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 Instrumentation Engineering
Semester – VI

Microcontroller & Microprocessor
EIA-601

EIA-601	**Microcontroller & Microprocessor**	**2L:1T:0P**	**3 credits**	**3Hrs/Week**

Course Preamble

1. To be able to understand in detail about 8086 microprocessor architecture, programming and interfacing.
2.To be able to understand about 8051 microcontroller architecture, and programming.

Course Outcomes

1. Acquire the knowledge of Architecture of 8086, writing assembly language programming for different applications.
2.Explain types of microcontrollers and their applications

UNIT-I (10H)

Microprocessor: Architecture of 8086 - Segmented memory, Addressing modes, Instruction set, Minimum and maximum mode operations.

UNIT-II (10H)

Introduction to Programming: Assembly language programming, Assembler directives, Simple programs using assembler, Strings, Procedures, Macros timing.

UNIT-III (10H)

Interfacing to Microprocessor: Memory and I/O interfacing, A/D and D/A interfacing, 8255(PPI),
Programmable Internal Timer (8253), Keyboard and display interlace, Interrupts of 8086.

UNIT- IV (6H)

Micro Controller Architecture: Types of Micro Controllers, 8051 MC - Architecture input / output pins, Ports and circuits, Internal and external memories, Counters and timers, Serial data input / output, Interrupts & timers.

UNIT-V (6H)

Introduction to Programming: Basic Assembly Language Programming, instruction cycle, Addressing modes, 8051 instruction set, Classification of instructions. Simple programs.

Reference Book:

1. Douglas. V. Hall microprocessors and Interfacing -Tata McGraw Hill -Revised 2nd Edition,

2006.
2. Krishna Kant - microprocessors and Microcontrollers - Architecture, Programming and System Design 8085, 8086, 8051, 8096, Prentice-Hall India - 2007.
3. Kenneth. J. Ayala–The 8051 Microcontroller Architecture Programming and Applications", Thomson publishers, 2nd Edition, 2007.
4. Waiter A. Triebel & Avtar Singh - The 8088 and 8086 Microprocessor -Pearson Publishers, 4th Edition, 2007.

EIA-601	**Microcontroller & Microprocessor**	**0L:0T:2P**	**1 credits**	**2Hrs/Week**

Experiment List

1. To study development tools/environment for ATMEL/PIC microcontroller programme and Architecture.
2. Write an assembly language program to add, subtract, multiply, divide 16 bit data by Atmel microcontroller.
3. An assembly language program to generate 10 KHz frequency using interrupts on P1.2.
4. Study and analyze the interfacing of 16 x 2 LCD.
5. Study of implementation, analysis and interfacing of seven segment display.
6. Study of implementation of steeper motor angle control.
7. Study of implementation of DC Motor control using PWM method.
8. Study and observation of Position control of Servo Motor.
9. Study of Programming and Transmission and Reception of data through serial port.
10. To study implementation and programming of Pressure measurement.
11. To study implementation and programming of Temperature measurement.
12. Study and analysis of interfacing of graphical LCD using PIC Microcontroller.
13. To interface PWM based voltage regulator using PIC Microcontroller.
14. Study and interface of IR (RC5 Protocol) and RF Communication using PIC Microcontroller

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EIA-602 Biomedical Instrumentation

EIA-602	**Biomedical Instrumentation**	**2L:1T:0P**	**3 credits**	**3Hrs/Week**

Course Preamble

1. To provide students with an understanding of various medical instruments and latest techniques used in the hospital for diagnostic purpose.
2. To learn and understand electrical hazards of medical instruments and patient's safety.

Course Outcomes

1. Describe different general devices used in biomedical applications.
2. Explain instruments for recording Bio-potentials.
3. Explain different techniques and related instruments for measuring blood pressure, blood flow and heart sounds.
4. Describe radiography and explain recent biomedical instruments.
5. Describe electrical hazards, safety in hospital design.

UNIT-I (10H)
Introduction to Bio medical Instrumentation: General characteristics of medical instrumentation like linearity, range, frequency response, signal to noise ratio and stability. Amplifiers for Bio medical Applications: Differential, Carrier amplifiers. Recorders and display devices for Bio medical applications. General features of ink jet, thermo sensitive and optical recorders. General features of display devices for bio signals. Data acquisition and display using micro computers

UNIT-II (10H)
Electro Cardiograph(ECG) recording system: Block Schematic diagram of ECG machine, Amplifiers and circuits for ECG, ECG Leads, Noise problems and their elimination.
Electro Encephalography (EEG): Block schematic diagram of EEG recording system, General features of different blocks, Specification of EEG amplifiers, Qualitative requirements. 10 -20 electrode placement system, resting rhythms and sleep stages.
Electro Myography (EMG): Block schematic diagram of EMG recording system. EMG amplifiers. Design considerations of EMG amplifiers. Data display for EMG.

UNIT-III (10H)
Blood pressure and Blood Flows: Electronic Techniques for indirect and direct measurement of blood pressure. Measurement of blood flow by Electromagnetic, Doppler and Plethysmo graphic methods

Phonocardiography: Origin of heart sounds, Phonocardiography instrumentation consisting of microphone, filters and signal conditioners.

UNIT-IV (6H)

Introduction to Radiography: Physical properties of X-Rays, principles of generation of X-Rays. Radiation energy distribution, collimators and grids, fluoroscopy, and image intensifiers.
Recent Trends: Medical imaging, X-rays, laser applications, ultrasound scanner, echo cardiography, CT scan MRI/NMR, Cine angiogram, color Doppler systems, Holter monitoring, endoscopy.

UNIT-V (6H)

Electrical hazards during Bio electric monitoring: Safety codes and Standards, Micro and Macro shock and their physiological effects. Leakage currents and protection by the use of isolation transformers, Equipotential grounding and earth free monitoring. Electrical factors in Hospital Design: Electrical power supply systems in a Hospital building. Proper installation and grounding for providing safe patient electrical environment.

Reference Book:

1. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd Edition, Prentice Hall, New Delhi, 1998.
2. John G. Webstar, Medical instrumentation -Application & Design, John Wiley & Sons Inc., 3rd Edition, 2003.
3. R.S. Khandpur, Hand Book of Biomedical Instrumentation, Tata McGraw Hill Publishing Company Ltd., 2nd Edition, New Delhi, 2003
4. Joseph J.Carr and John M.Brown, Introduction to Biomedical Equipment Technology, Pearson Education, 2001.
5. L. A. Geddes, Principles of Applied Bio-Medical Instrumentation, John Wiley and Sons, New York, USA, 1975.
6. Geddes L. A. and Baker L. E., "Principles of Applied Biomedical Instrumentation", 3rd Edition, John Wiley, New York, 1989.
7. Richard Aston, "Principles of Bio-medical Instrumentation and Measurement", Merril Publishing Company, New York, 1990

EIA-602	**Biomedical Instrumentation**	**0L:0T:2P**	**1 credits**	**2 Hrs/Week**

Experiment List

1. Design of pre amplifiers to acquire bio signals along with impedance matching circuit using suitable IC's
2. Design of ECG Amplifiers with appropriate filter to remove power line and other artifacts.
3. Design of EMG amplifier

4. Design a suitable circuit to detect QRS complex and measure heart rate
5. Design of frontal EEG amplifier
6. Design of EOG amplifier to detect eye blink
7. Design a right leg driven ECG amplifier.
8. Design and study the characteristics of optical Isolation amplifier
9. Design a Multiplexer and Demultiplexer for any two biosignals.
10. Measurement of pulse-rate using Photo transducer.

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Program Elective-II
EIA-603(A)
Instrumentation in Aerospace and Navigation

EIA-603(A)	**Instrumentation in Aerospace and Navigation**	**3L:1T:0P**	**4 credits**	**4 Hrs/Week**

Course Preamble:

1. To expose the students to the field of aerospace engineering
2. To impart basic knowledge of its navigation instrumentation

Course Outcomes:

1. To understand the basics of aerospace and navigation
2. To know the technical aspects of this subject
3. To know about various troubles in aircrafts

UNIT-I (10H)
Introduction To Aviation: History of aviation and space flight anatomy of airplane and space vehicle with emphasis on control surfaces. Airfoil nomenclature, basics of aerodynamics to illustrate lift and drag, types of drag, finite wings, swept wings, flaps Airplane performance, thrust, power, rate of climb, absolute and service ceiling, range and endurance.

UNIT-II (10H)
Aircraft Instrumentation: Basic of engine instruments, capacitive fuel content, gauges, standard atmosphere, altimeters, aneroid, radio altimeters. Aircraft compass, remote indicating magnetic compass, rate of climb indicator, pilot static system, air speed indicator, mach meters, integrated flight instruments, flight testing and recording of flight tests.

UNIT-III (10H)
Radio Navigation Aids: Automatic direction finder distance measuring equipments, instrument landing system visual Omni range, radar, optical instruments, engine instruments and control, pressure measurements, thermal meter control, tachometer, accelerometer, smoke and fire detection, propeller controls, twin blade control, cabin pressure and temperature.

UNIT-IV (6H)
Satellite and space vehicle instrumentations: Satellite and space vehicle instrumentation, propulsion controls, sun sensors, horizon sensors, star tracker, stabilization controls.

UNIT-V (6H)

Electrical Troubles: Hydraulic systems trouble, landing gear troubles, cabin conditioning troubles, indication of unsafe canopy, Boeing condition, radio troubles, separate generator, system troubles, trouble indicator light, advantages of instrument flag, black box and its use.

REFEREANCE BOOK

1. John D Anderson JR, "Introduction to flight", Mc Graw hill
2. Pallett E.G.H, " Aircraft instrumentation and integrated systems", Longman scientific and Technical,1992
3. Nagaraja N.S, "Elements of electronic navigation", Mc Graw Hill , New Delhi 1975

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Reliability Engineering
EIA-603(B)

EIA-603(B)	**Reliability Engineering**	**3L:1T:0P**	**4 credits**	**4 Hrs/Week**

Course Preamble

1. To understand the concepts of different types of probability distributions importance of reliability evaluation of networks.
2. To make the students understand about Reliability, availability model of Power Systems and markov modeling of Power Plants. With identical and no identical units.

Course Outcomes

1. Able to understand the meaning of discrete and continuous random variables and their significance, causes of failures of a system.
2. Able to acquire the knowledge of different distribution functions and their applications.
3 .Able to develop reliability block diagrams and evaluation of reliability of different Systems

UNIT- I (10H)

Discrete and Continuous Random Variables: probability density function and cumulative distribution function, Mean and Variance, Binomial, Poisson, Exponential and Weibull distributions.

UNIT, II (10H)

Failure and Causes of Failure: Failure rate and failure density, Reliability function and MTTF, Bath tub curve for different systems, parametric methods for above distributions, Non-Parametric methods from field data.

UNIT- III (10H)

Reliability Block Diagram: Series and parallel systems, Network reduction technique, Examples, Evaluation of failure rate, MTTF and reliability, Active and Standby Redundancy, r out of n configuration. Non-series, parallel systems. Path based and cut set methods.

UNIT- IV (6H)

Availability, MTTR and MTBF: Markov models and State transition matrices, Reliability models for single component, two components, Load sharing and standby systems, Reliability and availability models of two unit parallel system with repair and standby systems with repair.

UNIT- V (6H)

Repairable Systems: Maintainability, Preventive maintenance, Evaluation of reliability and J1TTF, Overhauling and replacement, Optimum maintenance policy, Markov model of a power plant with identical units and non-identical unit, Capacity outage probability table.
Frequency of failures and Cumulative frequency

Reference Book

1) Charles E.Ebeling, "**Reliability and Maintainabelity Engineering**", Mc Graw Hill International Edition, 1997.
2) Balaguruswamy, "**Reliability Engineering,**"Tata McGraw Hill Publishing company Ltd,1984.
3) R.N.Allan. "**Reliability Evaluation of Engineering Systems**", Pitman Publishing, 1996.
4) Endrenyi. "Reliability Modelling in Electric Power Systems". JohnWiley & Sons, 1978.

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Digital Image & Video Processing
EIA-604(A)

EIA-604(A)	**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

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Speech and Audio Processing
EIA-604(B)

EIA-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
EIA-605 (A)

EIA-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.

Digital System Design using HDL Verilog

EIA-605(B)

EIA-605 (B)	Digital System Design using HDL Verilog	**3L:0T:0P**	**3 credits**	**3 Hrs/Week**

Course Preamble

1. Describe Verilog hardware description languages (HDL).
2. Develop Verilog HDL code for combinational digital circuits.
3. Develop Verilog HDL code for sequential digital circuits.
4. Develop Verilog HDL code for digital circuits using switch level modeling and
5. describes system tasks, functions and compiler directives
6. Describes designing with FPGA and CPLD.

Course Outcomes

1. To understand syntax of various commands, data types and operators available with
2. verilog HDL
3. To design and simulate combinational circuits in verilog
4. To design and simulate sequential and concurrent techniques in verilog
5. To write Switch level models of digital circuits
6. To implement models on FPGAs and CPLDs

UNIT I (10H)

Introduction to Verilog HDL: Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools

Verilog Data Types and Operators: Binary data manipulation, Combinational and Sequential logic design, Structural Models of Combinational Logic, Logic Simulation, Design Verification and Test Methodology, Propagation Delay, Truth Table models using Verilog.

UNIT II (10H)

Combinational Logic Circuit Design using Verilog: Combinational circuits building blocks: Multiplexers, Decoders , Encoders , Code converters, Arithmetic comparison circuits, Verilog for combinational circuits , Adders-Half Adder, Full Adder, Ripple-Carry Adder, Carry Lookahead Adder, Subtraction, Multiplication.

UNIT III (10H)

Sequential Logic Circuit Design using Verilog: Flip-flops, registers & counters, synchronous sequential circuits: Basic design steps, Mealy State model, Design of FSM using CAD tools, Serial Adder Example, State Minimization, Design of Counter using sequential Circuit approach.

UNIT IV (10H)

Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with Strengths and Delays, Strength Contention with Trireg Nets.

System Tasks Functions and Compiler Directives: Parameters, Path Delays, Module Parameters. System Tasks and Functions, File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.

UNIT V

Designing with FPGAs and CPLDs: Simple PLDs,ComplexPLDs,Xilinx 3000 Series FPGAs, Designing with FPGAs, Using a One-Hot State Assignment, Altera Complex Programmable Logic Devices (CPLDs), Altera FLEX 10K Series CPLDs.

Reference Book:

1) T.R. Padmanabhan, B Bala Tripura Sundari, "**Design Through Verilog HDL**", Wiley 2009.
2) Samir Palnitkar, "**Verilog HDL**", 2nd Edition, Pearson Education, 2009.
3) Stephen Brown, Zvonko Vranesic , "**Fundamentals of Digital Logic with Verilog Design**, TMH, 2nd Edition 2003.

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Minor Project
EIA-606

EIA -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 design work with a focus on electronic circuit design.
2. The Minor project may be a complete hardware or a combination of hardware and software.
3. The software part in Minor project should be less than 50% of the total work.

3Minor Project should cater to a small system required in laboratory or real life.

4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. 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.
6. 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.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due 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.