SCHOOL OF ENGINEERING
SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES
Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Electronics and Communication Engineering

Semester – VI

Control Systems
ECA-601

ECA-601	**Control Systems**	**2L:1T:0P**	**3 credits**	**3Hrs/Week**

Course Preamble

1. The students should be able to learn the type of System, dynamics of physical systems, classification of control system, analysis and design objective.
2. The students should learn how to represent system by transfer function and block diagram reduction method and Mason's gain formula.
3. The students should able to learn time response analysis and demonstrate their knowledge frequency response.
4. Students can be able to learn stability analysis of system using Root locus, bode plot, polar plot, and Nyquist plot.

Course Outcomes:

1. Identify open and closed loop control system
2. Formulate mathematical model for physical systems.
3. Simplify representation of complex systems using reduction techniques.
4. Use standard test signals to identify performance characteristics of first and second-order systems.
5. Apply root locus technique for stability analysis.
6. Analyze performance characteristics of system using Frequency response methods

UNIT-I(10H)

Introduction to control problem- Industrial Control examples. Transfer function. System with dead-time. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis.

UNIT-II(10H)

Feedback control systems- Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feedforward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion.

UNIT-III(10H)

Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain. Root locus method of design. Lead and lag compensation.

UNIT-IV(6H)

Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain. Frequency domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation. Op-amp based and digital implementation of compensators. Tuning of process controllers. State variable formulation and solution.

UNIT-V(6H)

State variable Analysis- Concepts of state, state variable, state model, state modelsfor linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability. Introduction to Optimal control & Nonlinear control, Optimal Control problem,Regulator problem, Output regulator, treking problem. Nonlinear system – Basic concept & analysis.

Text/Reference Books:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.

ECA-601	Control Systems	0L:0T:2P	1 credits	2Hrs/Week

Experiment list

1. Overview of the MATLAB Environment for control system.
2. Step Response of 1st and 2nd order systems in MATLAB.
3. Analysis and Designing of bode plot using MATLAB.
4. Analysis and Designing of Root locus using MATLAB.
5. Introduction to Simulink for Control System.
6. To study of PID controller with Simulink.
7. Introduction of State Spaces design in MATLAB.
8. Test of Controllability and Observability.
9. Determination of state transition matrix
10. Introduction to LTI viewer.
11. Design of digital compensators, Lag, Lead

SCHOOL OF ENGINEERING
SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES
Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Electronics and Communication Engineering

Optical Communication

ECA-602

ECA-602	**Optical Communication**	**2L:1T:0P**	**3 credits**	**3Hrs/Week**

Course Preamble

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations an structures.
2. To understand the different kind of losses, signal distortion, SM fibers.
3. To learn the various optical sources, materials and fiber splicing
4. To learn the fiber optical receivers and noise performance in photo detector.

Course Outcomes:
At the end of the course, students will demonstrate the ability to:

1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.

2. Understand the properties of the optical fibers and optical components.

3. Understand operation of lasers, LEDs, and detectors

4. Analyze system performance of optical communication systems

5. Design optical networks and understand non-linear effects in optical fibers

UNIT-I(10H)

Introduction to vector nature of light, propagation of light, propagation of light ina cylindrical dielectric rod, Ray model, wave model.

UNIT-II(10H)
Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

UNIT-III(10H)

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

UNIT-IV(6H)

Optical switches - coupled mode analysis of directional couplers, electro-opticswitches. Optical amplifiers - EDFA, Raman amplifier. WDM and DWDM systems. Principles of WDM networks.

UNIT-V(6H)

Nonlinear effects in fiber optic links. Concept of self-phase modulation, groupvelocity dispersion and solition based communication.

Text/Reference Books

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

ECA-602	**Optical Communication**	**0L:0T:2P**	**1 credits**	**2Hrs/Week**

List of Experiments:

1. Launching of light into the optical fiber and calculate the numerical aperture and V-number.
2. Observing Holograms and their study.
3. Optic version Mach-Zehnder interferometer.
4. Measurement of attenuation loss in an optical fiber.
5. Diffraction using gratings.
6. Construction of Michelson interferometer.
7. Setting up a fiber optic analog link and study of PAM.
8. Setting up a fiber optic digital link and study of TDM and Manchester coding.
9. Measurement of various misalignment losses in an optical fiber.

Program Elective-II
Computer Networks
ECA-603(A)

ECA-603(A)	**Computer Networks**	**3L:1T:0P**	**4 credits**	**4Hrs/Week**

Course Preamble

1. Describe the general principles of data communication.
2. Describe how computer networks are organized with the concept of layered approach.
3. Describe how signals are used to transfer data between nodes.
4. Implement a simple LAN with hubs, bridges and switches.

Course Outcomes:

1. Understand the concepts of networking thoroughly.
2. Design a network for a particular application.
3. Analyze the performance of the network

UNIT-I(10H)

Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic ail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

UNIT-II(10H)

Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical

UNIT-III(10H)

Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connectionoriented transport – Transmission Control Protocol, Remote Procedure Call. Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call.

UNIT-IV(6H)

Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

UNIT-V(6H)

Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

Text Reference books:

1. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition
2. L. Peterson and B. Davie, "Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
4. S. Keshav, "An Engineering Approach to Computer Networking" , Pearson Education
5. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition
6. Andrew Tanenbaum, "Computer networks", Prentice Hall
7. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall
8. William Stallings, "Data and computer communications", Prentice Hall

Information Theory and Coding
ECA-603(B)

ECA-603(B)	**Information Theory and Coding**	**3L:1T:0P**	**4 credits**	**4 Hrs/Week**

Course Preamble

1. Understand error–control coding.
2. Understand encoding and decoding of digital data streams.
3. Be familiar with the methods for the generation of these codes and their decoding techniques.
4. Be aware of compression and decompression techniques.
5. Learn the concepts of multimedia communication.

Course Outcomes:

1. Design an application with error–control.
2. Use compression and decompression techniques.
3. Apply the concepts of multimedia communication

UNIT-I (10H)

INFORMATION THEORY:

Entropy, Information rate, source coding: Shannon-Fano and Huffman coding techniques, Mutual Information, Channel capacity of Discrete Channel, Shannon- Hartley law, Trade-off between bandwidth and SNR.

UNIT-II (10H)

ERROR CONTROL CODES:

Examples of the use of error control codes,basic notations, coding gain,Characterization of Error control codes, performance of error control codes, comparison of uncoded and coded systems.

UNIT-III (10H)

LINEAR BLOCK CODES:

Linear block codes and their properties, standard arrays, syndromes, weight distribution. Error detection/correction properties, modified linear block codes.

UNIT-IV (6H)

CONVOLUTION CODES:

Convolution encoders, structural properties of convolution codes, trellis diagrams, Viterbi algorithm, performance analysis.

CYCLIC CODES:

General theory, Shift Register Implementations, Shortened Cyclic codes, CRCs for Error Detection.

UNIT-V (6H)

BCH AND RS CODES:

Algebraic Description, Frequency Domain Description, Decoding Algorithms for BCH and RS Codes.

REFERENCE BOOKS:

[1] John Proakis, "Digital Communications", TMH, 5th Ed.,2008.

[2] Simon Haykin, "Communication System", Wiley, 2008.

[3] Jorge Castineira, Moreira, "Essentials of Error Control

Coding", Wiley, 2006.

Digital Image & Video Processing
ECA-604(A)

ECA-604	**Digital Image & Video Processing**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Course Preamble

1. To study the image fundamentals and mathematical transforms necessary for image processing.

2. To study the image enhancement techniques

3. To study image restoration procedures.

4. To study the image compression procedures.

Course Outcomes

1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image compression and coding

UNIT-I (10H)

Digital Image Fundamentals-Elements of visual perception, image sensing andacquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

UNIT-II (10H)

Image Enhancements and Filtering-Gray level transformations, histogramequalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

UNIT-III (10H)

Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation. Image Segmentation- Detection of discontinuities, edge linking and boundarydetection, thresholding – global and adaptive, region-based segmentation.

UNIT-IV (6H)

Wavelets and Multi-resolution image processing- Uncertainty principles of FourierTransform, Time frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis,wavelets and Subband filter banks, wavelet packets.NImage Compression-Redundancy– inter-pixel and psycho-visual; Losslesscompression – predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

UNIT-V (6H)

Fundamentals of Video Coding- Inter-frame redundancy, motion estimationtechniques – fullsearch, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.Video Segmentation- Temporal segmentation–shot boundary detection, hard-cutsand soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

Text/Reference Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
3. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

SCHOOL OF ENGINEERING
SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES
Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Electronics and Communication Engineering

Speech and Audio Processing
ECA-604(B)

ECA-604(B)	**Speech and Audio Processing**	**3L:0T:0P**	**3 credits**	**3 Hrs/Week**

Course Preamble

To provide an introduction to basic concepts and methodologies for the analysis, modeling, synthesis and coding of speech and music. To provide a foundation for developing applications and for further study in the field. To introduce software tools for the analysis and manipulation of speech and music and to gain practical experience in the design and implementation of speech and music processing algorithms.

Course Outcomes

1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.

UNIT-I (10H)
Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ;Requirements of speech codecs –quality, coding delays, robustness.

UNIT-II (10H)
Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

UNIT-III (10H)
Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of non stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

UNIT-IV (10H)
Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

UNIT-V (10H)
Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions,

quantization based on LSF. Linear Prediction Coding- LPC model of speech production; Structures of LP Cencoders and decoders; Voicing detection; Limitations of the LPC model.

Text/Reference Books:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students_ *Edition), 2004.*
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.

Introduction to MEMS
ECA-605(A)

ECA-605 (A)	**Introduction to MEMS**	**3L:0T:0P**	**3 credits**	**3 Hrs/Week**

Course Preamble

The objective of this course is to present the state of the art in the areas of mechanical systems to enable the control systems.

Course Outcomes

At the end of the course the students will be able to
1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices

UNIT-I (10H)

Introduction and Historical Background, Scaling Effects. Micro-Nano Sensors.

UNIT-II (10H)

Actuators and Systems overview: Case studies. Review of Basic MEMS fabrication modules: Oxidation,
Deposition Techniques, Lithography (LIGA), and Etching.

UNIT-III (10H)

Micromachining: Surface Micromachining, sacrificial layer processes,

UNIT-IV (6H)

Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding. Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods,

UNIT-V (6H)

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

Text/Reference Book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.

SCHOOL OF ENGINEERING
SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES
Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Electronics and Communication Engineering

Bio-Medical Electronics
ECA-605(B)

ECA-605(B)	**Bio-Medical Electronics**	**3L:0T:0P**	**3 credits**	**3Hrs/Week**

Course Preamble

1. To introduce the basic concepts related to the operation of electrical & electronic measuring instruments.
2. To understand operational and application aspects of CRO (normal and storage).
3. To analyze and apply various AC bridges for the measurements of various physical quantities minimizing errors by following proper precautions.
4. To study the principles behind various transducers and their applications in the measurement of various parameters in electrical and mechanical engineering fields.

Course Outcomes

1. Understand the basic concepts of electrical units, measurement errors and accuracy.
2. Measure different physical parameters using different transducers.
3. Gain experience in interpreting technical specifications and selecting sensors and transducers for a given application.
4. Apply the principles and practice for instrument design and develop for real world problems.

UNIT-I (10H)

Measurements & Errors: Significance of measurements, methods of measurements: Direct & indirect methods, Mechanical, Electrical, Electronic Instruments, Classification of instruments, Deflection & null type, Characteristics of instruments: accuracy, precision, drift, span & range, Significant Figures, Static Sensitivity, Linearity, hysteresis, Threshold, Dead zone, Resolution, Loading effect etc. Error & its types: Gross systematic error: Instrumental Error, Environmental error, observational error. Random error: Arithmetic mean, Range, deviation, Average deviation, Standard deviation, variance etc.

UNIT-II (10H)

CRO & Measurements: Basic CRO Circuit, Dual trace Oscilloscope, Dual beam Oscilloscope, Sampling Oscilloscope, Analog Storage Oscilloscope, Digital Storage Oscilloscope. Measurement with CRO: Frequency, Voltage, Current, Phase, Dielectric, Frequency ratio etc.
A.C Bridges: General equation for bridge balance, Measurement of inductance, Capacitance and Q of the coil, Capacitance Maxwell's, Wiens, Schering Bridge, Wagner Earth Tester.

UNIT-III (10H)

Signal generator, function generator, sweep frequency generator, pulse and square wave generator, wave analyzers, harmonic distortion analyzer, spectrum analyzer, heterodyne frequency meter, frequency counter, measurement errors, automatic and computing counter, Digital voltmeter, Ramp type DVM, Integrating DVM, successive approximation DVM.

UNIT –IV (6H)

Transducer: Electrical transducers, classification of transducers, resistive transducer, resistance thermometers, thermistors, thermocouples, Inductive transducer, LVDT, Capacitive, piezoelectric, hall effect transducers. Measurement of non Electrical quantity: Displacement, strain, flow measurements, Rota meter, Venturi meter, Bourdon tube pressure transducer, temperature.

UNIT-V (6H)

Sensors: Gas Sensor, NBA agent, Microbial sensor, electro analytical sensor, Enzyme based sensor-glucose sensor, Electronic nose –halitosis, breath analysis. Advances in sensor technology: lab –on –a chip, smart sensor, MEMS and Nano sensor. Radiation sensor , Thermal radiation sensor.

Reference Books:

1. Electrical Electronics Measurement & Measuring Instrumentation by A.K Shawney.
2. Electronics & Instrumentation Measurement by J.B Gupta.
3. Instrumentation & Measurement by Helfrick Cooper, PHI India
4. Electronics Instrumentation, H.S. Kalasi, TMH India
5. Biomedical senses & Measurement by Wane, Pind, Liu, Sprinper.
6. Measurement, Instrumentation, and Sensors Handbook, Second Edition: TwoVolume Set John G. Webster, Halit Eren, CRC Press
7. Measurement System by Doebelin, Tata McGraw-Hill Education
8. Biosensors: Theory and Applications, Donald G. Buerk, by CRC Press
9. Fundamentals of Instrumentation 2nd Edition by NJATC, Cengage Learning; 2 edition

SCHOOL OF ENGINEERING
SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES
Outcome based Curriculum for
Undergraduate Degree Courses in Engineering & Technology
Department of Electronics and Communication Engineering

Minor Project
ECA-606

ECA -606	**Minor Project**	**0L:0T:4P**	**2 credits**	**4Hrs/Week**

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Design and validate DC and AC bridges
2. Analyze the dynamic response and the calibration of few instruments
3. Learn about various measurement devices, their characteristics, their operation and their
4. limitations
5. understand statistical data analysis
6. Understand computerized data acquisition.
7. Conceive a problem statement either from rigorous literature survey or from the requirements
8. raised from need analysis.
9. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
10. Write comprehensive report on Minor project work.

Guidelines:

1. The Minor-project is a team activity having 3-4 students in a team. This is electronic product.
2. design work with a focus on electronic circuit design.
3. The Minor project may be a complete hardware or a combination of hardware and software.
4. The software part in Minor project should be less than 50% of the total work.
5. Minor Project should cater to a small system required in laboratory or real life.
6. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
7. After interactions with course coordinator and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and Preambles of Minor project.
8. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
9. The student is expected to exert on design, development and testing of the proposed work as
10. per the schedule.
11. Art work and Layout should be made using CAD based PCB simulation software. Due
12. considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

Working schedule the faculty and student should work according to following schedule:

Each student undertakes substantial and individual project in an approved area of the subject and supervised by a member of staff. The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty.

Action plan for Minor Project work and its evaluation scheme (Suggestive)

Task/Process	**Week**	**Evaluation**	**Marks For Term Work**
Orientation of students by HOD/Project Guide	1st	-	-
Literature survey and resource collection	2nd	-	-
Selection and finalization of topic before a Committee*	3rd	Seminar-I	20
(Detailing and preparation of Project) Modeling, Analysis and Design of Project work	4th to 5th	-	20
Testing, improvements, quality control of project	6th to 10th - 11th	-	25
Report Writing	12th to 15th		25
Presentation before a committee (including user manual, if any)	16th	Seminar-II	30

* Committee comprises of HOD, all project supervisions including external guide from Industry (if any)

NOTE: At every stage of action plan, students must submit a write up to the concerned guide.