Dept. of Electronics and Communication Engineering of Amal Jyothi College of Engineering hosted the Science Academies’ Lecture Workshop on Advances in Wireless Communications and Networking sponsored by Indian Academy of Sciences, Bangalore, Indian National Science Academy, New Delhi and The National Academy of Sciences, Allahabad on July 23-24, 2015. Wireless communication is among technology’s biggest contributions to mankind. The workshop aimed at providing the platform for students, engineers, researchers and scientists to enhance their knowledge about the recent trends in the field of wireless communication and networking. The course covered and highlighted the key developments, technical details and standard activities of major modern wireless communication systems throughout the world like WiFi, convex optimization, networking etc. There were around 150 registered (55 faculties and 95 students including both PG and UG) participants from all over Kerala. The inaugural ceremony was presided over by our beloved principal, Rev. Dr. Jose Kannampuzha. Prof. KG Satheeshkumar, HOD, ECE, welcomed the gathering. The workshop was inaugurated by Dr. A. Chokalingam, Professor, ECE, IISc Bengaluru. The felicitations was done by Dr. James Jacob, Dean R&D, AJCE. The dignitaries on the dais included Dr. Nelesh Mehta, AP, ECE, IISc. Bengaluru. Dr. K Karunakaran Nair, PG coordinator, AJCE proposed the vote of thanks. Following the meeting the various sessions on different areas of Wireless Communications were discussed.

23-7-15: FN Session-Lecture 1 & 2

Introduction to Wireless Communications and Next Generation Wireless

Dr. Nelesh Mehta,
AP, ECE, IISc, Bengaluru

Dr. Nelesh Mehta, Associate Professor in the ECE department of IISc Bengaluru, took the first lecture on Introduction to Wireless Communication. He started with the line of sight communication, from where the first wireless communication began. If the signal underwent no attenuation and was unaffected by noise, the transmitted signal would be received at the receiver without any error and communication could have been a success one. As we all know, this is never possible and the signal undergoes effects like reflection, refraction, interference, etc., from other channels and many more, which depends on the channel used for communication. This makes the design of a wireless system complex. These effects on the signal on each channel were analyzed. The effects of fading, shadowing and diversity were also dealt with in this session.

As a continuation from the first lecture, the second lecture was about a next generation wireless communication system which dealt with multiple transmitters and receivers or a MIMO. Wireless network architecture using sensor nodes and a master node was considered. Power saving sensor nodes that remain active lifelong are explained. Cognitive radio technology that senses the spectrum periodically is the latest emerging technology in wireless network communications. A system model for the same was also discussed.
23-7-15: AN Session-Lecture 1 & 2

Convex Optimization

Dr. P Ubaidulla,
AP, IIIT Hyderabad

The first lecture was an introduction to optimization. The basic terms and requirement for optimization was discussed. The advantages of optimization include using a global minimum value, infeasible solutions, etc. Convex optimization is used in signal processing, where filter arrays, signal denoising and similar comes to play. Current technologies enable real-time convex optimization in signal processing. Various optimization techniques were discussed like Lagrange’s duality, linear program, second order cone program and quadratic program.
In the second lecture, the applications of convex optimization was discussed which included, optimization in power allocation in MIMO, Multicarrier system and various other areas. A system model was also discussed to emphasise on the use of robust designs as well.

24-7-15: FN Session-Lecture 1 & 2

Wireless Networking

Dr. Premkumar K
AP, Dept of EEE,
IIITD&M, Kancheepuram

Wireless network consist of wireless hosts, base station, wireless links. Wireless hosts such as laptop, smartphone, etc basically stationary or mobile. Wireless links typically used to connect mobile to base station and base station transmit packets. In the case of cellular network, mobile switching center manage call setup and handles mobility. In 3G, new cellular data network operates in parallel (except at EDGE) with existing cellular voice network. The voice network unchanged in core and data network operates in parallel. The basic challenges in wireless networks are wireless and mobility. Wireless channel characteristics are decreased signal strength, multipath propagation and Interference from other sources. The packets are transmitted in network either by packet switching or by circuit switching.
Data-link layer has responsibility of transferring datagram from one node to adjacent node over a link. “MAC” addresses used in frame headers to identify source and destination. Multiple access protocol use distributed algorithm that determines how nodes share channel, that is determine when node can transmit. Three broad classes of MAC protocols are channel Partitioning, random access and taking turns. Physical layer define the transmission format and type of medium for transmission.
24-7-15: AN Session-Lecture 1

Next Generation Wifi

Dr. Santapal Chaudhuri
Distinguished Engg
Aruba Communications, Bengaluru

Santa Pal Chaudhuri an Engineer from Aruba Networks, took an informative lecture on the topic next generation WiFi. His entire talk focused on three main areas. First there was a brief session about the Evolution of 802.11 standards. Next he dealt with Enterprise Wi-Fi and he concluded the session with the Core innovations in Wi-Fi. Mr. Chaudhuri gave an overall idea about Hidden Terminal Problem and Exposed Terminal Problem and various modes of operation (DCF (Distributed Coordination Function) and PCF (Point Coordination Function) used to deal with these problems. Then he focused on the need for using Enterprise Wi-Fi and adaptive radio management. Core innovations in Wi-Fi include the tunnel Mode, virtual cell and virtual controller. The entire presentation provided a new insight into the next generation Wi-Fi and was informative and thought provoking. Towards the end of the session the students were permitted to interact with this eminent personality and they could get valuable information and guidance for continuing with their research.

24-7-15: AN Session-Lecture 2

Visible Light Wireless Communications

Dr. A. Chockalingam
Professor, Dept. of ECE,
IISc., Bengaluru

The Optical wireless communication (OWC) is a promising complementary technology for RF communication (RFC) technology in which information conveyed via optical radiation in free space and it includes visible light wave lengths. Visible light communication’s (VLC) main advantage is it has abundant VLC spectrum and can transmit multi-gigabit rates over short distances. In VLC the transmitter is a LED and a photo detector is used as a receiver. It is first implemented as ‘photophone’ by Graham Bell. In Analog voice transceiver. He used a mirror controls the amount of light reflected from a source as the transmitter and a photocell connected to a speaker as a receiver. VLC have a lot of advantages, it has low power, low cost equipment (e.g., LED, photo diode), no spectrum cost, high data rates, full duplex, simultaneous data transmission and lighting, improve spectral efficiency and performance. But it also have some disadvantages, ambient light noise/interference, alignment between Tx and Rx and scattering and multipath dispersion (ISI). We can incorporate MIMO (Multiple Input Multiple Output) in Visible Light Communication. It results in high data rates and gives MIMO gains even under LOS conditions.

The VLC can be used for indoor communication using a geometrical arrangement of the LEDs. The photo detectors are used along with the LEDs to receive the signal. After the channel analysis the CIR information is calculated by summing the information obtained through each channel. In VLC the key elements are the LED and the photo detector so the characteristics of both the components should be analyzed properly. The emission pattern of
the LED can be denoted as the radiation pattern of the LED. The performance of the GSM system can be analyzed using the BER Vs Average SNR plot. The experiment is conducted in a room which satisfies certain constraints and then the transmitted and receiver is chosen such that it should be within certain set of parameters. GSM can be compared with other MIMO systems to analyze the performance of the system. OFDM (Orthogonal Frequency Division Multiplexing) can also be used in the Visible Light Communication systems in order to increase the performance of the system. It transmit signal as real and imaginary part and uses Hermitian symmetry on information and it achieves good performance.

Various areas of wireless communication were discussed and some were totally new and thought provoking specially those on Visible Light Communication. All participants, both from AJCE and outside AJCE found the sessions really useful and moreover inspirational for their further research and study. In the valedictory ceremony Amal Jyothi Engg college principal Rev. Dr. Jose Kannampuzha had given a valedictory address. The summary of the workshop was given by Dr. Jacob Philip (Professor, AJCE and former Director Sophisticated Test and Instrumentation Centr, CUSAT, Cochin). Prof. K G Satheeshkumar (Head Dept of AJCE, Co ordinator of the workshop) proposed the vote of thanks.

The feedback from all of the participants was very positive and motivational to the coordinators as well. The two day workshop threw light into new areas and some even said that now they know how to look into a subject and how to start a research. AJCE looks forward to come up with such inspirational workshops in the coming days as it has been doing.
PHOTOS:

**Inaugural Ceremony:**

*Inaugurated by Dr.A.Chokalingam, Prof, IISc, Bangalore.*
Rev. Dr. Jose Kannampuzha, Principal, Amal Jyothi College of Engineering
Visible Light Communication: Dr. A. Chokalingam, Prof. IISc, Bangalore