# A.V.C COLLEGE OF ENGINEERING, MANNAMPANDAL, MAYILADUTHURAI

*Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai*

*Reaccredited by NAAC with 'B++ (2nd cycle) 'Grade, an ISO 9001:2015 certified institution*

*Department of Electronics and Communication Engineering*

*(Accredited by NBA)*

# "LEMON NEWSLETTER"

***Volume: 10*** ***Month: September '22*** ***Issue: 05***

## *Message from Head of the Department*

I appreciate the students of ECE whoever participated and bagged cash prizes and certificates in symposiums and conferences.

All the final year students make use of the time to complete the Nalaiyathiran Project and expertise yourself to best match with the industrial requirements.

I expect from the Faculty members to prepare for submission of funding proposals and publications.

***Dr.CHITRAVALAVAN***

***HOD/ECE***

## SPEAK 5 LINES TO YOURSELF EVERY MORNING

- *I AM THE BEST*
- *I CAN DO IT*
- *GOD IS ALWAYS WITH ME*
- *I AM A WINNER*
- *TODAY IS MY DAY*

\- *Dr.A.P.J.ABDUL KALAM*

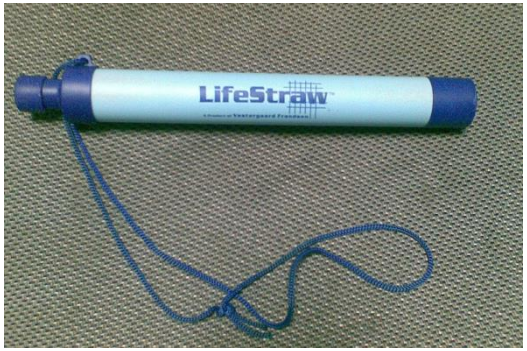
## *Faculty Corner:*

### ***WATER FILTER STRAW (LIFE STRAW)***

- ***Mrs.R.Ramya, AP/ECE***

**LifeStraw** is a brand of water filtration and purification devices. The original LifeStraw was designed as a portable water filter "straw". It filters a maximum of 4000 litres of water, enough for one person for three years. It removes almost all waterborne bacteria, microplastics and parasites.

A bottle was later developed which incorporated a Life Straw cartridge into a 650-millilitre (22 US fl oz) BPA-free plastic sports water bottle. In addition to these portable filters, the manufacturer also produces high-volume purifiers powered by gravity that also remove viruses. These are designed for family and community use.




The water filters are designed by the Swiss-based Vestergaard Frandsen. While originally developed for people living in developing nations and for distribution in humanitarian crisis, the filters have gained popularity as consumer products. The device is now used as a tool for survivalists and outdoor enthusiasts in addition to being used to help combat clean water scarcity worldwide. The filters can provide clean water without the need for batteries or chemical treatment. They are made using hollow fiber membrane technology; some of them also incorporate an activated carbon component.

The devices were distributed in the 2010 Haiti earthquake, 2010 Pakistan floods, 2011 Thailand floods, and 2016 Ecuador earthquake, among other crises and initiatives. In the Mutomo District in Kenya which has suffered from long term drought, the Kenya Red Cross supplied filters to 3,750 school children and 6,750 households. In 2015, they were deployed in Rwanda. The company also funds a retail give back program that as of 2018 has provided safe water to more than 1 million school children in rural Kenya.

Contrary to popular belief, the original device does not incorporate a reverse-osmosis membrane nor is it able to filter out salts or mineral.

### ***CONSTRUCTION:***

The original LifeStraw is a plastic tube 22 centimetres ($8+\frac{5}{8}$ in) long and 3 centimetres ($1+\frac{1}{8}$ in) in diameter. Water that is drawn up through the straw first passes through hollow fibres that filter water particles down to 0.2 µm across, using only physical filtration methods and no chemicals.

The entire process is powered by suction, similar to using a conventional drinking straw, and filters up to 4,000 litres (1,100 US gal) of water. While the initial model of the filter did not remove *Giardia lamblia*, current models remove a minimum of 99.999% of waterborne protozoan parasites including *Giardia* and *Cryptosporidium*.

The original device does not filter viruses, chemicals, salt water, and heavy metals, but newer versions of the product, (like LifeStraw Flex or LifeStraw Home) are capable of removing chemicals and heavy metals including lead.

LifeStraw has been generally praised for its effective and quick method of bacteria and protozoa removal and consumer acceptability. Although the devices are available for retail sale in the developed world, the majority are distributed as part of public health campaigns or in response to complex emergencies by NGOs and organizations that give them away for free in the developing world. It Costs around INR 4000 to INR 6000.

## *Student Corner:*

### EYE TRACKING

- ***S.Sivapriya, III ECE***

***What is eye tracking?***

Eye tracking is a sensor technology that can detect a person's presence and follow what they are looking at in real-time. The technology converts eye movements into a data stream that contains information such as pupil position, the gaze vector for each eye, and gaze point. Essentially, the technology decodes eye movements and translates them into insights that can be used in a wide range of applications or as an additional input modality.

How does an eye tracker work? An eye tracker uses invisible near-infrared light and high definition cameras to project light onto the eye and record the direction it's reflected off the cornea. Advanced algorithms are then used to calculate the position of the eye and determine exactly where it is focused.

**Types of Eye Trackers:**

There are three main types of eye tracker:

- Screen-based (also called remote or desktop)
  glasses, (also called mobile)
- Eye tracking within VR headsets.

***Eye-tracking vs. Gaze-tracking***

Eye-trackers necessarily measure the rotation of the eye with respect to some frame of reference. This is usually tied to the measuring system. Thus, if the measuring system is head- mounted, as with EOG or a video-based system mounted to a helmet, then eye-in-head angles are measured. To deduce the line of sight in world coordinates, the head must be kept in a constant position or its movements must be tracked as well. In these cases, head direction is added to eye-in-head direction to determine gaze direction.

If the measuring system is table-mounted, as with scleral search coils or table-mounted camera (remote) systems, then gaze angles are measured directly in world coordinates. Typically, in these situations head movements are prohibited. For example, the head position is fixed using a bite bar or a forehead support. Then a head-centered reference frame is identical to a world- centered reference frame. Or colloquially, the eye-in-head position directly

determines the gaze direction.

Some results are available on human eye movements under natural conditions where head movements are allowed as well. The relative position of eye and head, even with constant gaze direction, influences neuronal activity in higher visual areas.

***Eye-tracking while driving a car in a difficult situation***

The eye movement of two groups of drivers have been filmed with a special head camera by a team of the Swiss Federal Institute of Technology: Novice and experienced drivers had their eye-movement recorded while approaching a bend of a narrow road. The series of images has been condensed from the original film frames to show 2 eye fixations per image for better comprehension.

Each of these stills corresponds to approximately 0.5 seconds in real time.

The series of images shows an example of eye fixations of a typical novice and of an experienced driver.

Comparison of the images shows that the experienced driver checks the curve and even has Fixation left to look aside while the novice driver needs to check the road and estimate his distance to the parked car.

In the middle images, the experienced driver is now fully concentrating on the location where an oncoming car could be seen. The novice driver concentrates his view on the parked car.

In the image the novice is busy estimating the distance between the left wall and the parked car, while the experienced driver can use their peripheral vision for that and still concentrate vision on the dangerous point of the curve: If a car appears there, the driver has to give way, i.e. stop to the right instead of passing the parked car.

More recent studies have also used head-mounted eye tracking to measure eye movements during real-world driving conditions.

***Eye-tracking of younger and elderly people while walking***

While walking, elderly subjects depend more on foveal vision than do younger subjects. Their walking speed is decreased by a limited visual field, probably caused by a deteriorated peripheral vision.

Younger subjects make use of both their central and peripheral vision while walking. Their peripheral vision allows faster control over the process of walking.

***Applications***

A wide variety of disciplines use eye-tracking techniques, including cognitive science; psychology (notably psycholinguistics; the visual world paradigm); human-computer interaction (HCI);human factors and ergonomics; marketing research and medical research (neurological diagnosis).

Specific applications include the tracking eye movement in language reading, music reading, human activity recognition, the perception of advertising, playing of sports, distraction detection and cognitive load estimation of drivers and pilots and as a means of operating computers by people with severe motor impairment.

In the field of virtual reality, eye tracking is used in head mounted displays for a variety of purposes.

## ***IBOC TECHNOLOGY***

- ***S.Abirami ,II ECE***

In-band on-channel (IBOC) is a hybrid method of transmitting digital radio and analog radio broadcast signals simultaneously one some frequency. However, by putting RF energy outside of the normally defined channel, interference to adjacent channel stations is increased when using digital sidebands.

The addition of the digital sidebands works better in the United States, where the FM broadcast band channels have a spacing of 200 kHz, as opposed to the 100 kHz that is normal elsewhere. The 200 kHz spacing means that in practice, stations having concurrent or adjacent coverage areas will not be spaced at less than 400 kHz.

Outside of the US, spacing can be 300 kHz, which causes problems with the IBOC digital sidebands. IBOC does allow for multiple program channels, though this can entail taking some existing subcarriers off the air to make additional bandwidth available in the modulation baseband.

On FM, this could eventually mean removing stereo. On AM, IBOC is incompatible with analog stereo, and any additional channels are limited to highly compressed voice, such as traffic and weather.

Eventually, stations can go from hybrid mode (both analog and digital) to all-digital, by eliminating the baseband monophonic audio.

## ***INTRODUCTION***

In-band on-channel (IBOC) is a hybrid method of transmitting digital radio and analog radio broadcast signals simultaneously on the same frequency and increased when using digital sidebands. The addition of the digital sidebands works better in the United States, where the FM broadcast band channels have a spacing of 200 kHz, as opposed to the 100 kHz that is normal elsewhere. The 200 kHz spacing means that in practice, stations having concurrent or adjacent coverage areas will not be spaced at less than 400 kHz. Outside of the US, spacing can be 300 kHz, which causes problems with the IBOC digital sidebands.

IBOC does allow for multiple program channels, though this can entail taking some existing subcarriers off the air to make additional bandwidth available in the modulation baseband. On FM, this could eventually mean removing stereo. On AM, IBOC is incompatible with analog stereo, and any additional channels are limited to highly compressed voice, such as traffic and weather. Eventually, stations can go from hybrid mode (both analog and digital) to all-digital, by eliminating the baseband monophonic audio in FM there are currently three methods of IBOC broadcasting in use.

## ***ARCHITECTURE OF IBOC***

The first, and currently only, digital technology approved for use on AM and FM broadcast frequencies by the

Federal Communications Commission in the United States, is the proprietary HD Radio system developed by iBiquity Digital Corporation, which transmits energy beyond the allotted ±100 kHz FM channel. This creates potential interference issues with adjacent channels. This is the most widespread system in use, with approximately 1,556 stations transmitting HD radio in the US, plus over 800 new multicast channels.

***A.FMextra***

In-band on-channel (IBOC) is a hybrid method of transmitting digital radio and analog radio other system is FMeXtra by Digital Radio Express, which instead uses subcarriers within the existing signal.

This system was introduced more recently. The system is compatible with HD Radio in hybrid mode, but not in all digital mode, and with RBDS. The stereo subcarrier can be removed to make more space available for FMeXtra in the modulation baseband. However, the system is not compatible with other existing 67–92 kHz subcarriers which have mostly fallen into disuse. The system is far less expensive and less complicated to implement, needing only to be plugged into the existing exciter, and requiring no licensing fees.

FMeXtra has generally all the user features of HD Radio, including multicast capability; the ability to broadcast several different audio programs simultaneously. It uses the aacPlus (HE-AAC) codec. FMeXtra can control listening with conditional access and encryption.

***B. DRM***

Digital Radio Mondiale allows for simultaneous transmission of multiple data streams alongside an audio signal. The DRM mode for VHF provides bandwidths from between 35 Kbit/s to 185 Kbit/s and up to four simultaneous datastreams, allowing 5.1 surround DVD quality audio to be broadcast alongside other multimedia content - images, video or HTML content are typical examples. While it is not backwardly compatible with existing FM receiver equipment,with broadcasts digitally encoded using HE-AAC or xHE-AAC, this ability to operate within the internationally agreed FM spectrum of 88-108 MHz makes DRM a viable candidate for future adoption when countries begin to switch off their analogue broadcasts.

***C. HD Radio Broadcasting***

iBiquity also created a mediumwave HD Radio system for AM, which is the only system approved by the Federal Communications Commission for digital AM broadcasting in the United States.The HD Radio system employs use of injected digital sidebands above and below the audible portion of the analog audio on the primary carrier. This system also phase modulates the carrier in quadrature and injects more digital information on this phase-modulated portion of the carrier. It is based on the principle of AM stereo where it puts a digital signal where the C-QUAM system would put the analog stereo decoding information.

***D. Cam-d***

CAM-D is yet another method, though it is more of an extension of the current system. Developed by AM stereo pioneer Leonard R. Kahn, It encodes the treble on very small digital sidebands which do not cause interference to adjacent channels, and mixes it back with the analog baseband. Unlike the other two, it is not intended to be capable of multichannel, opting for quality over quantity.

Unlike the HD system iBiquity calls "hybrid digital" the CAM-D system truly is a direct hybrid of both analog and digital. Some engineers believe that CAM-D may be compatible with analog AM stereo with the right engineering.

***Critics of CAM-D point to several drawbacks:***

1) Being primarily analog, the system will be just as subject to artificial interference and noise as the current AM system

2) There are virtually no receivers available for the system and at present, no major manufacturer has announced even the intention to begin production of them; and
3) The cost of retrofitting with CAM-D is more than that of simply buying a new, HD-ready solid-state transmitter.

## *III. IBOC MODES OF OPERATION*

There are three IBOC modes of operation. IBOC allows transition from analog to digital through a Hybrid and Extended Hybrid mode of operation, before adopting an All-Digital mode of operation.

### *A. Hybrid Mode*

In this mode the digital signal is inserted within a 69.041 kHz bandwidth, 129.361 kHz on either side of the analog FM signal. The IBOC Hybrid mode digital signal is transmitted in sidebands either side of the analog FM signal and each sideband is approximately 23 dB below the total power in the FM signal.

The hybrid sidebands are referred to a Primary Main (PM) sideband. The host analog signal may be mono or stereo, and may include subsidiary communication channels. The total power of the digital sidebands is 20 dB below the nominal power of the FM analog carrier with power relative to the total analog FM power of ñ41.39 dB/kHz.

### *B. Extended Hybrid Mode*

This mode includes the hybrid mode and additional digital signals are inserted closer to the analog signal, utilising a 27.617 kHz bandwidth, 101.744 kHz on either side of the analog FM signal. Analog FM Signal 129,361 Hz 198,402 Hz
115,553 Hz .IBOC Extended Hybrid mode digital sidebands are extended towards the analog FM signal to increase digital capacity.The extended hybrid sidebands are referred to as Primary Extended (PX) sidebands. The total power of the digital sidebands is 20 dB below the nominal power of the FM analog carrier with power relative to total analog FM power of
41.39 dB/kHz.

### *C. Benefits of DAB*

DAB devices perform band-scans over the entire frequency range, presenting all stations from a single list for the user to select from.DAB can carry "radio text" (in DAB terminology, Dynamic Label Segment, or DLS) from the station giving real-time information such as song titles, music type and news or traffic updates, of up to 128 characters in length. This is similar to a feature of FM RDS, which enables a radio text of up to 64 characters.

The DAB transmission contains a local time of day and so a device may use this to automatically correct its internal clock when travelling between time zones and when changing to or from Daylight Saving.DAB is not more bandwidth efficient than analogue measured in programmes per MHz of a specific transmitter (the socalled link spectral efficiency), but it is less susceptible to co-channel interference (cross talk), which makes it possible to reduce the reuse distance, i.e. use the same radio frequency channel more densely.

The system spectral efficiency (the average number of radio programmes per MHz and transmitter) is a factor three more efficient than analogue FM for local radio stations. For national and regional radio networks, the efficiency is improved by more than an order of magnitude due to the use of SFNs. In that case, adjacent transmitters use the same frequency. The specialised nature, limited spectrum and higher cost of DAB broadcasting equipment provides barriers to unlicensed ("pirate") stations broadcasting on DAB. In cities such as London with large numbers of unlicensed radio stations broadcasting on FM, this means that some stations can be reliably received via DAB in areas where they are

regularly difficult or impossible to receive on FM because of interference from unlicensed radio stations. Mono talk radio, news and weather channels and other non-music programs need significantly less bandwidth than a typical music radio station, which allows DAB to carry these programmes at lower bit rates, leaving more bandwidth to be used for other programs.

DAB transmitters are inevitably more expensive than their FM counterparts. DAB uses higher frequencies than FM and therefore there may be a need to compensate with more transmitters to achieve the same coverage as a single FM transmitter. DAB is commonly transmitted by a different company from the broadcaster who then sells the capacity to a number of radio stations. This shared cost can work out cheaper than operating an individual FM transmitter.

This efficiency originates from the ability a DAB network has in broadcasting more channels per transmitter/network. One network can broadcast 6–10 channels (with MP2 audio codec) or 10–18 channels (with HE AAC codec). Hence, it is thought that the replacement of FM-radios and FM-transmitters with new DAB-radios and DAB-transmitters will not cost any more compared with new FM facilities. It is also argued that the power consumption will be lower for stations transmitted on a single DAB multiplex compared with individual analog transmitters.

## ***IV. IBOC CAPABILITIES***

IBOC enables the broadcaster to select the desired audio quality and data transmission rate however, as expected,
there is a trade-off between audio quality and the data transmission rate. The audio quality and data trade off in the
three modes is summarised in Table 1: The audio quality at 96 kb/s is near CD quality but in Hybrid mode this only allows 1 kb/s for data.

IBOC allows the bit rate to be adjusted in 8 kb/s steps. By transmitting audio at the satellite DARS3 bit rate of 64 kb/s, additional data capacity, exceeding that of the current generation of mobile phones (9 ñ 19kb/s), is available. At times when audio quality is not as important, the audio bit rate may be reduced to as low as 48 kb/s but audio quality will be reduced to near telephone audio quality.

IBOC incorporates a 4.5 second delay between the analog and digital audio signals. The receiver initially acquires the analog signal and takes a few seconds to begin to decode the audio on the digital sidebands. If 10% of the digital data blocks sent are corrupted during transmission, the IBOC receiver reverts to the analog signal. This is referred to as the ìblend–to analog feature of IBOC. The blend
process is perceived to have the same quality as the analog audio and the process itself does not degrade the audio quality below that of analog. Field tests indicate that Hybrid FM IBOC digital coverage is comparable to analog coverage but IBOC reception can be obtained in areas where the analog service is currently of an unacceptable quality due to interference such as co-channel interference, impulse noise and multipath fading. The enhancements claimed over traditional analog FM broadcasting include:

- Almost full immunity from typical FM multipath reception problems;
- Significantly improved full stereo coverage;
- Flexible data casting opportunities:
- Efficient means for FM broadcasters to begin the transition to digital broadcasting
- Use of OFDM in IBOC allows on-channel digital repeaters. It is expected that there will be a trade off in audio
- signal to-noise ratios in some areas where 1st adjacent (IBOC) stations overlap, but this is only expected. The

- iBiquity field tests conducted with eight FM broadcasting stations in the US, concluded that digital coverage
- with one hundredth the power (-20dB) of analog, extended to the 45 - 50 dB signal.

## *V. CONCLUSION*

IBOC is capable of transmitting audio services and a variety of wireless data services. At the basic level, it will enable broadcasters to transmit data related to digital audio programming, including song title, artist and station information. The initial receiver applications are expected to include the ability to display simple text information related to audio programming. Additional data services are expected to include the delivery of paging-like services, including traffic, weather, sports scores, stock quotes and target.

## *Importance of Voting - Drawing*

- ***Rajkumar.R, IV ECE***


## *QUIZZES AND TRICKY RIDDLESFOR BRAIN GAMES*

- ***S.Gobika, IV ECE***

1 Which company developed the PDF file format?
A.Adobe B.Microsoft C.Sony
2. Which of these social media sites waspreviously called picaboo?
A.Tik-tok B.Instagram C.Snapchat
3 What does the 'M' in MP3 stand for
A.Movie B.Music C.Moving
4 What does the word pixel mean?
A.Picture embedded element B.Primary image element C.Picture element
5. What is the name for either pole of an electricbattery?
A.Node B.Electrode C.Anode
6. QR stands and this code can be any colour format, it is true or false.
A.Quick Reading B.Quick Reacting C.Quick Response
7. What mathematical symbol can be put between 5 and 9, to get a number value bigger than '5' and smaller than '9
8. **101-102 = 1**.It's an incorrect equation. How will you move one numeral to make it correct?
9. Grammatically, the helping verb 'am' is used with 'I' Example: I am an engineer, say one sentencethat has the helping verb 'is' used with '
10. Divide 30 by half and add 12. What do you get?

***Answers:***

1.A.Adobe
2.C.Snapchat
3.C.Moving
4.C.picture element

5.B.Electrode
6.C.Quick Response , true
7.Decimal point (.)That is, 5.9
8.101-10^*2=1*
*9.* I is a letter
10. Ans: 72. Reason: we have to divide 30 by half not by 2 , so divided by ½ is equal to 30 multiplied by 2,that is 60+12=72.

## ***Editors Desk***

### ***Millets and its Health benefits***

Millets are a powerhouse of nutrients. They have reclaimed their space in the kitchen of those more health-conscious. Millets boost our health and improve weight loss, besides being gluten-free.Millets are available in a variety of types, and each has its health benefits.

### ***Seven Proven Health Benefits of Millets***

Millets are rich in several beneficial nutrients, such as phosphorus, magnesium, copper, and manganese. Incorporate them into your diet to gain the following benefits.

***1. Millets Aids Weight Loss***

The calorie content of millets is low, and they are an excellent food product for weight loss. It prevents snacking and overeating.

***2. Millets Keeps Your Blood Sugar Levels Low***

Millets have a low glycaemic index. Therefore, consume millets regularly to lower your risk of developing diabetes.

***3. Millets Boost Your Immunity***

Millets provide a great source of protein and can help develop and strengthen our immunity. Stronger immunity means fewer chances of you catching diseases.

***4. Millets Reduces Cardiovascular Risks***

Millets contain essential fats, which provide our bodies with good fats which prevent excess fat storage as well as effectively lowers the risk of high cholesterol, strokes, and other heart complaints.

***5. Millets Prevents Asthma***

The magnesium content in millets can reduce how frequently you experience migraines. It can also bring down the severity of your asthma complaints.

***6. Millets Helps Your Digestion***

Millets are a rich fibre source that benefits digestion by alleviating bloating, gas, cramping, and constipation. In addition, good digestion keeps issues like gastric/colon cancer and kidney/liver complaints away.

***7. Millets Acts as an Antioxidant***

Millets help your body detox because of their antioxidant properties; Quercetin, curcumin, ellagic acid, and other valuable catechins flush out toxins from your body and neutralise the enzymatic actions of your organs.

***Send your suggestions to:***

Dr.K.R.Vinothini, AP/ECE –Editor / **LEMON NEWSLETTER**

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1.U.Bragathishwari ,IV ECE

2.B.Maheshkumar ,IV ECE

3.M.Yogeshwaran,III ECE

4.S.Ashika,III ECE

**Department Vision**

To create globally competent engineers in Electronics and Communication Engineering to meet the industrial progress for betterment of the society

**Department Mission**

1. To create an academic ambience for quality education in the field of Electronics and Communication Engineering
2. To make the best use of modern tools and software for teaching and research activities
3. To promote industry-institution interaction for skill-based learning of students from rural society
4. To inculcate moral and ethical values with a sense of professionalism.

**PROGRAMME EDUCATIONAL OBJECTIVES:**

**PEO1:** To enable graduates to pursue research, or have a successful career in academia or industries associated with Electronics and Communication Engineering, or as entrepreneurs.

**PEO2:** To provide students with strong foundational concepts and also advanced techniques and tools in order to enable them to build solutions or systems of varying complexity.

**PEO3:** To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to solve the problems identified.

**PROGRAMME OUTCOMES:**

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAMME SPECIFIC OUTCOMES (PSOs)**

1. To analyze, design and develop solutions by applying foundational concepts of electronics and communication engineering.
2. To apply design principles and best practices for developing quality products for scientific and business applications.
3. To adapt to emerging information and communication technologies (ICT) to innovate ideas and solutions to existing/novel problems.