europe are the main target areas for India.

The quality of programmes beamed and the poor transmission are to be blamed if the external service and the general overseas service have not made any impact. The listener who does have an abiding interest in India is nowhere at fault in this regard. This has been reflected in Verghese Committee’s report. It says,
AIR’s External Service Broadcasts are only dimly heard in significant areas and we have the picture of an ill-planned service, a wasteful use of resources, a frustrated staff and dissatisfied listeners, whether overseas, Indians or foreigners at whom these broadcasts are directed.

### 0.4 PRIVATE FM RADIO STATIONS

Private radio channels in India go for Frequency Modulation (FM) broadcasts and before we go any further on this topic, it is necessary to understand the background/history of FM broadcasts.

It was 1977 – a tumultuous year in political history of India when FM broadcasts were launched in Chennai. After a gap of 15 years the experiment was restarted in Jalandhar in 1992. In 1993, it became possible that FM became synonymous with pop music and youth culture when time slots came to be leased to the private companies.

On 46th Independence day of India – 15th August, 1993 to be more precise – a Frequency Modulation (FM) channel was launched in Mumbai with nine hours of radio time leased to private producers like Times FM, Radiostar and Radio Midday.

It is, however, just a coincidence that music video channels, like channel V and MTV were launched on Star TV at the same time.

What was indeed noticeable about FM broadcasts was the fact that their reception had no effect of atmospheric noise and electric interference. Probably this was the reason that Information and Broadcasting Ministry of the Government of India realized the business potential of FM broadcasts and soon All India Radio (AIR) stations of Delhi, Bombay, Panaji, Bangalore, Chennai and Kolkata decided to sell FM slots to private producers.

When the deal was done, All India Radio charged a fee of ₹3000 per hour, but the private companies who bought the slot charged advertisers ₹250-300 for a ten-second commercial. In most of the cities, the major chunk of audience of these broadcasts comprised urban English-speaking youth. These youngsters were interested in programmes pertaining to western pop music so musical programmes dominated the content of the broadcasts. In fact this conclusion was reached at the behest of the report of National Readership Survey of 1997 which said that barely seven per cent of the population claimed to listen to FM channels. According to All India Radio annual report in 1995, there were only five million FM radio households out of a total of 11 million radio household in the country.

The FM programmes, in addition to sponsored hit parades and countdowns, included chat shows, contests and quizzes, phone-ins, page-ins and write-ins. In a way, no holds were barred and no strategies were spared to attract and involve listeners. This paid rich dividends in the form of advertising support for the leased slots and as a result revenue began to soar.
The new mass medium of urban India was ready to take off! However, there were several hurdles on the way. For one, the low percentage of FM radio sets turned out to be one of the main roadblocks to the further growth of private FM broadcasting until 2000. For another, the conflict of interests between AIR authorities who did not want to let go of their control and the private broadcasters at that time (two of them – The Times of India and Midday, are major newspaper publishers) who wanted to hold on to their monopoly. They resisted AIR’s bid to raise the rates and with great force and vigour went against those Indian companies that had 25 per cent foreign equity and those who wanted to do bidding for the time being on the FM channels.

FM radio technology facilitates localization of broadcasting and the operation of large number of stations. New York, for instance, has as many as 82 stations; London has 42, Manila 35 and Jakarta 29, while New Delhi had only five. Transmission bands for FM radio range between 80 and 108 MHz, though the Indian government has kept 80-108 MHz for its own services. Still, 13 frequencies are available for a whole lot of stations in different languages in multi-linguistic cities. AIR has extended FM broadcasting to many Indian cities.

**FM Radio – Auctioning the Airwaves**

In 1995, the Supreme Court of India pronounced a judgement which stated that, ‘the airwaves are public property’ and thus, could not be a monopoly of the government or the private businesses. The government understood the judgement to mean a direction to privatize the airwaves. In lieu of this bizarre reading, the Government of India auctioned off the radio waves to the highest bidder.

The government monopoly of the airwaves through AIR ended in 1999 when the government opened up the sector to private commercial FM Radio stations. In phase one, 108 licenses for 40 cities were auctioned off in 2001 by the government, however, due to the very expensive licensing fees and pre-conditions, only 21 stations became operational. In 2006, 338 licenses in 91 cities were auctioned off. In the second phase, 97 stations in 27 cities were auctioned off; the focus of phase two was on the smaller cities like Udaipur, Gangtok, Bikaner, and so on.

The auctioning of licenses by the government to the highest bidder was enormously beneficial to large media houses like the Times of India group, Dainik Bhaskar, Living Media, Hindustan Times and so on. Unfortunately, public ownership of the airwaves was given scant attention.

By the close of 2007, the FM radio industry was worth over ₹310 crores and was expected to grow to even further by the end of the decade. Big FM, Survan, Radio Mirchi, Radio City and of course AIR’s FM stations (Rainbow FM and FM Gold) were the main players. Nevertheless, the scene was expected to explode with the auction of the third phase. Music, chat and utilities (traffic updates and public announcements) are the main drivers, since news and current
affairs and live sports commentaries were yet to be allowed by the government; user generated content was yet another aim of the broadcasters. However, several companies that have won licenses for radio stations appear to be reluctant to launch them in the small cities and towns primarily because of the uncertainty of revenues from advertising. Further, there has not been a remarkable uptake in the purchase of FM-enabled radio sets. In January 2007, the Working Group of Eleventh Five year Plan found that out of the total number of 132 million radio sets, barely 78 million were FM receivers. By the end of 2007, 281 of these private stations; another 130 remained to be operationalized.

Radio continues to be primarily a medium that unites the country and functions as a home medium. However, the early years of the 21st century have been a witness to FM radio turning gradually into an outdoor (or Out-of-Home) medium. Around 30 per cent of people listen to radio on mobiles with most mobiles being FM enabled sets. Nokia handsets even had Radio City’s logo marked on them. Another 15 per cent tend to listen to FM radio outside home – mostly in cars and auto rickshaws in shopping malls, restaurants and other open spaces where leisure and entertainment dominates.

Revenues of Radio Industry

The radio industry works closely hand in hand with two bodies. One of these is Phonographic Performance Ltd. This company represents the interests of music companies. The other one is Indian Performing Rights Society (IPRS) that charges royalty from radio stations. The duration of music that most radio stations play comes out around 18 hours a day and it costs them ₹1320 per needle hour. 20-30 per cent of revenue that comes from advertising, sponsorship and product placements goes to PPL for cost of music rights. Human resources, marketing and branding account for other costs that a radio station incurs. Private FM stations have collectively paid a sum of ₹1300 crores as one time entry/license fee for ten years.

The revenue of radio industry in India has been rising since the year 2000. This fact has emerged from studies conducted by Zenith Optimedia and FICCI-Price Waterhouse Coopers. The study points out that the share of radio in overall advertising expenditure has been around 3 per cent compared to the worldwide average of 8.7 per cent. This is 4.4 per cent in China, 6.5 per cent in Thailand and 9.4 per cent in Singapore. The bulk of the revenue goes to All India Radio.

Interestingly, radio happens to be a profitable enterprise despite the complaints of private broadcasters. This has been exemplified by the rush for FM radio stations during the three phases of radio expansion from 2000 to 2008.

The revenue of radio industry was 17.6 crore in 2000 which went up to 22.2 in the next corresponding year, that is, 2001. From there, the figure rose to 25.7, 28, 29.2, then 33.2 and 36.8 respectively, according to figures released by Zenith Optimedia in October 2006.
**Major Channels**

Adlabs has 44 FM radio stations in seven out of top 13 towns. South Asia/Kaal Radio has 45 out of ten towns. Times of India has 32 out of 13 while Radio City has 20 out of 11. Dainik Bhaskar and BAG Films have 17 and 10 out of top 4 towns. Zee has 8, Midday has 7 and Hindustan Times has four radio stations.

It is also interesting to note that there are many newspaper publishers who own stake in FM radio broadcasting. Jagran Prakashan owns channel Radio Mantra, while Midday Multimedia owns Radio One. Similarly, Radio Fever belongs to Hindustan Times. Times of India has the ownership of Radio Mirchi. India Today owns Radio Today and Radio Meow and Dainik Bhaskar has My FM. Similarly, publications from South like Dinakaran and Malayala Manorama own Suryan FM and Manorama Radio respectively. Publications from East also do not lag behind. Ananda Bazar Patrika owns Radio Today and Radio Meow. Similarly, publications from South like Dinakaran and Malayala Manorama own Suryan FM and Manorama Radio respectively. Publications from East also do not lag behind. Ananda Bazar Patrika owns Radio Today and Radio Meow.

**Radio Industry’s Projected Growth**

There is no denying that radio has the widest reach and coverage of all the mass media. Radio is accessible to almost the entire Indian population as the number of radio sets is over 13.20 crores in the country. Out of this, 7.8 crore are FM receivers. The geographical coverage of radio is 98.3 per cent. It means the coverage is nationwide. Of this percentage, 31 per cent belongs to AIR’s FM stations. The coverage of private FM stations is a bare 9 per cent. This has been revealed in a Working Group Report of the 11th Five year plan (2007-12) for the Ministry of Information and Broadcasting during 2007.

According to FICCI-Price Waterhouse Cooper Report titled as ‘The Indian Entertainment and Media Industry 2007,’ the radio industry was valued at ₹30 crore in 2005 and growing at 32 per cent per annum and was estimated to expand to ₹120 crore by 2010. The prospects of its growth have increased manifold due to the Indian economy’s liberalization and foreign investment in radio broadcasting.

Since FDI (Foreign Direct Investment) up to 20 per cent in an Indian company has now been allowed. BBC Worldwide, Virgin Radio and Astro have tied up with Radio Midday, Radio Today and HT Media respectively. With licenses for as many as 338 FM radio stations in 91 cities of India, the stability and steady growth of radio appears to be an inevitability. It is evident from the fact that Times of India group or Bennet Coleman and Company Ltd. (BCCL) which owns 32 FM stations in the name of Radio Mirchi around the country, acquired the London based Virgin Radio network. There can be no better sign of the future growth of Indian FM Radio.

This has been indicated by the growth in number of FM Radio stations. In 2004, there were only ten radio stations. The number remained static the next year. In 2006, it went up to 26 but the next year it went up to whopping 281 and further rose to 338 in 2008.
As per the Government records until 2016:

In India there were 243 operational FM Radio channels as on 10.03.2016. Out of which 32 FM Radio channels were coming under ‘A+’ category of City, 39 FM Radio channels were coming under ‘A’ category of City, 51 FM Radio channels were coming under ‘B’ category of City, 103 FM Radio channels were coming under ‘C’ category of City and 18 FM Radio channels were coming under ‘D’ category of City as on 10.03.2016. The above said 5 categories of City, viz., A+, A, B, C and D were accounted for 13.2%, 16%, 21%, 42.4% and 7.4% respectively of All India (243) operational FM Radio channels as on 10.03.2016.

In category ‘A+’ City, there were 4 Cities named Chennai, Delhi, Kolkata and Mumbai; which had 8, 8, 9 and 7 operational FM Radio channels respectively as on 10.03.2016. In category ‘A’ City, there were 9 Cities named Ahmedabad, Bengaluru, Hyderabad, Jaipur, Kanpur, Lucknow, Nagpur, Pune and Surat; which had 5, 7, 4, 5, 3, 3, 4, 4 and 4 operational FM Radio channels respectively as on 10.03.2016.

As per the Media Research Users Council (MRUC) (2017 data) presented in a Brand Equity report:

As per MRUC, nearly 20 crore people in India listen to FM radio every month, evenly split between urban and rural areas. Radio listenership grew by 13% in urban areas since the last research in 2014.

As per a report of Live Mint (2018):

The industry is expected to grow at a compounded annual growth rate of 16.1% between 2016 and 2021 and is projected to be a Rs 4,780 crore industry by 2021, according to another report titled ‘Media for the masses: The promise unfolds’ by consulting firm KPMG and lobby group Federation of Indian Chambers of Commerce and Industry.

As per another report on Financial Express (2017), ‘At ₹ 2,300 crore, we (radio industry) comprise about 5% of the broadcasting sector in India.’ (sic)

A few challenges have come up for the sector in the form of deduction in the internet rates and the subsequent rise of video as well as audio streaming services. But there are still the followers of the radio medium who tune in for fuss free music, infotainment as well as for their favourite radio announcers.

Check Your Progress

1. Which committee recommended promoting local radio for education and development?
2. When did the Government of India open up the FM radio in India?
3. When did AIR inaugurate its External Services Division?
4. Mention the gist of judgement that Supreme Court of India pronounced regarding the airwaves in 1995.
10.5 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. The Verghese Committee (1978) recommended a franchise system for promoting local radio for education and development.

2. The Government of India opened up FM radio in 2002 and 17 Campus Radio Stations came in quick succession in different parts of the country.

3. AIR inaugurated its External Services Division in 1939 with a broadcast in Pushtu.

4. In 1995, the Supreme Court of India pronounced a judgement which stated that, ‘the airwaves are public property’ and thus, could not be a monopoly of the government or the private businesses.

10.6 SUMMARY

- An interesting development in recent years has been the setting up of local radio stations in different regions of the country. The Verghese Committee (1978) recommended a franchise system for promoting local radio for education and development.

- The need for local/community radio, using FM radio technology, was discussed and accepted during the second plan period (1982-87). It was proposed that 73 districts out of a total of more than 500 launch local broadcast stations by 1992. Each local station was to have a reach of around 100 kilometres, and the thrust of the programmes was to be on indigenous folk formats and participation of local people. The proposal appears to have been captured by the takeover of FM channels by commercial broadcasters.

- Several NGO’s used local radio to further their development activities. Chetana (Kolkata) and Ravi Bharati (Patna), for instance, record their programmes on adult education, in the field using local talents. The communication division of UNESCO actively supports such endeavours in India and other countries. Community radio has perhaps been most successful in South Africa where religious and social action groups use low-cost radio stations involving local communities in promoting development at the grassroots level.

- The metros and other centres broadcast programmes for schools. There are more than 7 lakh schools in India. Of these, only 20,000 schools own radio sets. Of these 20,000, only 40 per cent school switch on their radio sets more or less regularly. A handful of these schools show broadcasts on their time tables.
The Government of India opened up FM radio in 2002 and 17 Campus Radio Stations came up in quick succession in different parts of the country. These included university campuses such as Indira Gandhi National Open University (IGNOU), Jamia Millia Islamia, Pune and Annamalai universities and national campuses like Film and Television Institute of India (FTII), SR Film and Television Institute (SRFTI) and Indian Institute of Mass Communication (IIMC).

Some of the services of AIR are the following: National Service, Regional Services, Vividh Bharati Services, and External Service.

Private radio channels in India go for Frequency Modulation (FM) broadcasts.

It was 1977 – a tumultuous year in political history of India when FM broadcasts were launched in Chennai.

It is, however, just a coincidence that music video channels like Channel V and MTV were launched on Star TV at the same time.

When the deal was done, All India Radio charged a fee of Rs. 3000 per hour, but the private companies who bought the slot charged advertisers Rs. 250-300 for a ten-second commercial.

The Supreme Court gave a verdict in 1995 that ‘the airwaves are public property’, and therefore could not be the monopoly of either government or business.

In early 2006, as many as 338 licenses for FM stations in 91 cities were auctioned off to the highest bidders – all private companies that were allowed to get up to 20 per cent FDI.

The radio industry works closely hand in hand with two bodies. One of these is Phonographic Performance Ltd and the other one is Indian Performing Rights Society (IPRS).

It is also interesting to note that there are many newspaper publishers who own stake in FM radio broadcasting.

10.7 KEY WORDS

- **Community radio**: It is a model of radio broadcasting which caters to only a specific geographic community and communities of interest.

- **Vividh Bharati**: It is a service of AIR to provide ‘light entertainment to listeners.’
10.8 SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions
1. Write a short note on community/local radio in India.
2. Briefly explain the role of campus and school radio in India.

Long Answer Questions
1. Discuss the different services of the AIR.
2. Describe the entry of private FM radio stations in India.

10.9 FURTHER READINGS


Websites
https://www.thehindu.com/opinion/op-ed/is-radio-relevant-in-the-21st-century/article22423373.ece
UNIT 11 ASPECTS OF SOUND AND RECORDING

11.0 INTRODUCTION

Sound files need to be edited before they are encoded. The most common forms of sound editing are the removal of silence and noise and normalization of the volume so that all sounds may play at similar levels. Sound files are edited in uncompressed formats (PCM, WAV or AIFF format). If the sound is already in MP3 format, it is converted into a WAV format for being edited and then converted back to MP3. This unit discusses the various facets of sound editing software and application of sound in studio formats.

11.1 OBJECTIVES

After going through this unit, you will be able to:

• Understand the use of various kinds of sound editing software
• Analyse the general audio/video editors
• Discuss the use of various kinds of sound editing utilities
• Describe the application of sound in studio formats
• Know about the different audio formats
11.2 INTRODUCTION OF VARIOUS SOUND RECORDING SOFTWARES

NOTES

Sound editing involves converting a sound into digital format and changing it to a desired format with the help of relevant hardware and software. There are various sound editing software, which make these tasks easy to accomplish, a few which are commonly used, are discussed here along with some important features.

11.2.1 Sound Edit

This is one of the earliest software available for sound editing. Its main features are as follows:
- Initially designed for Mac, soundedit grew into an adequate application for quick time audio, CD quality tracks, and low resolution multimedia audio.
- Multiple tracks can be edited and recorded; Quick Time audio tracks can also be edited.
- Special effects can also be applied and loops for multimedia background tracks can be created.
- For downloading and streaming formats, highly compressed shockwave audio files for Web can be created.

Figure 11.1 depicts the uses of Sound Edit.

![Fig. 11.1 Uses of Sound Edit](image)

11.2.2 Sound Designer

This was also designed for Mac for digital audio production. Its main features are as follows:
- It is useful for editing digital master recordings for CD.
- It has precise and flexible editing tools with markers, memory location and memory loop support.
- Multi track recording or audio for video studio can be done.

The screenshot for Sound Designer is as follows.
11.2.3 Wave Convert for Mac and PC

It is an essential tool for multimedia audio producers. It shows the following features:

- With superior sample rate and bit-deep conversion algorithms, it allows batch process audio conversion.
- It can make cross platform compatible files.
- It can dither down the audio of Quick Time movie and save it back into the movie without recompressing the video-track.

The screenshot of Wave Convert is as follows:

![Wave Convert Software](image-url)
11.2.4 Sound Forge

Developed by Sonic Foundry, it is the best software for desktop audio production. Its main features are as follows:

- It is highly developed to work successfully with a wide variety of sound cards, including the standard Sound Blasters—Compatibles, Turtle Beach’s Tahiti and Digital Audio Labs Card D system.
- It supports Microsoft Active X format plug-ins and accepts third party plug-ins from Wave and others.
- It is a multipurpose application capable of recording and editing audio, media encoding and effects of processing.
- It provides CD and video writing support as a built-in service. It is also capable of saving files in various formats such as MP3, WAV, RM, WMA and AVI.

The screenshot of Sound Forge is as follows:

![Fig. 11.4 Sound Forge Software](image)

11.2.5 Other General Audio Editors

A list of other general audio editors is given as follows:

- **Audacity (current)**: It is a cross-platform editor that provides some impressive features.
- **Audio Cutter Cinema**: It is a great tool to process audio for those who demand more and better.
- **DAP**: It is Richard Kent’s digital audio processor/editor with XForms GUI.
- **Eisenkraut (current)**: It is an audio editor that provides playback with the help of SuperCollider3.
• **GLAME**: It is both a sound editor and an audio processor.
• **GNU sound**: It is a sound editor that provides support to 24/32, 16 and 6-bit samples and to multiple tracks.
• **JaWavedit**: It is created by using Java and is a WAV file editor.
• **Jokosher (current)**: It is a non-linear, multi-track non-linear editor that uses Python.
• **KWave**: It is created by Martin Wilz and is an extremely effective sound file editor.
• **Lamp**: It is Linux’s sound file editor and is short for Linux Audio Mangling Project.
• **LAoE**: It is Olivier Gëumann’s ‘Layer-based Audio Editor’. It needs Java 2.
• **Marlin**: It is a sample editor for GNOME.
• **MiXViews**: It is a sound file editor as also an analysis/synthesis engine.
• **Nightingale**: It is used for cutting up big WAV files editor.
• **ReZound**: It is used primarily for use with the Linux OS, this is a graphical audio file editor.
• **SndBite (current)**: This audio editor helps cut up huge files into small files.
• **Snuggles**: It is WAV/MP3 editor based on curses.
• **Studio**: It is lightweight and requires Tcl/Tk.
• **Swami (current)**: It is a new version of **Smurf** which is a Soundfont editor.
• **SweeP (current)**: Developed by Conrad Parker, it is a soundfile editor.
• **TAON, or The Art Of Noise**: It is a GTK-based soundfile editor.
• **Wave Mixer**: It was developed by Raoul Hecky et al. and is a multitrack wave editor, which is hassle free to use.
• **WaveSurfer**: It is a soundfile editor and requires the Snack extensions.
• **Wave Tools**: It is a suite that comprises small command-line programs for working with WAV-format soundfiles.
• **Xforge**: It is a new soundfile editor project for X11 and **Motif/LessTif**.
• **XWave**: It is a basic sound file editor.
• **aPeStudio**: It is a sound file processor/editor with FLTK GUI.
• **ecawave**: It is a sound file editor from Kai Vehmanen who also authored ecasound.
• **mbWaveEdit (current) from Magnus Hjorth**: It is sound file editor.
NOTES

11.2.6 Audio/Video Editors

The following is the list of general A/V editors.

- Blender: It is an open-source 3D animation renderer with audio track support.
- Broadcast 2000: It is the lone free non-linear realtime video/audio editing system for Linux.
- Cinelerra: It is an improved successor of Broadcast2000.
- Linux Audio/Video Tools: It is a program suite for both recording and playing back video and audio under Linux using the Iomega Buz.
- MainActor: It is a commercial suite for non-linear multi-media and video editing.
- Transcode: Created by Dr Thomas Östreich, it is a utility for audio/video stream processing.

Audio and Video Utilities

Free MP3 Recorder is a convenient software for recording audio to MP3 or WAV. It lets you record any sound like that from a CD, online radio, music from Winamp or Real Player etc., game and video sounds, chats conducted over a microphone, telephone conversations, to name a few. This captured audio can be MP3 encoded on the fly with no requirement of temporary files. The screenshot for MP3 Recorder 1.0 is as follows:

Fig. 11.5 MP3 Recorder 1.0 Software
Important audio and video utilities are discussed as follows:

1. **Audacity**

   Audacity, a free audio editor, is capable of live audio recording via a mixer or microphone. The main features of this software are as follows:
   - It can digitize recordings from cassette tapes, vinyl records or minidiscs.
   - When used along with some sound cards, it is capable of capturing streaming audio.
   - It even enables you to import and edit sound files and combine these into new recordings or with existing files.
   - You can also use the recording made with this software in various formats, use it easily for editing by using cut, paste, copy delete etc.
   - It lets you remove constant background sounds from your files like those of humming and hissing.

   The software lets you edit and record all 16-bit, 24-bit, and 32-bit (floating point) samples.
   - It lets you record at up to 96 KHz.
   - It works with various Windows OS like Windows 2003/XP/98/2000/ME.

   The screenshot of Audacity is as follows:

   ![Audacity Software](image)

   **Fig. 11.6 Audacity Software**
You will learn more about Audacity in Unit 14.

2. **Soliton II**

Soliton II is a sound editor that is available for free.

It offers all the standard editing facilities for audio. Some of these are:

- Special effects
- Fade-out
- Normalize
- Fade out

3. **Audio Video**

123 Audio Video lets you merge into a single file those audio/video files that are divided into a number of parts. This can be accomplished in three steps.

1. Select the files to merge
2. Specify the order in which to merge
3. Merge all the files into one file

4. **Clip**

MP3Clips helps cut or split MP3 files easily with no loss of functionality or quality based on:

- Time lengths
- Frame boundaries

This software is capable of splitting files which are very small and even those that are extremely large. It has the capacity to create limitless number of tracks and even grab time positions from Winamp.

5. **StationRipper 1.13**

StationRipper helps record from Internet radio stations. It helps you obtain a list of existing Shoutcast stations and begin their recording. Each song played by a station will be saved as an individual MP3 file. This software lets you record 200 streams at a time. It provides the facility of Memory Recording where a track is kept of all your downloaded songs and copying the final song file to your music library. The advantage of this software are:

- If a song is ever recorded again, it will be skipped.
- Also, the software remembers your recorded stations.
- It lets you re-record them with ease.
- With this software, you can easily track your recorded music, and even hear a station being recorded with a single mouse click.
Aspects of Sound and Recording

This software requires an MP3 player or Winamp.

6. StepVoice Recorder 1.0 beta (last freeware version)
   - StepVoice Recorder supports real-time recording and also the MP3 file format. It has the facility to record from any sound source. With just a change in the recording bit rate you can change the sound quality from phone (3.5–7.0 Mb/hour) to CD (3.5–7.0 Mb/3 minutes).
   - Its features include:
     - It provides support to record from any sound source, such as the Internet audio, media player or even a microphone.
     - It supports the MP3 file format.
     - It provides you to directly encode MP3 with no need to a temporary WAV file.
     - It has an auto file-naming system.
     - Its interface is user friendly.
     - It is supported on Windows versions such as XP, 2000, ME and 9x.
   Here is the screenshot of this software.
7. **Audio Editor Pro**

*Audio Editor Pro* is multifunctional visual *audio editing software* to be used with MS Windows. Its main features are as follows:

- It lets you manipulate audio data to:
  - Shows an audio file as a waveform image
  - Perform filtering
  - To apply various audio effects
  - Format conversion

- It provides support to all main sound formats.
- It comprises over twenty sound effects and has a total of six filters.
- It has support for the following formats:
  - Windows Media 9
  - MP3 VBR codec
  - CDDB and ID3 tag

### 11.3 APPLICATION OF SOUND IN STUDIO FORMATS

Audio files are stored in audio formats on various devices like computer, mobile, music pods, tabs etc. Some formats like mp3, wma are very common and are used worldwide. These formats can either be compressed or uncompressed formats.

**Uncompressed Audio Formats**

These are heavy bulky files which acquire a considerable space on the device or storage disc. The biggest advantage of this format is that the quality stays intact irrespective of the device or drive it is shifted to. One would not find any change or alteration in the quality of the sound or audio clip while using the uncompressed format. Repeated processing and encoding also doesn’t lead to any deterioration in the quality of audio. Formats like WAV or AIFF are examples of uncompressed audio formats.
Compressed Audio Format

These are small files which are most appropriate for digital data as it doesn’t require much space on the drive. They are portable and convenient to use but the quality might degrade on frequent use and switching from one device to another. There are two types of compressed formats namely lossless compressed audio format and lossy compressed audio format.

Lossless Compressed Audio Format

They are compressed audio files but there is no deterioration in the quality of the sound file during compression. For example file format FLAC (Free Lossless Audio Codec) is a lossless compressed audio file. FLAC files are very space efficient and are six times larger than MP3 files and half the size of a CD but have the same impact in the audio quality.

Lossy Compressed Audio

This audio format is a compressed digital audio formats but are known to get rid of some information and codes so as to squeeze the size of the file. There is a considerable loss in the file formats and causes the quality to dip down. So, these formats are low quality audio formats that are space efficient. The most classic example being of MP3.

Audio Studio

All the audio file formats are conveniently used by radio studios. However, the radio station frequency, transmission towers and area of relay all are instrumental in deciding the quality and format of the audio to be used.

The standard WAV files are preferred by all sound engineers for mixing and later converting them to mp3 files as they require less space. However, the process of transfer from wav to mp3 diminishes all inaudible content to squeeze the sound size. Condenser microphones are used in radio stations in order to enhance the frequency response.

Different audio formats

- wav - standard audio file format used mainly in Windows PCs. Commonly used for storing uncompressed (PCM), CD-quality sound files, which means that they can be large in size - around 10MB per minute of music. It is less well known that wave files can also be encoded with a variety of codecs to reduce the file size (for example the GSM or mp3 codecs).
- mp3 - the MPEG Layer-3 format is the most popular format for downloading and storing music. By eliminating portions of the audio file that are essentially inaudible, mp3 files are compressed to roughly one-tenth the size of an equivalent PCM file while maintaining good audio quality.
• aiff - the standard audio file format used by Apple. It is like a wav file for the Mac.
• wma - the popular Windows Media Audio format owned by Microsoft. Designed with Digital Rights Management (DRM) abilities for copy protection
• aac - the Advanced Audio Coding format is based on the MPEG4 audio standard owned by Dolby. A copy-protected version of this format has been developed by Apple for use in music downloaded from their iTunes Music Store.
• Real Audio (.ra .ram .rm): Real Audio is a proprietary format, and is used for streaming audio that enables you to play digital audio files in real-time. To use this type of file you must have RealPlayer (for Windows or Mac), which you can download for free. Real Audio was developed by RealNetworks.
• MIDI - Musical Instrument Digital Interface (.mid): Short for musical instrument digital interface, MIDI is a standard adopted by the electronic music industry for controlling devices, such as synthesizers and sound cards, that emit music. At minimum, a MIDI representation of a sound includes values for the note’s pitch, length, and volume. It can also include additional characteristics, such as attack and delay time.

Check Your Progress

1. Which editing software can make cross platform compatible files?
2. Name any five audio editors.
3. What do you know about audacity?
4. What are the advantages of MP3 Clips?
5. What do you mean by uncompressed audio format?
6. What is MIDI audio format?

11.4 ANSWER TO CHECK YOUR PROGRESS QUESTIONS

1. Wave Convert for Mac and PC is a sound editing software that can make cross platform compatible files.
2. The five audio editors are as follows
   (a) Audacity
   (b) Audio Cutter Cinema
   (c) DAP
   (d) GLAME
   (e) GNoise
3. Audacity is the name of a popular audio editor and recorder software that is used to record and edit sounds. It is a cross-platform that provides some impressive features.

4. MP3Clips helps cut or split MP3 files easily with no loss of functionality or quality based on:
   - Time lengths
   - Frame boundaries

5. Uncompressed audio format are heavy bulky files which acquire a considerable space on the device or storage disc. The biggest advantage of this format is that the quality stays intact irrespective of the device or drive it is shifted to. One would not find any change or alteration in the quality of the sound or audio clip while using the uncompressed format. Formats like WAV or AIFF are examples of uncompressed audio formats.

6. MIDI or (.mid) is a short for musical instrument digital interface. MIDI is a standard adopted by the electronic music industry for controlling devices, such as synthesizers and sound cards that emit music. At minimum, a MIDI representation of a sound includes values for the note’s pitch, length, and volume. It can also include additional characteristics, such as attack and delay time.

11.5 SUMMARY

- Sound files need to be edited before they are encoded. The most common forms of sound editing are the removal of silence and noise and normalization the volume so that all sounds may play at similar levels. Sometimes, addition of fades and equalization or dynamic range compression are also desired.
- The term editing literally means necessary additions and deletions in a given data to make it presentable in a desired form.
- Sound editing involves necessary corrections and changes into sound to make it presentable as required. Sound editing involves converting a sound into digital format and changing it to a desired format with the help of relevant hardware and software.
- Some common sound editing software are:
  - Sound Edit
  - Sound Designer
  - Wave Convert for Mac and PC
  - Sound Forge
- MP3 Recorder is a free and convenient software for recording audio to MP3 or WAV. It lets you record any sound, such as sound from a CD, online radio, Winamp or Real Player, etc.
NOTES

- Audacity, a free audio editor, is capable of live audio recording via a mixer or microphone. It can digitize recordings from cassette tapes, vinyl records, or minidisks.
- 123 Audio Video lets you merge into a single file those audio/video files that are divided into a number of parts.
- MP3Clips lets you cut or split MP3 files easily based on time lengths and frame boundaries with no loss of functionality or quality. This software is capable of splitting files which are very small and even those that are extremely large.
- StationRipper enables recording from Internet radio stations.
- Audio Editor Pro is a multifunctional visual audio editing software to be used with MS Windows.
- Audio files are stored in audio formats on various devices like computer, mobile, music pods, tabs etc. Some formats like mp3, wma are very common and are used worldwide. These formats can either be compressed or uncompressed formats.
- Uncompressed audio formats are heavy bulky files which acquire a considerable space on the device or storage disc. The biggest advantage of this format is that the quality stays intact irrespective of the device or drive it is shifted to.
- Compressed audio format are small files which are most appropriate for digital data as it doesn’t require much space on the drive.
- Lossy Compressed Audio format is a compressed digital audio formats but are known to get rid of some information and codes so as to squeeze the size of the file.
- All the audio file formats are conveniently used by radio studios. However, the radio station frequency, transmission towers and area of relay all are instrumental in deciding the quality and format of the audio to be used.

11.6 KEY WORDS

- Sound File: It refers to an audio file that can be played by a computer or other electronic device.
- Sound forge: It refers to a highly developed software to work successfully with a wide variety of sound cards.
- Audacity: It is a free audio editor that is capable of live audio recording via mixer or microphone.
- Compressed File: It refers to any file that contains one or more files or directory that is smaller than their original file size.
11.7 SELF ASSESSMENT QUESTIONS AND EXERCISES

Short Answer Questions
1. What are the functions of sound editing software?
2. What are the functions of Sound Forge?
3. What is the difference between sound edit and sound designer?

Long Answer Questions
1. Discuss the characteristics and features of sound editing software?
2. Describe the functions of various audio and video utilities.

11.8 FURTHER READINGS


12.0 Introduction

The primary and foundational element of audio production especially at radio stations is sound recording. The quality of sound recording is what forms the first impression in the minds of the listeners, and this is why, all the aspects related to sound recording should be considered carefully so as to arrive at the best possible sound reproduction. You were briefly introduced to the basics of sound recording in Unit 1, in this unit, you will learn more about the applications of sound recording in radio stations.

12.1 OBJECTIVES

After going through this unit, you will be able to:

- Discuss the concept of acoustics
- Explain the sound perspectives and effects
- Discuss music as an element of sound
- Describe sound distortion and filters
12.2 APPLICATION OF SOUND RECORDING IN RADIO STATIONS

As you have learnt in Unit 1 under the ‘basics of sound recording’, the term ‘acoustics’ describes how sound behaves in an enclosed space and one could devote a lifetime to its study. On the surface, it considers the direct sound, reflections and reverberation. The sound waves travel out and strike a multitude of surfaces the floor, ceiling, walls, chairs or pews, windows, people, and so on.

Depending on the makeup of each surface being struck, a portion of that sound will be reflected back into the room, a portion will be absorbed by the material, and some of the sound may even travel through that material.

A recording studio is a facility for sound recording and mixing. Ideally, the space is specially designed by an acoustician to achieve the desired acoustic properties (sound diffusion, low level of reflections, adequate reverberation time for the size of the ambient, etc.).

Acoustics is the interdisciplinary science that deals with the study of all mechanical waves in gases, liquids, and solids including vibration, sound, ultrasound and infrasound. The application of acoustics can be seen in almost all aspects of modern studios with the most obvious being the audio and noise control industries.

There are three types of surfaces which come into play while talking about acoustics.

(i) Reflective
(ii) Absorbing
(iii) Diffusing

Fine-tuning sound quality inside a studio setting requires strategic placement of sound absorption surfaces to control reverb time and diffusion materials to control ‘placement’ of the sound energy.

Today’s state-of-the-art acoustic materials include fiber based fiber glass, cotton/polyester, foams and a variety of alternative resin-based products. Selection of the proper materials is dependent on room size, composition, building codes and desired finished appearance.

12.2.1 Sound Perspective

The sound perspective refers to the apparent distance of a sound. Clues to the distance of the source include the volume of the sound, the balance with other sounds, the frequency range (high frequencies may be lost at a distance), and the amount of echo and reverberation.

A closer sound perspective may sometimes be simulated by recording with a directional microphone which rejects sound from other directions. A more distant
Basics of Sound Recording in Radio Stations

NOTES

12.2.2 Sound Balance

Balance is the relative volume of different sound elements in a scene. Since background sound effects can usually be added separately in post-production, the best original recording of dialogue or sound effects is often the cleanest recording, with the least background noise and reverberation.

Placing the microphone close to the sound source is the best way of reducing the relative amount of reverberation in an interior recording. Quilts or other absorbent material will also help reduce reverberation of hard surfaces. Interiors that contain a lot of hard surfaces—glass, stone, metal, etc.—are said to be ‘live’ because their high reflectivity. Soft or porous materials, like carpeting, draperies and upholstered furniture, are sound deadening. As furniture is moved into an empty room, the acoustics becomes ‘dead’. Distant perspective sound contains a high ratio of reflected sound to direct sound.

Outdoors, the relative level of wind and other background noise can also be reduced by close mic placement, even when a more distant sound perspective might be preferable. (Note: the mic must also be protected from direct wind pressure.) So, the sound editor might prefer to use wild sound recorded in closer perspective or recorded somewhere else.

12.2.3 Sound Effects

Sound effects or audio effects are artificially created or enhanced sounds, or sound processes used to emphasize artistic or other content of films, television shows, live performance, animation, video games, music, or other media. In motion picture and television production, a sound effect is a sound recorded and presented to make a specific storytelling or creative point without the use of dialogue or music.

The term often refers to a process applied to a recording, without necessarily referring to the recording itself. In professional motion picture and television production, sound effects are sometimes simulated in post-production by processing the sound and mixing in other sounds.

In recording sound for film, you usually select a sound perspective to match the picture with which it will be used.

- **Direct sound**: Direct sound issues from the source itself, such as those frequencies coming from an actor’s mouth. When a person is close to us, we hear essentially direct sound including low-frequency chest tones. As the person moves farther away, we hear more of the reflected sound. Close perspective sound contains a high ratio of direct sound to reflected sound.

- **Reflected sound**: Reflected sound is produced by the direct sound bouncing off the walls, floor etc. Reflected sound is much more complex in character than direct sound because the surfaces are at different distances from the source and have widely varying reflective properties.
production, dialogue, music, and sound effects recordings are treated as separate elements. Dialogue and music recordings are never referred to as sound effects, even though the processes applied to them, such as reverberation or flanging effects, often are called ‘sound effects’.

The most realistic sound effects originate from original sources; the closest sound to machine-gun fire that we can replay is an original recording of actual machine guns. In music and film/television production, typical effects used in recording and amplified performances are:

- **Diegetic**: Sound whose source is present on the scene or whose source is implied to be present by the action. For e.g., voices of characters, sounds made by objects in the story, music represented as coming from instruments in the story space.
- **Non diegetic**: Sound whose source is neither in the story nor has been implied to be present in the action. For e.g. Narrator’s commentary, sound effects which is added for the dramatic effect, mood music
- **Echo**: To simulate the effect of reverberation in a large hall or cavern, one or several delayed signals are added to the original signal. To be perceived as echo, the delay has to be of order 50 milliseconds or above. Short of actually playing a sound in the desired environment, the effect of echo can be implemented using either digital or analog methods. Analog echo effects are implemented using tape delays and/or spring reverbs.
- **Flanger**: To create an unusual sound, a delayed signal is added to the original signal with a continuously-variable delay (usually smaller than 10 ms). This effect is now done electronically using DSP, but originally the effect was created by playing the same recording on two synchronized tape players, and then mixing the signals together.
- **Phaser**: Another way of creating an unusual sound; the signal is split, a portion is filtered with an all-pass filter to produce a phase-shift, and then the unfiltered and filtered signals are mixed. The phaser effect was originally a simpler implementation of the flanger effect since delays were difficult to implement with analog equipment. Phasers are often used to give a ‘synthesized’ or electronic effect to natural sounds, such as human speech.
- **Chorus**: A delayed signal is added to the original signal with a constant delay. The delay has to be short in order not to be perceived as echo, but above 5 ms to be audible. If the delay is too short, it will destructively interfere with the un-delayed signal and create a flanging effect. Often, the delayed signals will be slightly pitch shifted to more realistically convey the effect of multiple voices.
- **Equalization**: Different frequency bands are attenuated or boosted to produce desired spectral characteristics. Moderate use of equalization (often abbreviated as ‘EQ’) can be used to ‘fine-tune’ the tone quality of a
Basics of Sound
Recording in Radio Stations

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- **Filtering**: In the general sense, frequency ranges can be emphasized or attenuated using low-pass, high-pass, band-pass or band-stop filters. Band-pass filtering of voice can simulate the effect of a telephone because telephones use band-pass filters.
- **Overdrive**: Effects such as the use of a fuzz box can be used to produce distorted sounds, such as for imitating robotic voices or to simulate distorted radiotelephone.
- **Pitch shift**: Similar to pitch correction, this effect shifts a signal up or down in pitch. For example, a signal may be shifted an octave up or down. This is usually applied to the entire signal and not to each note separately.
- **Time stretching**: The opposite of pitch shift, that is, the process of changing the speed of an audio signal without affecting its pitch.
- **Resonators**: It emphasizes harmonic frequency content on specified frequencies.
- **Robotic voice effects**: These are used to make an actor’s voice sound like a synthesized human voice.
- **Synthesizer**: It helps in generating artificially almost any sound by either imitating natural sounds or creating completely new sounds.
- **3D audio effects**: It places sounds outside the stereo basis.
- **Reverse echo**: It is a swelling effect created by reversing an audio signal and recording echo and/or delay whilst the signal runs in reverse. When played back forward the last echoes are heard before the effected sound creating a rush like swell preceding and during playback.

12.2.4 Music

Music is an art form whose medium is sound. Common elements of music are pitch (which governs melody and harmony), rhythm (and its associated concepts tempo, meter, and articulation), dynamics, and the sonic qualities of timbre and texture. You will learn more about music in later units.

**Elements of music**

- Pitch
- Rhythm
- Dynamics
- Timbre
- Texture
Kinds of Music

The development of music among humans must have taken place against the backdrop of natural sounds such as birdsong and the sounds other animals use to communicate. Prehistoric music is the name which is given to all music produced in preliterate cultures.

There are many kinds of music. Here is a list of some different styles of music:

- **Rap**: Rap is a fast singing rhyming kind of music. It is the latest kind of music.
- **Country**: Not a lot of kids listen to country music. It’s a typical old kind of music.
- **Rock**: Rock is a kind of music that you will usually use drums, keyboards, and electric guitars. Rock singers sing very loud.
- **Disco**: A lot of kids liked this music years ago. People take disco and mix it with rap.
- **Pop**: Pop is like a regular kind of music. Kids listen to it. Sometimes when you listen to pop, you can hear two of every kind of instrument from each family of instruments.

Families of Musical Instruments

- **String**: These are instruments that have strings. All you have to do is pluck the strings. They are made of different materials.
  Examples of string instruments: Harp, Guitar, Cello, Viola, Violin, Mandolin, Eass.
- **Woodwinds**: These are instruments that you blow in and they make music. Each instrument has a lot of different holes on top to hold so you can make music.
  Examples of woodwind instruments: Flute, Clarinate, Brass Clarinate, Bassoon, Saxophone, English horn, Piccolo, Recorder.
- **Brass**: These are instruments that are made from brass. Most of them are long. They make different tones. They have buttons of slides to make noises. You have to blow in them.
  Examples of brass instruments: Trumpet, Tuba, Bugle, Trombone, French Horn, Cornet, Sousaphone, Flugel Horn, Bariton Horn.
- **Percussion**: These are instruments that you have to hit to make different music. Percussion instruments are like a drum and piano. Some Indians use drums and drums are percussion instruments.
  Examples of percussion instruments: Drums, Piano, Kettledrum, Chimes, Snare Drums, Vibraphone, Gong, Sleigh Bell, Cymballs, Triangle.
12.2.5 Distortion

Distortion can occur at almost any point in the audio pathway, from the microphone to the speaker. The first priority is to find out exactly where the problem is. Ideally, you would want to measure the signal level at as many points as possible, using a VU (Volume Unit) meter or similar device. Generally speaking, you should keep the level below about 0dBu at every point in the pathway.

If you can’t measure the signal level, you’ll have to do some deducing. Follow the entire audio pathway, beginning at the source (the source could be a microphone, tape deck, musical instrument, etc).

Here are some things to look for:

- Is the distortion coming from a microphone? This could be caused by a very loud noise being too close to the mic. Try moving the mic further away from the noise source.
- Are you seeing any ‘peak’ or ‘clip’ lights on any of your equipment? These are warnings that a signal level is too high.
- Are any volume or gain controls in your system turned up suspiciously high? Are there any obvious points where you could drop the level?
- Are your speakers being driven too hard? If you have an amplifier which is pushing the speakers beyond their design limits, then be careful - you may well find that the distortion becomes permanent.
- If the distortion is coming from occasional peaking, consider adding a compressor.
- Could the distortion be caused by faulty equipment?
- Is the problem really distortion? There are some other unpleasant noises which could be confused with distortion; for example, the grousing sounds made by a dodgy cable connection or dirty volume knob.

12.2.6 Filters

An audio filter is a circuit, working in the audio frequency range that processes sound signals. Many types of filters exist for applications including graphic equalizers, synthesizers, sound effects, CD players and virtual reality systems.

In its simplest form, an audio filter is typically designed to pass some frequency regions through unattenuated while significantly attenuating others.

- **High-Pass Filter**, or HPF, is a filter that passes high frequencies well but attenuates (i.e., reduces the amplitude of) frequencies lower than the filter’s cutoff frequency. The actual amount of attenuation for each frequency is a design parameter of the filter. It is sometimes called a low-cut filter or bass-cut filter.
- **Low-Pass Filter** is a filter that passes low-frequency signals but attenuates (reduces the amplitude of) signals with frequencies higher than the cut-off.
frequency. The actual amount of attenuation for each frequency varies from filter to filter. It is sometimes called a high-cut filter, or treble cut filter when used in audio applications. A low-pass filter is the opposite of a high-pass filter, and a band-pass filter is a combination of a low-pass and a high-pass.

Low-pass filters exist in many different forms, including electronic circuits (such as a hiss filter used in audio), digital filters for smoothing sets of data, acoustic barriers, blurring of images, and so on. The moving average operation used in fields such as finance is a particular kind of low-pass filter and can be analysed with the same signal processing techniques as are used for other low-pass filters. Low-pass filters provide a smoother form of a signal, removing the short-term fluctuations, and leaving the longer-term trend.

- **Band-Pass Filter** is a device that passes frequencies within a certain range and rejects (attenuates) frequencies outside that range. An example of an analogue electronic band-pass filter is an RLC circuit (a resistor–inductor–capacitor circuit). These filters can also be created by combining a low-pass filter with a high-pass filter.

- **Linear Filter** applies a linear operator to a time-varying input signal. Linear filters are very common in electronics and digital signal processing (see the article on electronic filters), but they can also be found in mechanical engineering and other technologies.

  They are often used to eliminate unwanted frequencies from an input signal or to select a desired frequency among many others. There are a wide range of types of filters and filter technologies. Regardless of whether they are electronic, electrical, or mechanical, or what frequency ranges or timescales they work on, the mathematical theory of linear filters is universal.

- **Equalization (EQ) Filter** is a filter, usually adjustable, designed to compensate for the unequal frequency response of some other signal processing circuit or system. In audio engineering, the EQ filter is more often used creatively to alter the frequency response characteristics of a musical source or a sound mix.

  An EQ filter typically allows the user to adjust one or more parameters that determine the overall shape of the filter’s transfer function. It is generally used to improve the fidelity of sound, to emphasize certain instruments, to remove undesired noises, or to create completely new and different timbres.

  Equalizers may be designed with peaking filters, shelving filters, band pass filters, or high-pass and low-pass filters. Dynamic range circuitry can be linked with an EQ filter to make timbre changes only after a signal passes an amplitude threshold, or to dynamically increase or reduce amplitude based on the level of a frequency band. Such circuitry is involved in de-essing and in pop-filtering.
Check Your Progress

1. What is the selection of proper material for studio acoustics dependent on?
2. What does the close perspective sound contain?
3. What is never referred to as sound effects even though the processes applied to them are?
4. State the opposite of pitch shift.
5. List the common elements of music.
6. Define a band-pass filter.

12.3 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. Selection of the proper materials is dependent on room size, composition, building codes and desired finished appearance.
2. Close perspective sound contains a high ratio of direct sound to reflected sound.
3. Dialogue and music recordings are never referred to as sound effects, even though the processes applied to them, such as reverberation or flanging effects, often are called ‘sound effects’.
4. Time stretching is the opposite of pitch shift, that is, the process of changing the speed of an audio signal without affecting its pitch.
5. Common elements of music are pitch (which governs melody and harmony), rhythm (and its associated concepts tempo, meter, and articulation), dynamics, and the sonic qualities of timbre and texture.
6. Band-Pass Filter is a device that passes frequencies within a certain range and rejects (attenuates) frequencies outside that range. An example of an analogue electronic band-pass filter is an RLC circuit (a resistor–inductor–capacitor circuit). These filters can also be created by combining a low-pass filter with a high-pass filter.

12.4 SUMMARY

- The term ‘acoustics’ describes how sound behaves in an enclosed space and one could devote a lifetime to its study.
- A recording studio is a facility for sound recording and mixing. Ideally, the space is specially designed by an acoustician to achieve the desired acoustic properties (sound diffusion, low level of reflections, adequate reverberation time for the size of the ambient, etc.).
There are three types of surfaces which come into play while talking about acoustics: reflective, absorbing, diffusing.

Fine-tuning sound quality inside a studio setting requires strategic placement of sound absorption surfaces to control reverb time and diffusion materials to control ‘placement’ of the sound energy.

The perspective refers to the apparent distance of a sound. Clues to the distance of the source include the volume of the sound, the balance with other sounds, the frequency range (high frequencies may be lost at a distance), and the amount of echo and reverberation.

Balance is the relative volume of different sound elements in a scene. Since background sound effects can usually be added separately in post-production, the best original recording of dialogue or sound effects is often the cleanest recording, with the least background noise and reverberation.

Sound effects or audio effects are artificially created or enhanced sounds, or sound processes used to emphasize artistic or other content of films, television shows, live performance, animation, video games, music, or other media. In motion picture and television production, a sound effect is a sound recorded and presented to make a specific storytelling or creative point without the use of dialogue or music.

Music is an art form whose medium is sound. Common elements of music are pitch (which governs melody and harmony), rhythm (and its associated concepts tempo, meter, and articulation), dynamics, and the sonic qualities of timbre and texture.

Distortion can occur at almost any point in the audio pathway, from the microphone to the speaker. The first priority is to find out exactly where the problem is. Ideally, you would want to measure the signal level at as many points as possible, using a VU (Volume Unit) meter or similar device. Generally speaking, you should keep the level below about 0dBu at every point in the pathway.

An audio filter is a circuit, working in the audio frequency range that processes sound signals. Many types of filters exist for applications including graphic equalizers, synthesizers, sound effects, CD players and virtual reality systems.

In its simplest form, an audio filter is typically designed to pass some frequency regions through unattenuated while significantly attenuating others.

12.5 KEY WORDS

- Sound perspective: It refers to the apparent distance of a sound.
- Sound balance: It is the relative volume of different sound elements in a scene.
• **Sound effects or audio effects:** It refers to the artificially created or enhanced sounds, or sound processes used to emphasize artistic or other content of films, television shows, live performance, animation, video games, music, or other media.

• **Audio filter:** It is a circuit, working in the audio frequency range that processes sound signals.

### 12.6 SELF ASSESSMENT QUESTIONS AND EXERCISES

#### Short Answer Questions
1. Write a short note on acoustics.
2. What is sound perspective?
3. How is sound balance relevant to recording?
4. Write a short note on sound distortion.

#### Long Answer Questions
1. Describe the different types of sound effects which are used in sound recording.
2. Explain the concept of music, its kinds, and the different instruments.
3. Discuss the use of filters in sound recording and its various types.

### 12.7 FURTHER READINGS


UNIT 13 SOUND SPECTRUM AND RECORDING

13.0 INTRODUCTION

Sound can be defined as pressure waves in air. It cannot be heard in the absence of air; that is, it cannot be heard in space. Digital audio is a format that can create sound; it can also be defined as a tool that connects machines like computers to the audible environment. The unit used to measure the intensity of sound is known as decibel (dB). Sound is measured as amplitude and frequency. Audio recorded with physical representation of original sound encoded or a substrate like magnetic field of a magnetic tape is an analog audio. Analog format has virtually been replaced by the digital format. The process of conversion of an analog signal to a digital signal is known as digitizing. In this unit, you will study about the various aspects of sound, such as its measurement, frequency, etc. Analog and digital audio formats are also described in this unit.

13.1 OBJECTIVES

After going through this unit, you will be able to:

- Describe what sound is and how it is measured
- Explain the history of sound recording
- Discuss the characteristics of different recording methods
- Differentiate between audio and digital audio
13.2 SOUND SPECTRUM AND FREQUENCIES

To understand something better, measurement is necessary. It is necessary to measure sound for the following reasons:

- When sound is measured a specific criterion becomes more clear and understandable and also some means to better control the criterion are achieved.
- Measuring sound helps accurately and scientifically control all unwanted sounds.
- The intensity of sound is the key to a person’s auditory capabilities.
- If ears are exposed to extremely high sound levels, they can lose their sensitivity or they can even be damaged permanently. Therefore measuring sound is necessary to determine the level of sound pollution.

When you hear a sound, it means a change in the air pressure has occurred. If there is silence, it means the air pressure is constant. The unit used to measure the intensity of sound is known as decibel (dB).

Some common sounds in dB scale are as follows:

- The smallest audible sound (almost silence) = 0 dB
- Whisper = 15 dB
- Normal conversation = 60 dB
- Car horn = 110 dB
- Sound of a jet = 120 dB
- A firearm going off = 140 dB

The normal audible harmless intensity limit for human ears is 80 dB. A sound higher than 80 dB is capable of damaging the human eardrum, leading to the loss of hearing.

Sound is measured as amplitude and frequency:

- Frequency is the measure of the number of sound vibrations per second. A healthy ear can catch sounds of 20 hertz or 20 cycles per second right up to 20,000 hertz. To understand the sound levels, here are some parallels: the lowest A key of a piano has the frequency of 27 Hertz while the middle C key has a frequency of 262 Hertz. The piano’s highest key has a frequency of 4186 Hertz.
- Amplitude is a measure of how forceful the wave is. It is measured in dBA of sound pressure. Zero dBA signifies the softest sound that can be heard by the human ear. Normal level of a spoken word is approximately 65 dBA. The blaring sound of a rock concert is around 120 dBA.
Frequency

When an object vibrates, the movement from its initial position to its maximum displacement in one direction then movement to the maximum displacement point in the opposite direction and finally to its initial position again is known as one ‘cycle’. The time to complete one cycle is called a ‘period’ and number of cycles per period is called as ‘frequency’. It means frequency can be calculated as the number of complete oscillations per second.

The symbol for frequency is ‘\( f \)’ and its unit of measurement is hertz (Hz). This was formerly called cycles per second (cps or c/s). The frequency of one thousand cycles per second is referred to as a kilohertz (kHz).

Frequencies lying between a maximum of 20,000 and minimum of 20 Hz are audible to the human ear. So, the range of hearing or audible range for the human ear is 20 to 20,000 Hz.

While frequency is measurable and is an acoustic measure, the term pitch, associated with sound, is subjective and what the human mind perceives as frequency. In other words, pitch is psychoacoustic in nature. In other words, pitch is the perceived frequency of a note. Pitch describes what one thinks one has heard but it does not mean that it is always same as the sound that was made. Scientifically, pitch corresponds to the frequency of the wave.

The term sampling rate refers to the number of times a sound waveform is tested for its position. In movies, this implies the frame rate. If the frequency is higher than one-half of sampling rate, it cannot be recorded. This threshold frequency is termed Nyquist frequency. Frequencies above the Nyquist frequency appear to be noise.

There are several more measures of sound. These are:
- Sound pressure level
- Sound intensity level
- Sound power level
- Frequency spectrum
- Frequency response function

Sounds of 85 dBA or higher, are capable of causing permanent ear damage. The higher the sound pressure in a sound, the faster is damages the ear. For example: while a sound at 85 dBA can take about 8 h to cause permanent damage, sound of 100 dBA will start the same damage to hair cells in just 30 min.

You have already studied that the pressure difference in a medium that is detected by the human ear is referred to as sound. As already stated, unit for measuring sound pressure level is dB (decibels). The pressure of sound is measured with the help of...
• **Barometer**, which is a slow instrument. The least variation that the human ear can detect is approximately 20/second and the barometer being slow, it is not the best option.

• **Sound level meter**, which is a quicker means of measuring sound pressure. It can detect the variation even at very short intervals.

  dB or decibel is the ratio between an agreed reference level of sound and the current measured quantity. The decibel scale is a logarithm-like scale. The hearing capacity of the human ear varies from 0 dB(A)—the lowest sound human beings can hear—to 130 dB(A)—the highest sound our ears can bear.

**Decibel Exposure Time Guidelines**

Accepted standards for recommended permissible exposure time for continuous time-weighted average noise, according to the National Institute for Occupational Safety and Health (NIOSH) and Centre for Disease Control (CDC), 2002 are shown in Table 13.1. For every 3 dB over 85 dB, the permissible exposure time before possible damage can occur is cut in half.

<table>
<thead>
<tr>
<th>Continuous dB</th>
<th>Permissible Exposure Time</th>
</tr>
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<tbody>
<tr>
<td>85 dB</td>
<td>8 hours</td>
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<tr>
<td>88 dB</td>
<td>4 hours</td>
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<tr>
<td>91 dB</td>
<td>2 hours</td>
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<td>94 dB</td>
<td>1 hour</td>
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<td>97 dB</td>
<td>30 minutes</td>
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<td>100 dB</td>
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<td>103 dB</td>
<td>7.5 minutes</td>
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<td>106 dB</td>
<td>3.75 min (~4min)</td>
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<tr>
<td>109 dB</td>
<td>1.875 min (~2min)</td>
</tr>
<tr>
<td>112 dB</td>
<td>0.9375 min (~1 min)</td>
</tr>
<tr>
<td>115 dB</td>
<td>0.46875 min (~30 sec)</td>
</tr>
</tbody>
</table>

**Table 13.1 Permissible Exposure Time for Continuous Time-Weighted Average Noise**

**13.3 HISTORY OF RECORDING AND FORMATS**

Music was recorded in the form of written notations long before recording, the way we know it, began. We can say that automatic music reproduction started in the ninth century.

**Phonograph**

The phonograph was the first device that could record actual live sounds. However, there was no playback mechanism. Sheets of paper were used to record the sound in the form of white lines created by a vibrating stylus.
In phonographs, first came the phonograph cylinder, which was the first practical mechanical sound recording and reproduction device. The phonograph cylinder was succeeded by the gramophone disc, which went on to become highly popular in the international arena. Discs had multiple advantages over the cylinder. They include:

- Ease of manufacturing
- Ease of transport
- Ease of storage
- Had two usable sides
- Marginally louder than cylinders

The double-sided 78 rpm shellac disc became the standard during the early to mid-twentieth century. Initially, there was no regulation on the speed of the disc. Ultimately, recording companies accepted the 78 rpm as the de facto industry standard. It became known as the ‘seventy-eight’ when other speeds started becoming commercially available. The material used was shellac or similar brittle material. The reproduction/playback was done with the help of needles made of mild steel, thorn, sapphire etc. These discs had a limited lifespan and, therefore, had to be nurtured very carefully.

Earlier recording methods did not allow for much flexibility. There were limitations in sensitivity and frequency range. It was quite possible to record mid-frequency range music, but very low or high frequencies were not possible. For example, the violin required special adaptations to be made to be able to capture the sounds.

In 1948/1949, came the 33 1/3 rpm microgroove vinyl record, known as the ‘long playing (LP)’ record and also the 45 rpm microgroove vinyl, called the ‘single’ or ‘45’. Vinyl was an expensive but better material to use, providing better performance in both recording and playback. It had better longevity also. Consequently, the 78 was replaced by these two formats.

**Electrical Recording**

Along with developments in recording and playback devices was the development in microphone technology. Microphones hit an important milestone with electrical recording, where the sound was converted into an electrical signal and amplified by the microphone. The advances were such that it was now possible to record the previously unrecordable sounds like low and high frequencies, feeble and distant sounds, to be captured.

Till the mid twentieth century, sound recording remained a purely mechanical process. With the advent of electronics there has been a marked improvement in microphones, invention of auxiliary devices like electronic filters. One common requirement of these devices was electronic amplification.
Other Recording Formats

Optical recording technology came in during the 1920s, with graphically recorded audio signals on photographic film. The film had a ‘sound track’ for the audio and the amplitude variations of the signal were recorded.

During this period the magnetic wire recorder was developed, which was the first practical magnetic sound recording system. However, the sound quality was poor. In 1925, came the Blattnerphone, which used a steel tape instead of wire.

Magnetic Tape

The magnetic tape was the next important invention, which used amplified electrical signals to create variations of the magnetic field. A coated paper tape replaced the earlier steel tape, which was again replaced with acetate and later with polyester.

A quantum change came about with the magnetic tape. It was now possible to use the same tape to record, erase and re-record. Sound could be copied from one tape to another and precise editing became just a matter of physically cutting at the right place and rejoining it. This led to further technical development resulting in the multitrack tape recorder.

Other changes brought about by the use of the tape included:

- Pre-recording of entertainment programmes by radio networks, replacing the formerly live broadcasts.
- Comprehensive audio logging of the radio broadcasts of each day
- Production of complex and sophisticated radio programs and advertisements
- Innovative pacing and production style in content and advertising

Stereo and High Fidelity (Hi-fi)

As you have learnt earlier, in 1881, the concept of stereophony was born when it was realized that the movement of singers on the stage could be followed by using earpieces connected to different microphones held to the two ears. This was improved on and in the 1930s stereo microphones and stereo disc-cutting heads were used to record stereo soundtracks for a number of short films.

First practical commercial sound systems came about with the use of the magnetic tape. These were capable of recording and reproducing high-fidelity stereophonic sound. This was followed by two-channel stereo, then three track and four-track sound systems. Stereo recording and playback came of age in the mid-1950s when commercial use was made.

Subsequently, all old monophonic releases were re-mastered in stereo and released. The ‘fake stereo’ method was used to direct high-frequency sounds to one channel and the low-frequency sounds to another channel.
In 1964, came the commercial version of the cartridge-based tape systems. An outcome of miniaturization was the pocket-sized cassette player, known as the Walkman and introduced in 1979. The Walkman made the cassettes hugely popular ultimately pushing out the more cumbersome vinyl records and the magnetic tape.

**Audio Components**

The thermionic valve or vacuum tube was ultimately replaced by the transistor. Several advantages a transistor had over the vacuum tube were:

- Low power requirement
- No heating up
- Smaller

Due to the high cost of stereophonic systems, manufacturers began offering modular services. Hi-fi components like turntables, pre-amplifiers, amplifiers, both combined as integrated amplifiers, tape recorders and other ancillary equipment like the graphic equalizer were being marketed as separate units. These could be connected together to build a wholly integrated home theatre system.

**Digital Recording**

Digital sound recording brought about another substantial change in the sound and music industry. This was closely followed by the compact disc, which eventually brought about the demise of the vinyl record.

Now most of the innovations and development happens around digital sound recording. We have a choice of uncompressed and compressed digital audio file formats with inexpensive mass storage. Processing capabilities have increased such that conversion from digital data to sound can happen in real time. The compact disc gave birth to the minidisc player; however, it had a short lifespan as it was soon replaced as the preferred medium by the solid-state non-volatile flash memory. There was a quick succession of other medium like the super audio CD, DVD-A, blu-ray disc and HD DVD with larger capacity and better technology. Today, it is possible to download sound files from the internet or other sources and copy them on your computer or directly to your disc or flash drive. With computers and internet the options of internet radio and podcasting has opened up.

The dependence on experts to perform the highly technical activities of sound recording, audio editing and sound storage has been removed with the availability of computers and relevant applications that allow anyone to create their own music and do whatever they want with. There are so many applications a user can do sitting at the desktop/laptop with the use of appropriate software. Some of them are:

- Tracking
- Mixing and mastering (editing, level balancing, compressing and limiting)
- Adding effects (reverberation, equalization, flanging and much more)
Software

Today, a professional, a serious amateur or a casual user, all can play around with different digital audio recording and processing programmes available under any operating system. Point to be noted is that digital dictation software is different from the software available for music. The priorities are different, where the digital dictation requirements include intelligibility and flexible playback facilities. Wide frequency range and high audio quality are not critical characteristics for digital dictation.

Terminology

Terminology used across English-speaking nations is not consistently uniform. The playback device has names like ‘turntable’, ‘record player’ or ‘record changer’. A record changer is slightly different from a turntable or record player, as it can play more than one record without human intervention. The term ‘decks’ has also been used in a disc jockey (DJ) setup where a record player is used along with a mixer.

The origins of the word phonograph come from the Greek words meaning ‘sound’ or ‘voice’ (phonç) and ‘writing’ (graphç). Gramophone came from the Greek words ‘letter’ (gramma) and ‘voice’ (phônç).

Any device that can record or reproduce sound can be called a phonograph. However, we refer to phonograph as those devices that have historic connotations like earlier versions of sound recording technologies with a physical trace or groove method of audio-frequency modulations.

As the terms phonograph, gramophone, graphophone, and zonophone were brand names, while talking machine, was the generic term used to refer to them. Let us look at how some of the terms were used:

- The term gramophone in British English referred to any sound-reproducing machine that was based on disc records. Initially it was a trademark of the Gramophone Company, but later was made a generic term by law.
  - Machines that used cylinder records were called phonographs.
  - Gramophone was the machine that required to wound up and played only the 78 rpm variety of records.
  - The machines used for the later vinyl records like the 33 1/3 rpm long-playing records (LPs) and the 45 rpm single or two-song records, and extended-play recordings (EPs) were called record players or turntables.
  - The home record player was called a radiogram when a record player and a radio was part of a combined system, sometimes including audiotape cassettes players. Later, such combined systems were referred to as a “hi-fi” (high fidelity) system.
• In American English, machines that used cylinder records were called “phonographs”, till the time disc records were invented.
  o The comprehensive generic term was ‘talking machine’.
  o However, in the early 1900s, phonograph was being used for both cylinder and disc machines and the records that were used in them.
  o With the advent of Victor Talking Machine Company’s disc-playing machines with concealed horns, ‘victrola’ became the generic term used for machines that played discs. The discs were still called phonograph records or simply records.
  o The introduction of electrical disc-playing machines mounted in the same cabinet with a radio receiver brought about use of the term ‘record player’.
  o Next, came the term hi-fi (high fidelity) system or to be more specific high-fidelity, monophonic and also stereo (stereophonic) sound systems.
  o Terms like ‘record changer’ where a stack of discs could be played automatically or turntable which could play only one disc at a time became common.
  o The change in terms was mainly for the machines. Discs were called phonograph records or records throughout this period.
  o Gramophone was not a term generally used in the USA since 1901.
  o The word Grammy has been taken from gramophone to denote the Grammy Awards. The trophy also is a replica of a gramophone similar to a Victor disc machine with a taper arm.

• In Australian English, there are some slight variations.
  o The term record player was generally used.
  o The technical term usually was turntable.
  o Gramophone was reserved for the wind-up machines that were manufactured initially.
  o The phonograph was the machines used for cylinder records.

Many modern amplifiers have a provision (input jack) for accepting the output from magnetic pickup cartridges. This jack is labeled phono, which is an abbreviation of phonograph.

13.3.1 Analog vs Digital Formats

Analog and digital are common terms used in several fields, including audio. The term analog may be defined as something that is similar or analogous to something. The term digital, on the other hand, is defined as something that uses a digit or number to explain something.
Analog Audio

Audio recorded with physical representation of original sound encoded or a substrate like magnetic field of a magnetic tape is an analog audio. In analog recording, the physical quantity in the medium and the sound’s physical properties are directly connected. For example, when one speaks into the microphone, the change in pressure of air is converted to electrical voltage change. This change is termed as an analog signal.

To record any sound, its signal is conveyed to any of the various media capable of recording an analog signal, like magnetic tape, which can store the analog signal. To play the recorded signal back, a device like an audio speaker is used that works on the principle of consistently moving a cone from one position to the other. When you playback a recording, the playing device creates a current that is fed to an amplifier. This current is capable of moving a connected speaker to produce the same pressure change that the microphone sensed when recording was done. Analog recording can be done on magnetic tapes or vinyl grooves.

Advantages of Analog Signals
The analog signal has following advantages:

- An analog signal has fine definition and is capable of an endless amount of signal resolution.
- When compared to digital signals, analog signals prove to be of a higher density.
- The analog signals can be easily processed by an analog component.

Disadvantages of Analog Signals
The disadvantages of analog signal are:

- Linear access
- Subject to electrical and mechanical hiss and noise
- Subject to wow and flutter
- Tape is expensive to buy and maintain
- Regenerations have inferior quality

Digital Audio

The digital audio consists of bits of data (1 and 0). Digital audio recording is a technological process whereby an analog audio signal is converted into a stream of digits as follows:

- The physical properties of the original sound or acoustic sound is encoded as digital information.
- The digital information is decoded for reproduction.
Advantages of Digital Audio

The advantages of digital audio may be explained under the following heads:

- **Storage:** Analog signals prove difficult to record without noise addition. But, once in the digital form, the signal is extremely resistant to degradation caused by system noise or defects in the storage or transmission medium. Also, the replication of recording is very easy.

- **Reproduction of sound:** In part, the reproduction of an analog sound reflects its surface imperfections and its substrata nature. But, in a digitally recorded sound, the nature of the physical medium does not play any role in recovering the encoded information if all individual bits are to be recovered.

- **Editing:** Editing with magnetic tape proved to be a tedious task as it involved tasks like rewinding, slicing, fast-forwarding and other such time consuming actions. But, in digital sound non-linear editing is done, which is easier and less complex.

Disadvantages of digital audio

The disadvantages of digital audio are as follows:

- Digital audio files require a huge amount of memory as these files are loaded on random access memory (RAM) before these are played.

- External speakers are required for higher volume.

Digital Vs Analog sound

Analog format has virtually been replaced by the digital format. In the analog format, where one of the recording media was audiocassette tapes, the signal produced was analogous to its source. This is how the format got its name—analogue. In the digital format, which used media MP3 and CD, sound is stored digitally by using a binary code of 0s and 1s.

The analog format produces more subtlety and nuance, yet the digital format provides numerous advantages that make it a leader. Analog and digital formats can be compared under the following points:

- **Longevity:** Analog media are perishable. They wear off, lose clarity, get scratched or damaged in other ways. In comparison, MP3 (moving player 3) and CD (compact disk) face no such threat. With no moving parts to wear off on the digital media they last endlessly. Digital media never comes in contact with needles, etc. for the purpose of recording. The audio quality on digital media does not change even after repeated use.

- **Copying:** Analog sound is not as easy to copy as digital sound. This is because in digital sound format all the information is saved in the form of a code; this ensures that the signal does not lose quality as copies are made. So, every digital output of a piece can be reproduced with the same quality as the original digital piece.
• **Storage:** While analog sound has to be stored on tapes or similar media, which use a lot of space for storage, digital sound is stored on a computer hard drive and occupies much less space. Interestingly, a tiny iPod, as small as 2 inches by 2 inches by 1 centimeter is capable of saving hundreds of songs that on an analog media would take many a tapes.

• **Length of play:** It is a fact that a playlist on an analog media is restricted by the capacity of the media physically. In other words, while playing, for example, a record, you have to turn the record over when a side finishes playing to listen to the recording on the other side. On the other hand, digital music is free from this kind of limitation. So long as the battery on an MP3 player, to take an example, does not run out, it is capable of playing endless number of digital songs for endless number of days without human intervention and without listening to the same piece more than once.

• **Flexibility:** If you record an analog piece on a tape, it might be more or less stuck that way. The order in which you have recorded the pieces is the order in which you can listen to it or else you keep forwarding, going back etc. In effect, the songs play in a set order if left to themselves. Though, you have an option to overwrite the existing recording with a new one, you do not have the option to change the order of items in the playlist on a whim. But when you look at digital playlists, you are surrounded with flexibility. Altering a playlist and playing around with playlists is only limited by your ability and imagination, not the ability of the digital media.

**Digital Recording of Sound**

Recording onto a tape is an example of analog recording. The process of conversion of analog signal to digital signal is known as digitizing. An ‘analog to digital converter’ is the hardware that performs digitizing; it is also called A to D or ADC. The ADC allows recording through microphone directly onto the computer’s hard drive. The digitized signal is easily recordable on optical or magnetic media. To play back the sound, the signal is reconverted into an analog signal.

The ADC captures a snapshot of the electric voltage on an audio line and represents it as a digital number that can be sent to a computer. By capturing the voltage thousands of times per second, you can get a very good approximation to the original audio signal (Figure 13.1).
Each dot in Figure 13.1 represents one audio sample. There are two factors that determine the quality of a digital recording:

- **Sample rate**: It is the rate at which the samples are captured or played back. Its unit is hertz (Hz) or samples per second. An audio CD has a sample rate of 44,100 Hz. This is also the default sample rate that Audacity uses, because audio CDs are prevalent.

- **Sample format or sample size**: This is the number of digits in the digital representation of each sample. An audio CD has a precision of 16 bits.

Higher sampling rates allow a digital recording to accurately record higher frequencies of sound. The sampling rate should be at least twice the highest frequency you want to represent. As humans cannot hear frequencies above about 20,000 Hz, so 44,100 Hz was chosen as the rate for audio CDs to just include all human frequencies. Sample rates of 96 and 192 KHz are starting to become more common, particularly in DVD-Audio, but many people cannot hear the difference.

The dynamic range on an audio CD is theoretically about 90 dB, but realistically signals that are 24 dB or more in volume are greatly reduced in quality. Digital audio supports two additional sample sizes:

1. Twenty-four-bit, which is commonly used in digital recording
2. Thirty-two-bit float, which has almost infinite dynamic range and only takes up twice as much storage as 16-bit samples.

There are two main types of audio files on a computer:

- **PCM**: It stands for pulse code modulation, where each number in the digital audio file represents exactly one sample in the waveform. Common examples of PCM files are WAV files and AIFF files.

- **Compressed files**: Examples of the compressed files include MP3 (MPEG I, layer 3), Ogg Vorbis, and WMA (Windows Media Audio).

**Equipment Required to digitize sound**

The following equipment is essential for digitizing sound:

- **Audio source**: For example, a DAT (digital audio tape), an audio cassette and CD (compact disk).

- **A computer**

- **Digitizing and editing software**: For example, Sound Edit 16 and CoolEdit.

- **RCA-mini or Mini-mini audio cable to connect the computer and the audio source**.

- **Speakers or headphones to listen to the sounds while digitizing and editing. This will aid in volume adjustment.**
File Size and Bandwidth

File size measures the size of a computer file. File size is measured in bytes. The actual disk space that is occupied by a file depends on the file system. Some common file size units are:

- 1Kb = 1,024 bytes
- 1Mb = 1,048,576 bytes
- 1Gb = 1,073,741,824 bytes
- 1Tb = 1,099,511,627,776 bytes

Note: The windows report the size in GiB where 186 GiB = 200 GB (approximately).

Bandwidth

Band is the term given to the grouping of frequencies in the audible frequency spectrum. The range of frequency across which an audio system can reproduce sound is known as bandwidth. The bandwidth determines the number of octaves (centred on the selected frequency), which will be affected by the filtering, i.e. sets the size of the sound.

Streaming Bandwidth and Storage

The storage size of streaming media is calculated by using the bandwidth available for streaming and the length of the media with the formula:

\[
\text{Storage size in megabytes} = \frac{\text{Length in seconds} \times 8 \times 10^6}{8 \times 10^4 \times 10^4}
\]

For example,

A one-hour-long audio, which is encoded at 300 kbit/s, will require the storage space:

\[
= \frac{3,600 \times 300,000 \text{ bit/s}}{8 \times 10^4 \times 10^4} = 128 \text{ MiB storage space (approximately)}
\]

Further, if you want to store the file in a server to provide on-demand streaming and it receives about 1,000 simultaneous views, with Unicast protocol, you require:

\[
300 \text{ kbit/s} \times 1,000 = 300,000 \text{ kbit/s} = 300 \text{ Mbit/s} \text{ of bandwidth} = 135 \text{ GB per hour (approximately)}
\]

If you use a multicast protocol, a single stream is sent out by the server and this serves all users. Such a stream, will therefore, use just 300 kbit/s of serving bandwidth.
Even for environments with low bandwidth, audio streaming can be effectively implemented. Though broadband usage is on the rise, many Internet users still have a dial-up connection to the Internet. A dial-up connection limits data transfer to 56 kilobits per second (kbps). Such users need files that are small in size and are quickly downloaded.

Digital audio’s quality and size of file depend heavily on:
- Type of audio
- File format

File format implies the capability and the structure of the digital sound (Table 13.2). It is recommended that, for the Internet, you stay with variable bit rate encoding and a lossy format. When you stream data, the data is delivered over a sustained time period with no need to download it all right at the beginning. As you have seen, streaming works on the basis of mathematical calculations that do away with superfluous data and compress it into a smaller file size. One such format is MP3.

<table>
<thead>
<tr>
<th>Format</th>
<th>Compression</th>
<th>Streaming</th>
<th>Bit-rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP3</td>
<td>Lossy</td>
<td>Yes</td>
<td>Variable</td>
</tr>
<tr>
<td>My3PRO</td>
<td>Lossy</td>
<td>Yes</td>
<td>Variable</td>
</tr>
<tr>
<td>Ogg Vorbis</td>
<td>Lossy</td>
<td>Yes</td>
<td>Variable</td>
</tr>
<tr>
<td>RealAudio</td>
<td>Lossy</td>
<td>Yes</td>
<td>Variable</td>
</tr>
<tr>
<td>Windows Media Audio</td>
<td>Lossy</td>
<td>Yes</td>
<td>Variable</td>
</tr>
</tbody>
</table>

After you have saved recorded sound by using a lossy, you must listen to this audio to ensure that the audio sounds good, and you have retained all important information.

It is a good idea to use variable bit rate. When used for speech, based on requirement this can be from 8 to 32 kbps.

Selecting the Right Encoding Method

The quality of audio that is needed as per bit rate is greatly dependent on whether it is music or voice that you need to record.

Voice: Voice signals are less demanding than music signals. The reason for this is that the human voice has a limited range, that mostly reaches just 3 khz to 4 khz. So, a bit-rate of 8 to 32 kbps and sampling rate of 8 to 15 khz is sufficient for good quality audio. Audio data transmitted over one speaker or mono audio is also appropriate for the purpose of voice. General audio players tend to transmit mono channel data via two speakers for a stereo effect. This provides the same quality as a short-range or AM radio. Keeping this in mind can enable you to maintain complete quality and even decrease the size of the voice data files by more than 60 per cent than if you had recorded it at a higher bit-rate.
Music: Music signals with a sampling rate of 32 to 64 khz are effective with low-bandwidth. They enable listening of streamed audio without interrupting other running tasks.

Assessing Quality of Audio Data

When you create audio for low bandwidth environments, you do not have to compromise on quality of the sound or settle for loss of quality. To test if the quality has been maintained, check the following:

- Is the recorded voice clearly understood?
- Are quiet sounds easily audible?
- Are loud sounds clear and undistorted?

Check Your Progress

1. What is decibel in sound?
2. What is the relation of frequency and amplitude in terms of sound?
3. What is pitch in a sound wave?
4. Name the several measures of sound.
5. How is the pressure of the sound measured?
6. What do mean by stereophony?

13.4 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. The decibel (dB) is the unit to measure the intensity of sound.
2. Sound is measured as amplitude and frequency. Frequency is the measure of the number of sound vibrations per second. While amplitude is a measure of how forceful the wave is. It is measured in dBA of sound pressure.
3. Pitch is the perceived frequency of a note. Pitch describes what one thinks one has heard but it does not mean that it is always same as the sound that was made. Scientifically, pitch corresponds to the frequency of the wave.
4. There are several measures of sound, such as:
   - Sound pressure level
   - Sound intensity level
   - Sound power level
   - Frequency spectrum
   - Frequency response function
5. The pressure of the sound is measured with the help of barometer and sound level meter.

6. In 1881, the concept of stereophony was born when it was realized that the movement of singers on the stage could be followed by using earpieces connected to different microphones held to the two ears.

13.5 SUMMARY

- Measuring sound helps accurately and scientifically control all unwanted sounds. The intensity of sound is the key to a person’s auditory capabilities.
- If ears are exposed to extremely high sound levels, they can lose their sensitivity or they can even be damaged permanently. Therefore measuring sound is necessary to determine the level of sound pollution.
- When you hear a sound, it means a change in the air pressure has occurred. If there is silence, it means the air pressure is constant. The unit used to measure the intensity of sound is known as decibel (dB).
- The normal audible harmless intensity limit for human ears is 80 dB. A sound higher than 80 dB is capable of damaging the human eardrum, leading to the loss of hearing.
- Frequency is the measure of the number of sound vibrations per second. A healthy ear can catch sounds of 20 hertz or 20 cycles per second right up to 20,000 hertz.
- When an object vibrates, the movement from its initial position to its maximum displacement in one direction then movement to the maximum displacement point in the opposite direction and finally to its initial position again is known as one ‘cycle’. The time to complete one cycle is called a ‘period’ and number of cycles per period is called as ‘frequency’. It means frequency can be calculated as the number of complete oscillations per second.
- While frequency is measurable and is an acoustic measure, the term pitch, associated with sound, is subjective and what the human mind perceives as frequency. In other words, pitch is psychoacoustic in nature.
- The term sampling rate refers to the number of times a sound waveform is tested for its position. In movies, this implies the frame rate. If the frequency is higher than one-half of sampling rate, it cannot be recorded.
- Music was recorded in the form of written notations long before recording, the way we know it, began. We can say that automatic music reproduction started in the ninth century.
- The phonograph was the first device that could record actual live sounds. The phonograph cylinder was succeeded by the gramophone disc, which went on to become highly popular in the international arena. Discs had multiple advantages over the cylinder.
Optical recording technology came in during the 1920s, with graphically recorded audio signals on photographic film. The film had a ‘sound track’ for the audio and the amplitude variations of the signal were recorded.

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In 1881, the concept of stereophony was born when it was realized that the movement of singers on the stage could be followed by using earpieces connected to different microphones held to the two ears.

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Many modern amplifiers have a provision (input jack) for accepting the output from magnetic pickup cartridges. This jack is labeled phono, which is an abbreviation of phonograph.

Analog and digital are common terms used in several fields, including audio. The term analog may be defined as something that is similar or analogous to something. The term digital, on the other hand, is defined as something that uses a digit or number to explain something.

Audio recorded with physical representation of original sound encoded or a substrate like magnetic field of a magnetic tape is an analog audio.

The digital audio consists of bits of data (1 and 0). Digital audio recording is a technological process whereby an analog audio signal is converted into a stream of digits.

Analog format has virtually been replaced by the digital format. In the analog format, where one of the recording media was audiocassette tapes, the signal produced was analogous to its source. This is how the format got its name—analog. In the digital format, which used media MP3 and CD, sound is stored digitally by using a binary code of 0s and 1s.

Analog and digital formats can be compared under the points namely longevity, copying, storage, length of play, and flexibility.

Recording onto a tape is an example of analog recording. The process of conversion of analog signal to digital signal is known as digitizing. An ‘analog to digital converter’ is the hardware that performs digitizing; it is also called A to D or ADC.
Sample rate is the rate at which the samples are captured or played back. Its unit is hertz (Hz) or samples per second. An audio CD has a sample rate of 44,100 Hz.

Higher sampling rates allow a digital recording to accurately record higher frequencies of sound.

Band is the term given to the grouping of frequencies in the audible frequency spectrum. The range of frequency across which an audio system can reproduce sound is known as bandwidth.

The quality and size of digital audio file is heavily depended on type of audio and file format.

13.6 KEY WORDS

- **Audio compression**: It is the compression of sound data for reducing the amount of bandwidth that will be needed to stream the audio and reduce the amount of space that will be required to store the file.
- **Band**: It is the term given to the grouping of frequencies in the audible frequency spectrum.
- **Bandwidth**: It is the range of frequency across which an audio system can reproduce sound.
- **Cycle**: It is the movement of a vibrating object from its initial position to that of maximum displacement in one direction and then to the maximum displacement point in the opposite direction and finally to its initial position again is known as one ‘cycle’.
- **Period**: It is the time required to complete one cycle.
- **Frequency**: It refers to the number of cycles per period.

13.7 SELF ASSESSMENT QUESTIONS AND EXERCISES

**Short Answer Questions**

1. Name any three characteristics of sound.
2. Identify the instruments used to measure the pressure of sound.
3. List the advantages of analog signal.
4. Compare the flexibility of analog and digital formats.
5. Identify the two factors that determine the quality of a digital recording.
Long Answer Questions

1. Discuss various characteristics of sound. How is it measured?
2. What is digital audio? Discuss its advantages and disadvantages.
3. Discuss the technique of audio compression.

13.8 FURTHER READINGS


UNIT 14  BASICS OF DIGITAL RECORDING AND EDITING

Structure
14.0  Introduction
14.1  Objectives
14.2  Digital Recording
   14.2.1  Digital Technology and Advancements
14.3  Basics of Digital Sound Editing
   14.3.1  Creating Files and Naming Them
   14.3.2  Using EQ, DYNMS and SFX
   14.3.3  Reverb
   14.3.4  Source Selection and Cleaning
   14.3.5  Elements of Music Recording
   14.3.6  Mixing Pre and Post Mastering
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14.0  INTRODUCTION

In the previous unit, you were introduced to the concept of digital recording and its formats. In this unit, you will study in great detail, the actual process and elements which constitutes the process of digital recording. This form of recording is what is majorly used in sound recording and editing in today’s time. You will also learn about some of the advancements which have come with the advent of digital recording. Further in the unit, you will also learn some of the fundamental concepts involved in sound editing including the creation of files, the basic editing functions, the use of effects and concepts of mixing and mastering. Lastly, you will learn the application of the primary editing functions in two popular sound editing software: Audacity and Sound Forge.

14.1  OBJECTIVES

After going through this unit, you will be able to:

- Explain the important elements of digital recording
- Discuss the digital technology and advancements
14.2 DIGITAL RECORDING

You have briefly learnt about the concept of digital recording in the previous unit under the history of recording. In this unit, you will study its main concepts.

The process of converting audio or video signals into a sequence of discrete numbers that represent changes over time in air pressure or chroma and luminance values, and finally recorded in a storage device is digital recording. To listen to a digital recording, the discrete numbers need to be retrieved and converted back to their original waveforms.

Recording

There is a standard process that is followed when a sound input is recorded:

1. The sound signal in analog form is transmitted from the sound source and does to the analog-to-digital converter (ADC).

2. The analog signal is converted by the ADC to digital format. This is done by determining the transitory level of the analog (audio) wave repetitively and designating a binary number with a given number of bits (word length) to each measuring point.
   - This measuring frequency is known as the sample rate or sampling rate.
   - The audio level at one instance is represented by the digital audio sample with a given word length.
   - The accuracy of the wave level wise representation of the original audio will be greater with longer word lengths.
   - The digitized audio signal's upper cutoff frequency will be higher if the sampling rate is higher.

3. A continuous stream of 0s and 1s is the output sequence of samples generated by the ADC.

4. This output of binary numbers is recorded onto a digital media like hard drive, optical drive or solid state memory.

Playback

The playback process is relatively simple:

1. Previously recorded sequence of binary numbers is read from the digital storage.
2. This is passed through the digital-to-analog converter (DAC) for conversion to analog signals. The original analog wave form is rebuilt by joining the level information stored in each digital sample together.

3. The signal goes through an amplification process and then transmitted to the loudspeakers.

Recording of Bits

After converting the analog signals to digital format, recording the bits is a delicate process. What is required is a scheme that can work fast enough to record the bits as the signal is converted. For example, recording software receives 1,411,200 bits per second (bps) for a two channel audio at 44.1 kHz sample rate having a 16 bit word size.

One technique used for digital cassettes, in order to maintain a high enough speed, is to move the read-write head and the tape, to keep the bits at a manageable size.

In the case of optical disc recording technologies like CDs and DVDs, microscopic holes are burnt into the dye layer of the medium with a laser. For reading these signals, a weaker laser is used.

Concerns with Digital Audio Recording

Digital audio recording, despite all its hype has certain constraints.

- **Word Size**: The word size is the number of bits required to represent a single audio wave. This word size impacts the attainable noise level of a signal, which includes dither, or the distortion of an undithered signal. The more the number of bits, the larger the word size and the more the space required to store. The lesser the bits will result in decreased signal levels and subsequently increase distortion.

- **Sample Rate**: This is another important parameter. A low sample rate means that the original sound signal cannot be reconstructed from it. To work around this, the rate of sampling must be at least twice that of the highest frequency component in the signal. This is according to the Nyquist-Shannon sampling theorem.

- **Error Rectification**: This is a big advantage that digital recording has over analog recording. It is resistant to errors.

Basics of Digital Coding

**Audio Codec**

A device or computer program that can code or decode a digital data stream of audio is an audio codec. The audio codec computer program runs an algorithm to compress and decompress any digital audio signal and passes it to a particular audio file or converts it to a streaming media audio coding format. The algorithm uses the minimum number of bits without impacting the quality to represent the
high-fidelity audio signal. In this way it effectively reduces the storage space and
the bandwidth that is required to transmit the stored audio file. The codecs are in
the form of libraries that interface with the various multimedia players. For example,
LAME implements encoding and decoding audio in the MP3 audio coding format.

The audio codec hardware is a device that can encode analog audio signals
as digital signals and vice versa. That means it is a combination of ADC and DAC
running off the same clock. For example, a sound card that has both audio in and
out.

Audio Coding Format

An audio coding format is also referred to as an audio compression format. This is
a content representation format to enable transmission or storage of digital audio
like digital television, digital radio and in audio and video files. Some standard
audio coding formats are MP3, AAC, Vorbis, FLAC and Opus. You already
learnt about them in Unit 12.

Several of these audio coding formats come with an audio coding specification,
which is a detailed technical specification document that is written and approved by
standardization organizations and are known as an audio coding standard.

Normally, a container format encapsulates the audio content that is encoded
in a particular audio coding format. What the user gets is not a raw AAC file but a
.m4a audio file. The container for this is a MPEG-4 Part 14 that contains AAC-
encoded audio. Metadata like title and other tags and sometimes an index for fast
search is included in this container. MP3 files are an exception as they are raw
audio coding without a container.

Lossless, Lossy and Uncompressed Audio Coding Formats

The total data needed to represent a sound can be reduced by using a lossless
audio coding format. However, when it is decoded, it returns to its original,
uncompressed form. Using a lossy audio coding format can, in addition, reduce
the bit resolution of the sound on top of compression. This can result in irrevocably
lost information but with far less data. Quite often, uncompressed audio formats
such as pulse-code modulation (.wav) are also used.

In the commercial arena, the file size is much more preferable due to its
distribution benefits. Here the audio is compressed using lossy audio codecs.

Basics of DA Conversion

The conversion of digital data in binary form into an analog signal (current, voltage
or electric charge) is the work of a digital-to-analog converter also referred to as
DAC, D/A, D2A or D-to-A. The reverse function is performed by an analog-to-
digital converter or ADC. Digital data formats are very versatile and can be
transmitted, manipulated and stored without any loss but with the use of some
complex equipment. However, to get any sound out of earphones or loudspeaker
amplifiers from digital data, a DAC is required to convert it to analog signals.
The digital revolution has been greatly supported by these DACs and ADCs. Let us take a look at how it works in a telephone system. When a person speaks into the telephone mouthpiece, the voice is converted into an analog signal by the microphone. An ADC converts this analog signal into a digital stream which is divided into packets and sent may be along with other digital data. At the destination the digital packets are received and the digital voice is extracted from the packets and arranged into a digital data stream which is converted to an analog signal by a DAC and sent to an amplifier which amplifies the signal and drives the loudspeaker of the telephone of the receiver. The receiver hears to words spoken by the speaker without any loss in quality.

DACs come in several architectures and applicability can be determined based on the following six parameters:

- Physical size
- Power consumption
- Resolution
- Speed
- Accuracy
- Cost

DACs are mostly implemented as integrated circuits (ICs) and as the conversion can degrade signals, a DAC that has insignificant errors in terms of the application should be selected.

Music players are frequent users of DACs for converting digital data streams into analog audio signals. Televisions and mobile phones also use DACs to convert digital video data into analog video signals. There is a speed/resolution tradeoff that needs to be addressed. Some examples:

- Low speed high resolution type: Used in audio DACs.
- High speed low to medium resolution type: Used in video DACs.
- Extremely high speed low resolution types: These are power hungry for discrete applications like in military radar systems.
- Very high speed test equipment: Sampling oscilloscopes, may work with discrete DACs.

An abstract finite-precision number like a fixed-point binary number or a finite-precision time series data is converted into a physical quantity, like a voltage or a pressure, or a continually varying physical signal by a DAC.

These abstract numbers when converted to a concrete sequence of impulses are processed by a reconstruction filter. The reconstruction filter fills in data between the impulses by using some form of interpolation. There are other methods also that produce a pulse-density modulated signal which is similarly filtered to produce a smoothly varying signal.
The Nyquist–Shannon sampling theorem states that the original signal from the sampled data can be reconstructed by a DAC if its bandwidth meets certain requirements. A quantization error manifested as low-level noise is introduced and is added to the reconstructed signal.

Applications
Today, storage of audio signals are mostly done in digital form like MP3s and CDs. So, they have to be converted to analog signals to be able to be heard through speakers. As a result, DACs are available in CD players, digital music players and PC sound cards.

Nowadays, high-end hi-fi systems also incorporate specialist standalone DACs that take the digital output of a compatible CD player, with no internal DAC, convert it to analog signals and passes it on to the amplifier that drives the speakers.

Other places where DACs can be found are digital speakers like USB speakers and sound cards.

Voice over IP (VoIP) applications is similar to telephones where the source is first digitized by an ADC and then sent to the destination. A DAC reconstructs the digital data into analog at the receiving party’s end.

DAC Types
There are quite a few DACs available today. Let us have a look at a few common ones:

- The pulse-width modulator: This is a very simple type of DAC. Among other applications, it is used for electric motor speed control often.
- Oversampling DACs or interpolating DACs: An example is the delta-sigma DAC. The technique used is pulse density conversion.
- The binary-weighted DAC: This is one of the fastest conversion methods but at the cost of accuracy. The use is limited to 8-bit resolution or less.
- The R-2R ladder DAC: This is a binary-weighted DAC.
- The Successive-Approximation or Cyclic DAC: Constructs the output successively during each cycle.
- The thermometer-coded DAC: This DAC provides the highest precision with the fastest speed, giving >1 billion samples per second. However, is quite expensive.
- Hybrid DACs: Combinations of the above techniques are incorporated in a single converter.

Most DACs create their output value based on a constant reference voltage. On the other hand, a variable input voltage is taken by a multiplying DAC for their conversion. However, constraints in the bandwidth of the conversion circuit come into play and need to be considered.
Basics of Audio Compression Techniques and Standards

You have already learnt a little bit about this concept in unit 11. Let’s learn the important elements related to it. The purpose of audio data compression is to reduce the transmission bandwidth and the storage requirements of audio data. These are algorithms embedded in software in the form of audio codecs. Less audible or meaningless sounds are eliminated through psychoacoustics in these algorithms so that the space requirement for storage and transmission is reduced.

Methods like coding, pattern recognition and linear prediction are used to reduce redundancy and the amount of information used to represent the uncompressed data. However, a trade-off needs to happen between audio quality and transmission/storage size, which is dependent on the application used. Take for example a compact disk (CD) of 640 MB can hold:

- One hour of uncompressed high fidelity music.
- Less than two hours of lossless compressed music.
- Seven hours of music compressed at a medium bit rate in MP3 format.

Compared to the above, around 200 hours of clearly intelligible speech can be stored by a digital sound recorder in 640 MB.

Lossless Audio Compression

When an analog signal is compressed using lossless audio compression methods the representative digital data when decompressed results in an exact digital duplicate of the original audio stream. A 50 per cent to 60 per cent compression of the original can be expected. Higher compression ratios are difficult due to the complex waveforms and the frequent sound form changes. The spectrum of the signal is estimated using linear prediction with codecs like FLAC, Shorten and TTA. To help the lossless compression work more efficiently, the spectrum may be slightly whitened or flattened with the use of convolution with the filter. During decompression, the process is reversed.

For any further processing, like editing or further compression, it is best to use the original in its unchanged form or in a losslessly compressed form. Lossily compressed files do not give the same kind of quality when decompressed. Most often, lossless compressed files are used for archival storage, as master copies, for sound editing or mixing.

Some lossless audio compression formats are: Free Lossless Audio Codec (FLAC), Apple’s Apple Lossless (ALAC), MPEG-4 ALS, Microsoft’s Windows Media Audio 9 Lossless (WMA Lossless), Monkey’s Audio, TTA and WavPack.

Lossy Audio Compression

A lot of applications use lossy audio compression. Applications like in most video DVDs, digital television, streaming media on the internet, satellite and cable radio and also in terrestrial radio broadcasts use digitally compressed audio streams. Lossy
Lossy audio compression uses an innovative system of psychoacoustics to identify and eliminate that data in an audio stream that cannot be perceived by the human auditory system. Another technique is identifying perceptually irrelevant sounds or sounds that are difficult to hear and remove those. Sounds that occur together with louder sounds are coded with less accuracy or ignored completely.

Files that are decompressed and recompressed using lossy algorithms degenerate in quality referred to as digital generation loss. Therefore, storing intermediate results in professional audio engineering applications like in sound editing and multi-track recording, using lossy compression is not desirable. End users prefer using these compressed versions like MP3s as storage space requirements are greatly reduced. For example, with adequate quality, one minute’s music can be stored in 1 MB.

**Coding Methods**

Transforms like the modified discrete cosine transform (MDCT) are widely used by lossy compression algorithms to identify, in an audio signal, what information is not relevant. A transform domain is the outcome of the conversion of time domain sampled waveforms using these transforms. After the transformation is done into a frequency domain, bits can be allocated to component frequencies based on their audibility. The audibility of spectral components is calculated on the following factors:

- The absolute threshold of hearing: The maximum and minimum limits of human hearing.
- The principles of simultaneous masking: One signal masking another separated by frequency.
- Temporal masking: One signal is masked by another signal separated by time.
- Equal-loudness contours may also be used to weight the perceptual importance of components.

Psychoacoustic models are basically models of the human ear-brain combination when such effects are incorporated.

Source-based coders are another type of lossy audio compressor like the linear predictive coding (LPC) that is used with speech. These coders whiten the audio signal (i.e., flatten its spectrum) before quantization using a model of the sound’s generator like the human vocal tract in the case of LPC. A basic perceptual coding technique like in the LPC, shapes the coder’s quantization noise into the spectrum of the target signal, by using a linear predictor and reconstructing the audio signal, thereby mask it.

Lossy formats have been found to be better for distributing streaming audio or interactive applications as in cell phone applications. The distinctiveness of these
Basics of Digital Recording and Editing

Applications is that decompression must happen as the data flows and not after the entire data stream is transmitted. Codecs specifically designed for streaming data effectively, will be chosen for such applications.

Methods that are used in the encoding and decoding of data can result in latency. To optimize on efficiency, longer segments of the data are analyzed by some codecs for coding. In such cases it will require a larger segment of data at a time when decoding. Latency of the algorithm is a significant factor in the quality of output as too long delays can have a degrading effect.

Latency is the number of samples that are to be analysed after which an audio block is processed. Low latency is also present with time domain algorithms as in the case of LPC, making them highly popular in telephony for speech coding. To implement a psychoacoustic model in the frequency domain in algorithms such as MP3, a large number of samples have to be analyzed, resulting in latency to the order of 23 ms, which is 46 ms for two-way communication.

Speech Encoding

Speech encoding is also important in the field of audio data compression. The models used for perception of music is different those that are for perception of speech. Sounds of a human voice usually fall in a narrower range of frequencies and are less complex than that of music. Therefore, encoding speech with a low bit rate can provide high quality results.

When analog data like a voltage that varies with time, is to be compressed, quantization needs to be done when it is digitized into numbers say integers. This process is called analog-to-digital (A/D) conversion. For 8 bit integers that are generated by quantization, the complete analog signal is broken up into 256 intervals, with the signal values of any particular interval quantized to the same number. For 16-bit integers, the range of the analog signal is divided into 65,536 intervals.

This provides some visibility of the compromise required between high resolution where there are more analog intervals and high compression where a small number of integers are generated. Many speech compression methods apply a compromise form of quantization. A combination of the two approaches would work like:

- Sounds made by a single human voice are encoded.
- Most of the data in the signal is thrown away, avoiding coding of the full frequency range of human hearing. Must be able to reconstruct an 'intelligible' voice.

Digital Tape Recording Systems

Digital audio recorders began with reel-to-reel decks with the use of a digital technology known as pulse-code modulation (PCM) recording. Subsequently, devices were available that could encode the digital audio data as a standard video signal and a U-matic or other videotape recorder to record it, using the rotating-head technology. Digital Audio Tape (DAT) used the same technology of
rotating heads on a narrow tape contained in a cassette. The sampling rates of DAT recording is 48 kHz or, as in compact discs, 44.1 kHz with a bit depth of 16 bits, like the compact disc. In the consumer audio arena, DAT turned out to be a failure due to cost, developer’s demands and stringent anti-copying regulations. However, studios and radio stations had a big demand for DAT. Another failure was the Digital Compact Cassette (DCC).

Multi-track recorders were the next in line for digital recording. These used a stationary head and their target was professional studios. In the 1990s, low-priced multi-track digital recorders were available for home use, like the Alesis Digital Audio Tape (ADAT). ADATs had the capability of recording 8 tracks of digital audio onto a single Super Video Home System (S-VHS) video cassette. Professional and home studios around the world still use ADAT systems.

The compact disc was the main contributor to the phasing out of tapes and gramophones from the consumer market. The compact disc is a fully digital media and the playback requires complex electronics.

All types of computer storage media is predominantly used to store digital sound files. Development in the digital audio field has kicked off since the creation of the MP3 audio file format and the issues related to copying such files, including the legal aspect.

One advantage that the tape recorder had over the gramophone was the capability to erase a previous recording or record over a previous recording. Thus, giving the option of correcting mistakes that may have occurred during the original recording session. Another advantage that recording on tape provided was the ability to cut the tape at any point and join it back. Thus, providing a user with the opportunity to edit a recording. It was possible to remove pieces of a recording or to rearrange portions of a recording.

The introduction of electronic instruments like keyboards and synthesizers opened up new possibilities in audio recording. Effects and other instruments increase the significance of electronics in audio recording and initiated the development of standards like the Musical Instrument Digital Interface (MIDI) in recording. For example, during a recording session, it is possible to ‘trigger’ different equipment without direct human intervention using MIDI timecode.

Lately, we find computers in the form of digital audio workstations (DAWs) being increasingly used in recording studios. Many tasks that are manually done in a studio can be accomplished easily with the help of DAWs. Some of these tasks are:

- Cutting and looping
- Allowing for instantaneous changes such as duplication of parts
- Addition of effects
- Rearranging of parts of the recording
Concept of MIDI

The musical instrument digital interface (MIDI) technical standard describes the digital recording protocol. It also defines the digital interface and connectors. It specifies the electronic musical instruments, computers and other related devices that can be connected, which lists a wide variety. It also stipulates the way different devices will be connected and the way these devices will communicate with each other. Up to 16 channels of information can be carried by a single MIDI link. Each of these 16 channels can be routed to a separate device.

A MIDI can specify control signals like notation, pitch and velocity through event messages. Parameters like volume, vibrato, audio panning, cues and clock signals are managed by these control signals. These parameters are meant to set and synchronize tempo between multiple devices. A MIDI cable is used to send these messages to other devices to control the sound generation among other features. A MIDI has the option to record the data in a sequencer (either hardware or software device). The sequencer can be further used to edit the data and to play it back any number of times, later.

The MIDI Manufacturers Association (MMA) was formed with one of their responsibilities to maintain the MIDI standards. The MIDI technology was standardized by a panel of industry representatives in 1983. The Association of Musical Electronics Industry (AMEI) in Tokyo, Japan and the MMA in California, USA, jointly developed and published the official MIDI standards.

MIDI offers the following advantages:

- Compactness of code
- Ease of modification and manipulation
- Choice of instruments

Introduction to Analog and Digital Mixers

In audio, mixing is a significant activity that can enhance the quality and effect of a recording. Developments in electronics have brought along what is known as a mixing console or audio mixer. This basically is an electronic device that allows a user to do the following:

- Combining also called mixing
- Routing
- Changing the level
- Changing the timbre or tone colour and/or dynamics

These actions can be done on most of the audio signals such as:

- Microphones being used by singers.
- Microphones that transmit sounds picked up from acoustic instruments such as drums or saxophones.
Microphones that transmit signals from electric or electronic instruments such as the electric bass or synthesizer. The modified signals are in the form of voltages or digital samples. These are summed (merged) to get a consolidated output signal, which can be broadcast, passed through a sound reinforcement system to be amplified or recorded. A combination of these applications may also be required.

The use of mixing consoles can be found in places like recording studios, public address systems, sound reinforcement systems, broadcasting, television and film post-production. Let us look at some typical sample applications:

- **Simple application**: Two microphones, the signals of which are combined into an amplifier that is connected to one set of speakers.
- **Live performance**: The mixer sends the signal directly to an amplifier. The mixer may have a built-in power amplifier or the speakers may be powered.
- **Coffeehouse setup**: A six channel mixer would be ideal and enough for two singers with their guitars.
- **Nightclub setup**: May have a 24 channel mixer to be able to mix the signals of rock music shows with a rhythm section and several vocalists.
- **Large concert**: May have a 48 channel mixing console.
- **Professional recording studio**: May have a 72 channel mixing console.

In actuality, mixers do a lot more than mix signals. For example, they provide:

- Phantom Power for capacitor microphones.
- Pan control to change a sound’s apparent position in the stereo soundfield.
- Filtering and equalization functions.
- Routing facilities.
- Monitoring facilities, which allow routing of sources to loudspeakers or headphones so that one can listen. This can be achieved without impacting the mixer’s main output.
- Onboard electronic effects, such as reverb, in some mixers.
- An integrated power amplifier, in mixers that are intended for small venue live performance applications.

**Digital vs. Analog**

Digital mixing consoles have become increasingly popular since the 1990s. Reasons for the preference over analog mixers are:

- Digital mixers are more versatile.
- They offer many new features, like reconfigure signal routing at the touch of a button.
They often include processing capabilities such as compression, gating, reverb, automatic feedback suppression and delay.

- They provide options to combine third-party software features also called plugins that provide more functionality like additional reverb, compression, delay and tone-shaping tools.
- Spectrograph and real time analyzer functions are available with several digital mixers.
- In some cases loudspeaker management tools are incorporated providing functions like crossover filtering and limiting.
- In some simple applications, like courtrooms, conferences and panel discussions automatic mixing can be done through digital signal processing.
- Consoles with motorized faders can read and write console automation.

**Propagation Delay**

Latency or propagation delay ranging from 1.5 ms to as much as 10 ms is an unavoidable complication in digital mixers. The quantum of delay depends on the model of the digital mixer and the functions that are engaged. The audience or even monitor wedges aimed at the artist are not affected by this small delay. The problem is with the in-ear monitors (IEMs) because the artist hears their own voice a few milliseconds before it is electronically amplified in their ears.

The ADC and DAC components in a digital mixer give rise to propagation delay. Further delays can happen with Audio inserts, format conversions and from normal digital signal processing steps.

Differing amounts of latency can exist within a digital mixer caused by the routing and on how much DSP is in use. Extreme comb filtering can result from recombining signals that were assigned to two parallel paths and each path went through significantly different processing. Such problems can be avoided with internal methods of latency correction that is incorporated in some digital mixers.

**Ease of Use**

Even today preference for analog consoles still remains because they contain a column of dedicated, physical knobs, buttons and faders for each channel. Although it takes up considerable space, the setup is logical and many users are familiar with these devices. Responses to changing performance conditions can be rapidly accommodated.

Mixers can occupy considerable physical space. So, where ever possible the help of technology is taken to reduce physical space requirements at the cost of user convenience. The compromise is in the user interface which has a single shared channel adjustment area, which needs to be selectable for only one channel at a time. Most digital mixers have virtual pages or layers for changing fader banks into separate controls. This will help for additional inputs or for adjusting equalization or aux send levels. However, many operators find this layering confusing.
It is easier to understand hardware routing in analog consoles. The feature of allowing internal reassignment of inputs whereby convenient groupings of inputs appear near each other at the fader bank can become very confusing for persons having to make a hardware patch change.

Taking saved data and making a mix is extremely easy using digital mixers. Past performance data can be brought to a new venue in highly portable manner with the use of USB flash drive and other storage methods. At the new venue, the collected data is simply plugged into the venue’s digital mixer and small adjustments need to be made to the local input and output patch layout and within a short time span it is ready for a full show.

Offline editing of the mix is also allowed by some mixers. A technician can make use of a laptop without being connected to the targeted mixer and make adjustments to the show. Ultimately, the time taken to prepare the sound system for the artist is shortened.

**Sound Quality**

The microphone preamplifiers used in both digital and analog mixers are analog with a high-gain circuit so that the low signal level from a microphone can be increased to a level matching the console’s internal operating level. The microphone preamplifier in a digital mixer is followed by an ADC. Monitoring has to be carefully done for this process to be able to deal with overloading and clipping instances when delivering an accurate digital stream.

Overloading and clipping can also occur with analog mixers at the microphone preamplifier. Overloading of mix buses should also be avoided. An analog mixer will always incorporate a background hiss, though the audibility of the hiss can be minimized with good gain stage management. Background hiss to the main outputs can also get added by idle subgroups left “up” in a mix. Low-level gating can be used to avoid this problem. Digital circuitry is not affected by radio transmitters like walkie-talkies and cell phones.

Perceived sound quality is influenced by a combination of many electronic design elements. Microphones and loudspeakers are a bigger source of noise than the choice of mixer. How a person does the mix plays a more significant role than the type of audio console. As a matter of fact, extremely high-quality concert performances and studio recordings have been achieved using both analog and digital mixers.

**Remote Control**

Use of wired remote controls for certain digital processes is an option that has been available with analog mixers since 1990s. The concept has been expanded to include wireless remote controls as well.

**14.2.1 Digital Technology and Advancements**

The media is going through a major technological transition where digital technology is the reason behind a shift from terrestrial to digital broadcast. The impact of the
technology is huge and so the radio is changing and that too for good. The advent of social media platforms has changed the way broadcasting is done. The radio jockeys have to multi-task.

**Traditional and Digital Audio Broadcasting**

The quality of digital radio may be really good, but we can actually just categorize digital radio and traditional (terrestrial) radio together as one. Sure, the quality may be better on digital, but they’re both essentially the same medium – dedicated devices for listening to broadcast radio.

**Interactive Radio**

Then there’s interactive radio on your PC, smartphone or tablet, which lets you open a specific app and gives you more control over the radio station in question, but it’s essentially still ‘radio’, insofar as it adheres to a linear broadcast schedule. There is often the added bonus of being able to access catch-up content too.

**Podcasting**

Popularized by the advent of the iPod era, podcasts typically offer episodic shows, similar to how radio shows have been broadcast for decades. However, when you downloaded them all in one fell swoop to a portable media player, you can listen to them in any order and they become part of your broader music and audiobook library.

**Web and Mobile Streaming Services**

The likes of SoundCloud behave a little like a subscription service, but it includes other kinds of audio too… including podcasts. Also, it may run contrary to your intuition, but sites such as YouTube, Vimeo, Vevo and all the rest encroach on radio territory too. YouTube may be a video site, but it can also be used as a radio-like platform, letting you subscribe to other users and queue up audio to listen to in bed.

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### Check Your Progress

1. What is the Nyquist-Shannon sampling theorem?
2. List the parameters on the basis of which architecture and applicability of DAC architecture can be determined.
3. Name the DAC which provides the highest precision with the fastest speed.
4. What are the codes through which the spectrum of the signal is estimated?
5. List the control signals and their parameters which can be specified by MIDI.

### 14.3 BASICS OF DIGITAL SOUND EDITING

In this section, you will learn about several functions of digital sound editing including creating files and naming them, recording, using EQ, DYNMS, SFX and Reverb, Source selection, mixing pre and post mastering and elements of music recording.
14.3.1 Creating Files and Naming Them

The first step involved in sound editing is creating files and naming them. The files can be recorded or a previously recording file can be edited. Although the function may vary from software to software, the basic process of creating files and naming them is done through the files tab in the application. From there, the desired selection can be made. You have already learnt about the different formats in which files for sound editing can be created. The same have been listed here:

- **wav** - standard audio file format used mainly in Windows PCs. Commonly used for storing uncompressed (PCM), CD-quality sound files, which means that they can be large in size - around 10MB per minute of music.
- **mp3** - the MPEG Layer-3 format is the most popular format for downloading and storing music.
- **aiff** - the standard audio file format used by Apple.
- **wma** - the popular Windows Media Audio format owned by Microsoft
- **aac** - the Advanced Audio Coding format is based on the MPEG4 audio standard owned by Dolby.
- **Real Audio** (.ra .ram .rm): Real Audio is a proprietary format, and is used for streaming audio that enables you to play digital audio files in real-time.
- **MIDI** - Musical Instrument Digital Interface (.mid)

Depending on the computer, the need, the file size, resource available, any of the above formats can be created and saved. Lossless or lossy and compressed or uncompressed files are all dependent on the sound editor and the production objectives.

The following guidelines can be kept in mind while naming the files in sound editing:

- Avoiding the use of the word final and instead opting for version numbers
- Using hyphens to provide additional information instead of underscores
- Adding metadata for critical information that might be need later on
- Adopting a consistent pattern of naming the files for the entire project

14.3.2 Using EQ, DYNMS and SFX

Let’s learn about some of the effects which can be used for sound editing.

**Equalization** - Different frequency bands are attenuated or boosted to produce desired spectral characteristics. Moderate use of equalization (often abbreviated as ‘EQ’) can be used to ‘fine-tune’ the tone quality of a recording. Extreme use of equalization, such as heavily cutting a certain frequency can create more unusual effects.

**Equalizing:** It shows you how to obtain a proper ratio of treble to bass in your sound files. While some people enjoy cranking up the bass on their home or car stereos, it isn’t a good idea to do the same with an audio file for the Web. Most
computer speakers can’t handle bass very well. In fact, sound files that contain only bass or only treble frequencies rarely sound as good as a file that contains both frequencies together.

**Dynamics (DYNMS):** In music, dynamics normally refers to the volume of a sound or note but can also refer to every aspect of the execution of a given piece, either stylistic (staccato, legato etc.) or functional (velocity). The term is also applied to the written or printed musical notation used to indicate dynamics. Dynamics do not indicate specific volume levels but are meant to be played with reference to the ensemble as a whole. Dynamic indications are derived from Italian words.

**SFX:** SFX is an abbreviation for special effects. There are a number of ways in which SFX can be described. One useful way to classify them is according to the function they perform. First, action sounds. Mostly, sound is created through movement or action. The sound produced thereby is an effective indication of the situation. Advancing footsteps may denote an entry. Retreating footsteps may denote an exit. The clock striking indicates the time. Tapping of a cane may denote a blind man and so on. Action sounds may also describe the mood of the situation. A door slamming shut may indicate anger or someone humming or whistling may indicate a sense of lightheartedness.

### 14.3.3 Reverb

Reverb constitutes the reflections and patterns which the echoes form when the sound is heard in space. This is to say that it gives the listener the idea as to where the sound is coming from and where the listener is in relation to the sound. Reverb gives the depth to the sound. Reverb provides the shape and size of the sound in space.

The following are some of the reverb controls:

- **Size:** It adjusts the tonal nature of the sound by adjusting the size of the artificial room.
- **Algorithms:** It provides the control for preset algorithms available like that of a concert hall, a room or a hall.
- **Damp:** In case, the editor is interested in achieving a warmer sound effect, the damp control helps them by dampening the high frequency content of the sound file.
- **Decay:** This control helps in determining the duration of the reverb. Longer decay shows less absorbency while shorter showcases greater absorbency.
- **Dry/wet:** The dry control refers to the unprocessed audio signal and the wet control refers to the delay effect.

### 14.3.4 Source Selection and Cleaning

Source selection refers to the method of selecting the source of audio while recording your files for sound editing. There can be multiple sources including a microphone,
Cleaning the audio refers to the process of removing any noise and maintaining a consistent level of volume throughout the audio file. The additional noise in the audio file compromises the quality of the audio. There can be several reasons for noise in the audio file including problems in conversion from one format to another or simply not a clean recording to begin with. Many softwares provide the noise reduction tool through which the noise profile can be understood and accordingly adjusted.

Another utility which comes into picture with cleaning the audio is the compressor function. It helps to set a consistent volume of the audio file. So for instance, if the file has certain sections which are louder than the others then a threshold can be set and the volume of the louder section will be adjusted accordingly. You can always preview the audio with updated settings and then save the file when you are satisfied with it.

14.3.5 Elements of Music Recording

The basic production technique for radio is tape-recording of the programme in ideal sound-proof conditions. In the early days of radio, live programmes were the order of the day; these days, almost everything except news is pre-recorded. This is an improvement, because it eliminates the defects and hazards of live broadcasts.

The equipment used for recording a radio programme include a good microphone and a recording machine with facilities for dubbing, editing and re-recording. Music-recording, particularly of an orchestra, needs a number of microphones placed near major components of the music, while a straight news commentary needs only one mike. A ‘current affairs’ programme in which 3-4 persons take part, needs 2-3 mics placed in such a manner that they give uniform sound levels.

As you have learnt earlier in Unit 12, music is an art form whose medium is sound. Common elements of music are pitch (which governs melody and harmony), rhythm (and its associated concepts tempo, meter, and articulation), dynamics, and the sonic qualities of timbre and texture.

Let’s look at the elements of music:

- **Pitch:** Pitch represents the perceived fundamental frequency of a sound. It is one of the four major auditory attributes of sounds along with loudness, timbre and sound source location. Pitch allows the construction of melodies; pitches are compared as “higher” and “lower”, and are quantified as frequencies (cycles per second, or hertz), corresponding very nearly to the repetition rate of sound waves. However, pitch is not an objective physical property, but a subjective psychophysical attribute of sound.
• **Rhythm:** Rhythm a “movement marked by the regulated succession of strong and weak elements, or of opposite or different conditions.” While rhythm most commonly applies to sound, such as music and spoken language, it may also refer to visual presentation, as “timed movement through space.” (and its associated concepts tempo, meter, and articulation).

• **Dynamics:** As you have seen earlier in this unit, dynamics normally refers to the volume of a sound or note but can also refer to every aspect of the execution of a given piece, either stylistic (staccato, legato etc.) or functional (velocity).

• **Timbre:** In music, timbre is the quality of a musical note or sound or tone that distinguishes different types of sound production, such as voices or musical instruments. The physical characteristics of sound that mediate the perception of timbre include spectrum and envelope. Timbre is also known in psychoacoustics as tone quality or tone color.

• **Texture:** In music, texture is the way the melodic, rhythmic, and harmonic materials are combined in a composition determining the overall quality of sound of a piece. Texture is often described with regards to the density, or thickness, and range, or width between lowest and highest pitches, in relative terms as well as more specifically distinguished according to the number of voices, or parts, and the relationship between these voices.

Recording is the process of saving data, and audio in this case, for future references and use.

**Signal processors:** The devices and software which allow the manipulation of the signal in various ways. The most common processors are tonal adjusters such as bass and treble controls.

**Record and playback section:** Devices which convert a signal to a storage format for later reproduction. Recorders are available in many different forms, including magnetic tape, optical CD, computer hard drive, etc.

The audio signal from the transducer (microphone) is passed through one or more processing units, which prepare it for recording (or directly for amplification).

The signal is fed to a recording device for storage.

The stored signal is played back and fed to more processors.

The signal is amplified and fed to a loudspeaker.

Sound recording and reproduction is an electrical or mechanical inscription and re-creation of sound waves, such as spoken voice, singing, instrumental music, or sound effects. The two main classes of sound recording technology are analog recording and digital recording.

**Sound mixer:** A device which takes two or more audio signals, mixes them together and provides one or more output signals. Mixers allow you to adjust
levels, enhance sound with equalization and effects, create monitor feeds, record various mixes, etc.

Mixers come in a wide variety of sizes and designs, from small portable units to massive studio consoles. The term mixer can refer to any type of sound mixer; the terms sound desk and sound console refer to mixers which sit on a desk surface as in a studio setting.

14.3.6 Mixing Pre and Post Mastering

You have already learnt about the concept of mixing earlier in the unit, let’s discuss the difference between mixing and mastering and the concept of pre and post mastering.

Mixing and mastering music are often confused as the same aspect of audio production but are actually different from each other. Mixing as a step comes before mastering and generally consists of steps like mixing of different independent files to form a single stereo audio file. Mastering, as a step then takes several stereo audio files to ensure that it is polished and cohesive to other tracks on the album, in case of music recordings. Mastering is, in essence, the step dedicated to providing the final touches to the track including tasks like cleaning and balance or sonic characteristic issues, compressing and limiting the files, applying broad equalizing, etc.

While mixing deals with individual elements of a single file adjusting its EQ, reverb, compression, volume, noise; the mastering is concerned with different files working together as a cohesive unit adjusting with its clarity, punch, frequency.

Pre-master is simply the stereo audio file which has not yet been mastered or is not ready for distribution. This may be called the final mix file which is ready to be sent for mastering. The Post-master file is then simply the audio file that is ready for distribution.

A music producer may not be able to affect the version of the music recording which is used for broadcast at radio stations. Radio broadcasts usually have a flat dynamic range. This is why it is advised that the music for radio must be radio-optimized in the sense that have an over expanded dynamic range, very forward and dominant mids and by focus on the lead parts more at their particular section in the recording.

Check Your Progress

6. What is aac?
7. What is the function of damp control?
8. List the equipment used for recording a radio programmes.
9. What is timbre in music?
14.4 EDITING WITH DIFFERENT SOFTWARES

The term editing literally means necessary addition and deletion in a given data to make it presentable in desired form. Sound editing involves necessary corrections and changes in sound to make it presentable as required. A person who captures the sound and edits it into the desired form using proper hardware and software is called an editor.

Masking a sound presentable involves multi-step processing (Figure 14.1), which includes:

1. Recording
2. Conversion (into digital format)
3. Editing
4. Applying effects
5. Exporting

A good sound editor should be capable in accomplishing all these tasks with creativity and success using proper software. A sound editing software should have the following features:

- It should be capable of operating with specialized sound cards and provide accurate input meters.
- It should also have the capacity to change bandwidth and format specifications.
- It should provide the facility to create multi-track and it should offer transitions between the RAM and the hard disk.
Let us study at some sound editing utilities.

**Important Some Sound Editing Utilities**

These days, a number of sound editing utilities are available in the market. Some of these sound editing utilities are:

- **Beat Monkey**: This utility can be used for calculating beat per minute or BPM of sound files and sample frames.
- **Sample Calculators**: This online calculator can be freely downloaded and used for a number of activities, such as sample transportation, time stretching and pitch shifting.
- **Wavelength**: This utility is used to repair WAV header files containing erroneous data entries.
- **WavUtility**: A very helpful utility, WavUtility splits WAV files on the basis of time values assigned to them.
- **ABrowse**: It is a useful utility mainly used for reading and converting sample CDS from AKAI.
- **Bsef**: This is a common utility; you can use it for changing and editing AIFF parameters in different soundfile headers.
- **WAVE**: This is a packaged utility, mainly used as a Java application for creation and processing of RIFF or WAV files.
- **mirage-disk**: Another utility that uses the Ensoniq Mirage diskettes to create and copy sample files.
- **shntool**: This utility not only helps in processing of WAV files and reporting the errors found in them but acts as a multi-purpose utility too.
- **Wavbreaker/wavmerge utility**: It is a GUI-based utility that helps in breaking or merging of WAV files.
- **Wav cut**: A utility from Stefan Ondrejicka, Wav cut is a small C program that helps in extracting small parts from WAV sound files.

After you have studied some common utilities that help in editing sounds, it would be helpful to learn about some utilities that help in denoising sound files. Some of these utilities are:

- **Gnome Wave Cleaner**: A common utility used to denoise, dehisce and amplify WAV files with CD qualities.
- **GramoFile**: This is a small program used for cleanup of gramophone records so that such recordings can be transferred to a CD.
- **GVC-lib**: This Wave Cleaner utility that was formerly a small program is now a big software library.
- **Declick**: It was developed by Joachim Schurig’s; it is a decliker for audio files in a dynamic digital format.
- **Dnr**: This denoising utility was developed by Matti Koskinen.
- **Tkdnoise**: It was developed by Hudson Lacerda. It is a denoise utility available in the Tcl/Tk GUI format.

### Normalizing Utilities

Some normalizing utilities are as follows:

- **Xpand**: It is a utility that comes with Python/Glade GUI interface. It is mainly used for dynamic compression or expansion of sound files. The utility requires SoX and normalizes to function properly.
- **wavnorm**: This utility is used to normalize WAV files available in 16-bit stereo format.
- **Calcamp**: This utility requires libsndfile to function properly. It is mainly used for calculating the factor that a sample sound file requires for amplification to the maximum sound volume.
- **Normalize**: This utility is used for normalizing the volume of WAV files.

### 14.4.1 Editing with Audacity

Editing means making necessary additions, deletions or other changes in some manuscript or data so that it can be presented to audience or reader. Here, you will study about editing of audio (sound). Before getting started, we should first know the process of selecting an audio data in data window. Follow the steps given here for editing sound:

1. Click on ‘Edit’ menu option, then click over the ‘Go To’ option in the drop-down menu.
2. Now a ‘Go To’ dialog box will appear as shown here:
3. Set the cursor position by;
   i. Clicking over the down arrow under go to option and selecting a preset, for example: custom preset.
ii. Choosing a format from ‘Input format’ list, and then entering the value in the position box in hrs : min : sec.

Here are some common yet important commands used during sound editing:

**NOTES**

**Cut**

As the name suggests this command is used to cut or delete the selected portion of the audio data from the file.

To cut a section of audio file the following steps can be followed:

1. Select from the menu bar **File → Open → Drum fill. Wav**
2. This will open the file containing audio data. Now play the file to hear the sound.
3. By clicking and dragging, select a portion of the audio file that is desired to be cut:
4. Select **Edit → Cut**
5. This will delete the selected portion of the data. The keyboard commands for cut are:

   - **Control + X** (for Windows)
   - **Command + X** (for Mac OS)

The cut effect is shown here:

![Cut Effect Image]

**Copy**

Copy option is used to copy a particular part of the data from the file. After opening the file, you can copy the desired portion of the audio data by selecting the data to be copied by clicking and dragging from one point to another.

1. Select **Edit → Copy** and the selected portion of the audio data will be copied.
2. The shortcut or keyboard command for copying for Apple Mac OS is: **Command + c**
3. The shortcut or keyboard command for copying for Microsoft Windows is: **Control + c**
4. Here is a screen showing copy option.
Paste

To paste the copied audio data PASTE command is used. For this, first take the cursor to the point where the copied data is to be pasted and then select Edit → Paste and the copied data will be pasted at that point.

The keyboard command for pasting in Apple Mac OS is:
Command + v

The keyboard command for pasting is in Microsoft Windows is:
Control + v

The paste effect will be as shown in the screen as follows.

Silence

Silence option allows us to insert silence at the cursor position in an audio file. It is important to note that silence cannot be inserted into a single channel of a stereo file.

When you silence sections between vocal lines, it is good to remember that if there is a sudden drop in the background ambience the effect in the track might not sound pleasant and might not match with the rest of the track. You could benefit by fading the area around the silenced part to lessen the harsh effect. You should always fade out slowly and fade in quickly.

To insert silence first open the audio file in which silence is to be inserted and then take the following steps:

Click Process → Insert Silence
Now an insert silence dialog box will appear; set cursor to the position where you want to insert silence and click ‘Ok’. Silence will be inserted and the output will be as shown in the following screens:

The initial screen is as follows:

The whole track becomes darker, when a sound track is selected.

Now you can insert silence.
Duplicate and Split

The **Duplicate** option allows us to copy the selected area and paste it in a new track at the same point in the time line.

To duplicate, the following steps are to be taken:

The keyboard commands for duplicating are:
- Control + D [For Windows]
- Command + D [For Mac OS]

The advantages of Duplicate option are as follows:
- It allows experimentation with effects.
- Special effects can also be created using this option.
- It lets you modify the volume of the original and duplicated audio separately.

Here is an example: you have added reverb to your audio. Now, at a later stage, you can only lower the volume of the processed audio. On the other hand, if you had duplicated the audio before adding reverb, you would be in the comfortable position of modifying the volume of either or both signals—the original and the reverb.

When you duplicate a piece of audio, you can experiment with the duplicate and create various effects to choose the best:
- You can silence parts of the audio.
- You can phase a part of the audio.
- You can filter a copy.
- You can even reverb another copy without harming the original track.

When you create a duplicate copy and make changes to it, remember that the new piece is not really copied to your hard disk. Audacity continues to play the audio from the original audio file(s) till you actually modify part of it. The screen for splitting is shown here as follows:
Split performs the same job as duplicate except that it also silences the selected material in the original track, after copying it to new track (see the following screen).

The keyboard command for split is:
- Control + Y [For Windows]
- Command + Y [For Mac OS]

**AVI Splitter**

You can use AVI Splitter for splitting of AVI files that are big into smaller size AVI videos. Or you can manually extract selected parts from an AVI video file to create a fresh AVI video file. While this is an extremely powerful tool, this process is also easy.

With AVI Splitter, you have the capability to split all formats of AVI file, like MPEG4, XviD, Uncompressed, DivX, Cinepak and MS Video 1. You can also use its in-built AVI player for playing AVI file. AVI Splitter screen is shown here.
AVI Splitter system requires:
- 16MB of memory
- 2G free space of hard disk

Submixes

A submixer is defined as a mixer which is used for mixing various sources and outputting the mixed signal to another mixer. This lets you mix more inputs than the master mixer can manage or for even the submix to be conducted at a location other than the main mixer’s.

The split function is used to pop the selected audio to a new track. Now, the tracks can be mixed using the Export as WAV function in the File Menu. Submixes are created using the Quick Mix function in the Project menu. The following screen shows 4 screens are selected:

![AVI Splitter interface]

You can quick mix the selected tracks to any number of submixes you want. Here is the screen for a two submixes.
14.4.2 Editing with Sound Forge

Sound Forge is the most recommended digital audio editing software known for its high end features. Some of the silent features of Sound Forge are as follows:

- Updated file software support and play bars
- Non-destructive editing
- Improved audio plug-in manager
- Multi-task background rendering
- Tabbed docking windows
- Customizable toolbars
- Play device toolbars
- Advanced preset manager
- Improved video handling

In order to run Sound Forge, you need to follow the following steps:

Click start > program Files > Sonic foundry > Sound Forge

Your Workspace

When you first open Sound Forge, you will be faced with an empty workspace, which looks like the screen shown here.

The workspace is a place where you actually perform operations to the audio data.

The screenshot of Sound Forge XP 4.5 is as follows:
When you open an audio file, a window opens, which contains sound file data, this window is termed as the 'Data Window'. Every audio comes with its own data window which displays the relevant information about the file. These windows contain many sub-windows and tools that are used during editing. The data Window has been shown in the next screen.

The components of the data Window are as follows:

- **Edit tool selector**: Used to toggle between edit, magnify and pencil tools.
- **Title bars**: Contains the file name.
- **Overview**: Used for quick play back and navigation
- **Time ruler**: Displays the present location in the data window.
- **Wave form display**: This represents the sound file in a graphical manner. Here, the horizontal axis represents the time (Time Ruler) and the vertical axis represents the amplitude (Level ruler).
- **Play Bars**: This comprises buttons like play looped, Go to end, stop, go to start, play as sample and play normal.
- **Level zoom in/out**: Lets you modify the resolution of the level of zoom.
- **Selection Status Field**: Shows the start, length & end of the selection.
- **Time Zoom Resolution (Zoom Ratio)**: It ascertains the time duration shows in the waveform display.

The background behind the data window is known as the workspace. Once you have opened Sound Forge, you can either create a new file or open an existing one.
The sound file that you open will be displayed in this window.

**Toolbars**

There are two toolbars at the top of the workspace:

1. For editing (the Editing toolbar)
2. For controlling the recording and playback of sound files (the Transport Toolbar)

**Opening and Saving a File**

There are two options available to you for opening a file:

1. Create a new file/an empty file to start recording the new audio.
2. Open an already existing sound file, for example, a song or a sample clip.

To create a new sound file:

- Click the **New** button on the toolbar or
- Select **File → New**:
Now, select the audio file from the dialog box and click ‘open’.

A new data window will appear, which would contain the selected audio file in the wave form display.

The next task, after opening the pre existing file is to save it as a project. The following steps are to be taken in order to save the file:

Select **File → Save → Save as**

These steps are elaborated here:

1. Ensure that the data window is selected.
2. To display the Save As dialog box, select **File → Save As**.

3. In the **Save In** field, specify the folder where you want to save the file.
4. In the **Save as Type** field, select the **.wav** option, if it is not already specified.
5. Click **Save**.

Keyboard commands for saving a file are:

- Control + S (For Windows)
- Command + S (For OS)
- Shift + F12 & Alt + Shift + F2 (For windows)
- Option + Shift + F2 (For Mac OS)

If you want to open an already existing sound file, either click **Open** on the toolbar, or select **File → Open**.
Keyboard commands to open an already existing sound file are:
- Control + N (For Windows)
- Command + N (For Mac OS)

**Data Window (Sound File Window)**

Every sound file opens in its own Data Window. The Data Window has some buttons in its bottom panel which are used for the purpose of navigation.

Each of the buttons of the Data Window can be described as follows:

- The **Zoom in** button and the **Zoom out** button on the right of the bar are used to control the sound wave’s horizontal scaling.
- The **Level Zoom in** button and the **Level Zoom out** buttons on the left of the bar are used to change the sound wave’s vertical scaling.
- The **Maximize Width** button is used to change the view to fit in the maximum amount of sound wave into the window.
- The **Playbar** button is used to go to the start or end of the sound wave, loop, stop, or loop the sound.

**Editing Sound**

Sound Forge is a great software for:

- Editing sound
- Adding effects to sound

You can edit sound:

- To increase the length of a sound clip
- To reduce the length of a sound clip
- Even for operations like eliminating unwanted noise

Some basic editing operations that can be performed on sound files have been discussed here. First of all, you ought to learn to play sound files before you edit them.

**Playing a Sound**

The following screen shot displays controls used in the playing of sound files.
Playing a File

After opening the sound file you can play the sound file, for this the following steps are to be taken:

Select Special à Transport → Play All

(The other options available with Transport are record, play, pause, stop, etc.)

Key board commands for playing a sound file are:
- Shift + Space / Shift + F12 / Shift + Play (For Windows)
- Shift + Space (Mac OS)

Other options to play a file on Sound Forge are:
- Click the Play button on the Transport toolbar to enable playback looping.
- Click the Play option on the Playbar.
- Click the Play Looped option on the Playbar.

Playing a Selection

You can begin playing from a specific position in the sound file.

To play a selected portion of the audio file:

1. Select the portion you want to play.
2. Click the Play button. Note that if you mistakenly click the Play All button, then the sound file will start playing from the beginning.
When a sound file plays, a vertical bar moves across the sound wave to indicate the part that is currently playing.

You can also use the other controls, such as Stop, Rewind, Forward, etc. for further control of playback.

**Basic Editing Operations**

You will use the Edit menu to make edits on your sound file. This menu provides you options for performing various edit operations. Here is a screen shot of the Sound Forge Edit menu.

Before you can edit a part of the currently open sound file, you need to highlight it by selecting it. Some common operations that you will be able to perform on this selected portion are:

**Cut**

As the name suggests, this command is used to cut or delete the selected portion of the audio data from the file.

To cut a section of audio file the following steps can be followed:

1. By clicking and dragging, select a portion of the audio file (desired to be cut)
2. Select Edit → Cut

This will delete the selected portion of the data the keyboard commands for cut are:

- Control + X (for Windows OS)
- Command + X (for Mac OS)
Copy

It copies a selection from the sound file onto the clipboard. After opening the file, you can copy the desired portion of the audio data means of the following steps:

1. Select the data to be copied by clicking and dragging from one point to another.
2. Select Edit → Copy and the selected portion of the audio data will be copied.
   The shortcut or keyboard command for copying is:
   Control + c (Windows OS)
   Command + c (Apple Mac OS)

Paste

This option is used to insert the data from clipboard to the current cursor position in the sound file. For this, first place the cursor to the point where the copied data is to be pasted and then

Select Edit → Paste and the copied data will be pasted at that point. The keyboard command for pasting is:

Control + v (Windows OS)
Command + v (Apple Mac OS)

Paste Special

Paste Special is used when the copied data is required to be pasted in various ways. Under paste special, you can find the following buttons:

- Mix
  It mixes contents of the clipboard with the current selection.
  Mix is used to mix the clipboard content with the current data. This can be done by following these steps:
  Select Edit → Paste special → Mix
  Keyboard commands for mixing are:
  Control + M (For windows)
  Command + M (For Mac)

Crossfade

It crossfades (blends the overlapping area) the contents of the clipboard with the data in the window.
Cross fade is used to give cross fading effect to the two selected audio data that are to be joined together. In this, the data to which the other is joined is called the destination data and it fades out while the one which is joined is called the source data, fades in.

Select Edit → Paste special → Cross fade

The keyboard commands for cross fade is:
Control + F (For Windows)
Command + F (For Mac OS)

Trim/Crop

Trim or crop is used to delete all the data except the selected portion. To trim a selected part, you need to follow these steps:

Select Edit → Clear/delete

Keyboard commands for trimming are:
Control + T (For Windows)
Command + T (For Mac OS)

Delete (Clear)

Delete or clear is used to delete the selected data or the selected part of the data completely. To delete a selected portion the following steps are to be taken:

Select Edit → Delete (Clear)

Keyboard command is:
Delete (for both Windows and Mac OS)
Undo

It reverses any change made. You can repeat the undo command to return to previous versions of the sound file.

For undoing any step:
Select Edit > Undo Cut
Keyboard commands for undoing are:
Control + z (For windows)
Command + z (For Mac OS)

For redoing any step:
Select Edit → Redo
Keyboard commands for redoing are:
Control + shift + z (For Windows)
Command + shift + z (For Mac OS)

Check Your Progress
10. State the function of wavnorm.
11. How is split different from duplicate function?
12. Mention the keyboard commands for trimming in Sound Forge.

14.5 ANSWERS TO CHECK YOUR PROGRESS QUESTIONS

1. The Nyquist-Shannon sampling theorem states that the original signal from the sampled data can be reconstructed by a DAC if its bandwidth meets certain requirements.

2. DACs come in several architectures and applicability can be determined based on the following six parameters:
   • Physical size
   • Power consumption
   • Resolution
   • Speed
   • Accuracy and
   • Cost

3. The thermometer-coded DAC provides the highest precision with the fastest speed, giving >1 billion samples per second. However, is quite expensive.
4. The spectrum of the signal is estimated using linear prediction with codecs like FLAC, Shorten and TTA.

5. A MIDI can specify control signals like notation, pitch, and velocity through event messages. Parameters like volume, vibrato, audio panning, cues and clock signals and managed by these control signals.

6. aac refers to the Advanced Audio Coding format is based on the MPEG4 audio standard owned by Dolby.

7. In case, the editor is interested in achieving a warmer sound effect, the damp control helps them by dampening the high frequency content of the sound file.

8. The equipment used for recording a radio programme include a good microphone and a recording machine with facilities for dubbing, editing and re-recording.

9. In music, timbre is the quality of a musical note or sound or tone that distinguishes different types of sound production, such as voices or musical instruments.

10. wavnorm is the utility used to normalize WAV files available in 16-bit stereo format.

11. Split performs the same job as duplicate except that it also silences the selected material in the original track, after copying it to new track.

12. Keyboard commands for trimming in Sound Forge are:
   - Control + T (for windows)
   - Control + T (for Mac OS)

### 14.6 SUMMARY

- The process of converting audio or video signals into a sequence of discrete numbers that represent changes over time in air pressure or chroma and luminance values, and finally recorded in a storage device is digital recording. To listen to a digital recording, the discrete numbers need to be retrieved and converted back to their original waveforms.

- A device or computer program that can code or decode a digital data stream of audio is an audio codec. The audio codec computer program runs an algorithm to compress and decompress any digital audio signal and passes it to a particular audio file or converts it to a streaming media audio coding format.

- An audio coding format is also referred to as an audio compression format. This is a content representation format to enable transmission or storage of
Some standard audio coding formats are MP3, AAC, Vorbis, FLAC and Opus.

- The total data needed to represent a sound can be reduced by using a lossless audio coding format. However, when it is decoded, it returns to its original, uncompressed form. Using a lossy audio coding format can, in addition, reduce the bit resolution of the sound on top of compression. This can result in irretrievably lost information but with far less data. Quite often, uncompressed audio formats such as pulse-code modulation (.wav) are also used. In the commercial arena, the file size is much more preferable due to its distribution benefits. Here the audio is compressed using lossy audio codecs.

- The conversion of digital data in binary form into an analog signal (current, voltage or electric charge) is the work of a digital-to-analog converter also referred to as DAC, D/A, D2A or D-to-A. The reverse function is performed by an analog-to-digital converter or ADC. Digital data formats are very versatile and can be transmitted, manipulated and stored without any loss but with the use of some complex equipment. However, to get any sound out of earphones or loudspeaker amplifiers from digital data, a DAC is required to convert it to analog signals.

- The purpose of audio data compression is to reduce the transmission bandwidth and the storage requirements of audio data. These are algorithms embedded in software in the form of audio codecs. Less audible or meaningful sounds are eliminated through psychoacoustics in these algorithms so that the space requirement for storage and transmission is reduced.

- Speech encoding is also important in the field of audio data compression. The models used for perception of music is different those that are for perception of speech. Sounds of a human voice usually fall in a narrower range of frequencies and are less complex than that of music. Therefore, encoding speech with a low bit rate can provide high quality results.

- Digital audio recorders began with reel-to-reel decks with the use of a digital technology known as pulse-code modulation (PCM) recording. Subsequently, devices were available that could encode the digital audio data as a standard video signal and a U-matic or other videotape recorder to record it, using the rotating-head technology. Digital Audio Tape (DAT) used the same technology of rotating heads on a narrow tape contained in a cassette.

- The musical instrument digital interface (MIDI) technical standard describes the digital recording protocol. It also defines the digital interface and connectors. It specifies the electronic musical instruments, computers and other related devices that can be connected, which lists a wide variety.
In audio, mixing is a significant activity that can enhance the quality and effect of a recording. Developments in electronics have brought along what is known as a mixing console or audio mixer.

The media is going through a major technological transition where digital technology is the reason behind a shift from terrestrial to digital broadcast. The impact of the technology is huge and so the radio is changing and that too for good. The advent of social media platforms has changed the way broadcasting is done. The radio jockeys have to multi-task.

The first step involved in sound editing is creating files and naming them. The files can be recorded or a previously recording file can be edited. Although the function may vary from software to software, the basic process of creating files and naming them is done through the files tab in the application.

EQ is the functions in which different frequency bands are attenuated or boosted to produce desired spectral characteristics. Moderate use of equalization (often abbreviated as ‘EQ’) can be used to ‘fine-tune’ the tone quality of a recording.

In music, dynamics normally refers to the volume of a sound or note but can also refer to every aspect of the execution of a given piece, either stylistic (staccato, legato etc.) or functional (velocity).

SFX is an abbreviation for special effects. There are a number of ways in which SFX can be described. One useful way to classify them is according to the function they perform.

Reverb constitutes the reflections and patterns which the echoes form when the sound is heard in space. This is to say that it gives the listener the idea as to where the sound is coming from and where the listener is in relation to the sound. Reverb gives the depth to the sound. Reverb provides the shape and size of the sound in space.

Source selection refers to the method of selecting the source of audio while recording your files for sound editing. There can be multiple sources including a microphone, tape deck, musical instrument, etc., speakers, etc.

Cleaning the audio refers to the process of removing any noise and maintaining a consistent level of volume throughout the audio file.

The elements of music include pitch, rhythm, dynamics, timbre and texture.

Mixing as a step comes before mastering and generally consists of steps like mixing of different independent files to form a single stereo audio file. Mastering, as a step then takes several stereo audio files to ensure that it is polished and cohesive to other tracks on the album, in case of music recordings.
Making a sound presentable involves multi-step processing which includes:
- Recording
- Conversion (into digital format)
- Editing
- Applying effects
- Exporting

14.7 KEY WORDS
- **Digital recording:** The process of converting audio or video signals into a sequence of discrete numbers that represent changes over time in air pressure or chroma and luminance values, and finally recorded in a storage device.
- **Audio codec:** It is a device or computer program that can code or decode a digital data stream of audio.
- **Audio coding format:** It is the representation format to enable transmission or storage of digital audio.
- **Normalizing:** It is the process of standardizing the volume of the recorded audio so that it becomes even and one part does not appear louder than the other.

14.8 SELF ASSESSMENT QUESTIONS AND EXERCISES

**Short Answer Questions**
1. What are the concerns with digital audio recording?
2. Write a short note on coding methods and speech encoding.
3. Briefly explain the digital tape recording systems.
4. What are the functions of reverb, EQ, DYNMS and SFX?
5. Write a short note on important sound editing utilities and normalizing utilities.
6. List the basic elements of music recording.
7. What is mixing pre and post mastering?

**Long Answer Questions**
1. Describe the elements of recording, playback and recording of bits.
2. Explain the basics of digital coding.
3. Discuss the audio compression techniques and standards.
4. Examine the use of analog and digital mixers.
5. Describe the basic functions of sound editing with Audacity.
6. Explain the simple functions of sound editing on SoundForge.

14.9 FURTHER READINGS


M.A. [Journalism and Mass Communication]  
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AUDIO PRODUCTION  
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