SRI SATYA SAI UNIVERSITY OF TECHNOLOGY & MEDICAL SCIENCES
SCHOOL OF ENGINEERING
Undergraduate Degree Courses in Engineering & Technology
Department of Civil Engineering

Course Content

VI SEMESTER

CEA-601	**Transportation Engineering-II**	**2L:1T:0P**	**3credits**	**3Hrs/Week**

Preamble:-

•The Course will try to introduce the basic engineering principles that helps in the planning, design, construction, operation and maintenance of Railways and Airports.

Outcome:-

Upon completion of the Transportation Engineering-II course, Students are expected to attain the following outcomes-

•Can handle the design, construction, and operation of railroads and mass transit systems that use a fixed guide way.

•Tasks that include determining horizontal and vertical alignment design, station location and design, and construction cost estimating.

•Will able to design and construct airports.

•Can account for the impacts and demands of aircraft in their design of airport facilities.

UNIT-I **9Hr**

High way planning, Alignment & Geometric Design: Principles of highway planning, road planning in India and financing of roads, classification patterns. Requirements, Engg. Surveys for highway location. Cross sectional elements- width, camber, super-elevation, sight distances, extra widening at curves, horizontal and vertical curves, numerical problems.

UNIT –II **11Hr**

Bituminous & Cement Concrete Payments: Design of flexible pavements, design of mixes and stability, WBM, WMM, BM, IBM, surface dressing, interfacial treatment- seal coat, tack coat, prime coat, wearing coats, grouted macadam, bituminous concrete specification, construction and maintenance. Advantages and disadvantages of rigid pavements, general principles of design, types, construction, maintenance and joints, dowel bars, tie bars. Brief study of recent developments in cement concrete pavement design, fatigue and reliability.

UNIT – III **12Hr**

Low Cost Roads, Drainage of Roads, Traffic Engg. & Transportation Planning: Principles of stabilization, mechanical stabilization, requirements, advantages, disadvantages and uses, quality control, macadam roads-types, specifications, construction, maintenance and causes of failures. Surface and sub-surface drainage, highway materials: properties and testing etc. Channelized and un-channelized intersections, at grade & grade separated intersections, description, rotary-design elements, advantages and disadvantages, marking, signs and signals, street lighting. Principles of planning, inventories, trip generation, trip distribution, model split, traffic assignment, plan preparation.

UNIT - IV **7Hr**

Airport Planning, Runway & Taxiway: Airport site selection. air craft characteristic and their effects on runway alignments, wind-rose diagrams, basic runway length and corrections, classification of airports. Geometrical elements: taxi ways and runways, pattern of runway capacity.

UNIT - V **6Hr**

Airport, Obstructions, Lightning & Traffic control: Zoning regulations, approach area, approach surface-imaginary, conical, horizontal. Rotating beacon, boundary lights, approach lights, runway and taxiway lighting etc. instrumental lending system, precision approach radar, VOR enroute traffic control.

Reference Books:

1. Highway Engineering by Gurucharan Singh
2. Principles of Pavement Design by E.J. Yoder & M.W. Witzech
3. Highway Engineering by O'Fleherty
4. Highway Engineering by S.K. Khanna & C.E.G. Justo
5. Airport Planning & Design by S.K. Khanna & M. G. arora
6. Foresch, Charles "Airport Planning"
7. Horonjeff Robert "The Planning & Design of Airports"
8. Sharma & Sharma, Principles and Practice of Highway Engg.
9. Haung, Analysis and Design of Pavements
10. Relevant IRC & IS codes
11. Laboratory Manual by Dr. S. K. Khanna
12. Highway Engg. By Hews & Oglesby
13. Highway Material by Walker

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CEA-601	**Transportation Engineering-II**	**0L:0T:2P**	**1credits**	**2Hrs/Week**

LIST OF EXPERIMENTS:

1. Aggregate Crushing Value Test
2. Determination of aggregate impact value
3. Determination of Los Angeles Abrasion value
4. Determination of California Bearing Ratio values
5. Determination of penetration value of Bitumen
6. Determination of Viscosity of Bituminous Material
7. Determination of softening point of bituminous material
8. Determination of ductility of the bitumen
9. Determination of flash point and fire point of bituminous material
10. Determination of Bitumen content by centrifuge extractor
11. Determination of stripping value of road aggregate
12. Determination of Marshall Stability value for Bituminous mix
13. Determination of shape tests on aggregate

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CEA-602	**Geotechnical Engineering-I**	**2L:1T:0P**	**3credits**	**3Hrs/Week**

Preamble:-

•To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

Outcome:-

Students will be able to

•Analyze the pin-jointed plane and space frames

•Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.

•Analyze the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.

•Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

UNIT - I **9Hr**

Basic Definitions & Index Properties: Definition and scope of soil mechanics, Historical development. Formation of soils. Soil composition. Minerals, Influence of clay minerals on engineering behavior. Soil structure. Three phase system. Index properties and their determination. Consistency limits. Classification systems based on particle size and consistency limits.

UNIT - II **11Hr**

Soil Water and Consolidation: Soil water, Permeability Determination of permeability in Laboratory and in field. Seepage and seepage pressure. Flow nets, uses of a flow net, Effective, neutral and total stresses. Compressibility and consolidation, Relationship between pressure and void ratio, Theory of one dimensional consolidation. Consolidation test, Fitting Time curves. Normally and over consolidated clays. Determination of reconsolidation pressure, settlement analysis. Calculation of total settlement.

UNIT - III **10Hr**

Stress Distribution in Soils and Shear Strength of Soils: Stress distribution beneath loaded areas by Boussinesq and water gaurd's analysis. New mark's influence chart. Contact pressure distribution. Mohr - Coulomb's theory of shear failure of soils, Mohr's stress circle, Measurement of shear strength, Shear box test, Tri axial compression test, unconfined compression test, Value shear test, Measurement of pore pressure, pore pressure parameters, critical void ratio, Liquefaction.

UNIT - IV **7Hr**

Stability of Slopes: Infinite and finite slopes. Types of slope failures, Rotational slips. Stability number. Effect of ground water. Selection of shear strength parameters in slope stability analysis. Analytical and graphical methods of stability analysis. Stability of Earth dams.

UNIT - V **8Hr**

Lateral Earth Pressure: Active, passive and earth pressure at rest. Rankine, Coulomb, Terzaghi and Culmann's theories. Analytical and graphical methods of determination of earth pressures on cosion-less and cohesive soils. Effect of surcharge, water table and wall friction. Arching in soils. Reinforced earth retaining walls.

Reference Books: -

1. Soil Mech. & Found. Engg. by Dr. K.R. Arora - Std. Publishers Delhi.
2. Soil Mech. & Found. by Dr. B.C.Punmia- Laxmi Publications, Delhi.
3. Modern Geotech Engg. by Dr.l Aram Singh - IBT Publishers, Delhi.
4. Geotech Engg. by C. Venkatramaiah - New Age International Publishers, Delhi
5. Soil Mech. & Found. Engg. by S.K. Garg- Khanna Publishers, Delhi.
6. Soil Testing for Engg. by T.W. Lambe - John Wiley & Soms. Inc.
7. Relevant I.S. Codes

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CEA-602	**Geotechnical Engineering-I**	**0L:0T:2P**	**1credits**	**2Hrs/Week**

List of Experiments:

1. Determination of Hygroscopic water content
2. Particle - size analysis
3. Determination of Specific gravity of soil particles
4. Determination of plastic limit
5. Determination of liquid limit
6. Determination of shrinkage limit
7. Permeability tests
8. Direct shear test
9. Consolidation test

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Program Elective-II

CEA-603 (A)	**Structural Analysis-II**	**3L:1T:0P**	**4 credits**	**4 Hrs/Week**

Preamble:-

•To introduce the students to the basic theory and concepts of classical methods of structural analysis.

Outcome:-

Students will be able to

•Analyze the pin-jointed plane and space frames

•Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.

•Analyze the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.

•Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

UNIT- I **13Hr**

Moment distribution method in analysis of frames with sway, analysis of box frames, analysis of portals with inclined members, analysis of beams and frames by Kani's method.

UNIT- II **9Hr**

Plastic analysis of beams and frames.

UNIT-III **14Hr**

Analysis of tall frames, wind and earthquake loads, codal provisions for lateral loads. Approximate analysis of multistory frames for vertical and lateral loads.

UNIT-IV **11Hr**

Matrix method of structural analysis: force method and displacement method.

UNIT -V **13Hr**

Influence lines for intermediate structures, Muller Breslau principle, Analysis of Beam-Columns.

Reference Books:-

1. Wang C.K. Intermediate structural analysis, McGraw Hill, New York.
2. Kinney Streling J. Indeterminate structural Analysis, Addison Wesley.
3. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Company, New Delhi.
4. Norris C.H., Wilbur J.B. and Utkys. Elementary Structural Analysis, McGraw Hill International, Tokyo.
5. Weaver W &Gere JM, Matrix Methods of Framed Structures, CBS Publishers & Distributors, Delhi

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Professional Elective-II

CEA-603 (B)	**Ground Water Hydrology**	**3L:1T:0P**	**4credits**	**4 Hrs/Week**

Preamble:-

- To study occurrence movement and distribution of water that is a prime resource for development of a civilization.
- To know diverse methods of collecting the hydrological information, which is essential, to understand surface and ground water hydrology.
- To know the basic principles and movement of ground water and properties of ground water flow.

Outcome:-

On completion of the course, the student is expected to be able to

- Provide a background in the theory of hydrological processes and their measurement
- Apply science and engineering fundamentals to solve current problems and to anticipate, mitigate and prevent future problems in the area of water resources management
- A systematic understanding of the nature of hydrological stores and fluxes and a critical awareness of the methods used to measure, analyze and forecast their variability; and the appropriate contexts for their application.

UNIT-I **10Hr**

Introduction: Ground water utilization & historical background, ground water in hydrologic cycle, ground water budget, ground water level fluctuations & environmental influence, literature/ data/ internet resources.

UNIT-II **13Hr**

Occurrence And Movement Of Ground Water: Origin & age of ground water, rock properties affecting groundwater, groundwater column, zones of aeration & saturation, aquifers and their characteristics/classification, groundwater basins & springs, Darcy's Law, permeability & its determination, Dupuit assumptions, heterogeneity &anisotropy, Ground water flow rates & flow directions, general flow equations through porous media.

UNIT-III **13Hr**

Pollution And Quality Analysis Of Ground Water: Municipal ,industrial ,agricultural ,miscellaneous sources & causes of pollution, attenuation, underground distribution, potential evaluation of pollution, physical ,chemical ,biological analysis of ground water quality, criteria & measures of ground water quality, ground water salinity & samples, graphical representations of ground water quality.

UNIT-IV **14Hr**

Surface & Sub-Surface Investigation Of Ground Water: Geological ,geophysical exploration, remote sensing , electric resistivity ,seismic refraction based methods for surface investigation of ground water, test drilling & ground water level measurement, sub-surface ground water investigation through geophysical , resistivity ,spontaneous potential ,radiation , temperature ,caliper , fluid conductivity , fluid velocity ,miscellaneous logging.

UNIT-V **10Hr**

Artificial Ground Water Recharge: Concept & methods of artificial ground water recharge, recharge mounds & induced recharge, wastewater recharge for reuse, water spreading.

REFERENCE BOOKS: -

1. D.K. Todd and L. F. Mays,"Groundwater Hydrology", John Wiley and sons.
2. K. R.Karanth,"Hydrogeology", TataMcGraw Hill Publishing Company.
3. S. Ramakrishnan,"Ground water",S. Ramakrishnan.

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Program Elective-III

CEA-604 (A)	**Environmental Engg.-I**	**3L:0T:0P**	**3credits**	**3Hrs/Week**

Preamble:-

- To prepare students for the effective use of the conventional techniques and engineering analytical methods for design and operation of water and wastewater treatment engineering systems.
- To present the foundations of many basic Engineering tools and concepts related Environmental Engineering.

Outcome:-

The students after completing this course will be able to

- Design and draw various units of municipal water treatment plants and sewage treatment plants.
- Recognize the design philosophy of water and wastewater treatment processes.
- The students will learn to understand the theoretical and practical aspects of environmental engineering along with the design and management applications.

UNIT - I **8Hr**

Estimation of ground and surface water resources. quality of water from different sources, Demand & quantity of water, fire demand, water requirement for various uses, fluctuations in Demand, forecast of population.

UNIT - II **9Hr**

Impurities of water and their significance, water-borne diseases, physical, chemical and Bacteriological analysis of water, water standards for different uses. Intake structure, Conveyance of water, pipe materials, pumps - operation & pumping stations.

UNIT -III **8Hr**

Water Treatment methods-theory and design of sedimentation, coagulation, filtration, disinfection, aeration & water softening, modern trends in sedimentation & filtration, miscellaneous methods of treatment.

UNIT - IV **10Hr**

Layout and hydraulics of different distribution systems, pipe fittings, valves and appurtenances, analysis of distribution system. Hardy cross method, leak detection, maintenance of distribution systems, service reservoir capacity and height of reservoir.

UNIT - V **10Hr**

Rural water supply schemes, financing and management of water supply project, water pollution control act, conservancy & water carriage system, sanitary appliance and their operation, building drainage system of plumbing.

Reference Books:-

1. Water Supply Engineering by B.C. Punmia - Laxmi Publications (P) Ltd. New Delhi
2. Water Supply & Sanitary Engg. by G.S. Birdi - Laxmi Publications (P) Ltd. New Delhi
3. Water & Waste Water Technology by Mark J.Hammer - Prentice - Hall of India, New Delhi
4. Environmental Engineering - H.S. Peavy & D.R.Rowe-Mc Graw Hill Book Company,New Delhi
5. Water Supply & Sanitary Engg. by S.K. Husain
6. Water & Waste Water Technology - G.M. Fair & J.C. Geyer
7. Relevant IS Codes

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Program Elective-III

CEA-604 (B)	**Industrial Waste Treatment**	**3L:0T:0P**	**3credits**	**3Hrs/Week**

Preamble:-

• To provide knowledge on sources and characteristics of Industrial Wastewaters, Techniques and approaches for minimizing the generation of wastewaters at the source and application of physico-chemical, biological and advanced treatment methods for recovery, reuse and disposal of wastewaters in Indian Industries.

Outcome:-

On Completion of the course, the student is expected to be able to

•Explain the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection

•Apply knowledge and skills to design industrial wastewater treatment schemes

•Design facilities for the processing and reclamation of industrial wastewater

•Plan and develop sludge management scheme for sludge generated from industries

•Conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable.

UNIT – I **12Hr**

Introduction:- Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health Environmental legislations related to prevention and control of industrial effluents and hazardous wastes

UNIT - II **8Hr**

Cleaner Production:- Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

UNIT – III **11Hr**

Pollution From Major Industries:- Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts

UNIT - IV **8Hr**

Treatment Technologies:- Equalization – Neutralization – Removal of suspended and dissolved organic solids – Chemical oxidation – Adsorption – Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Disposal

UNIT - V **7Hr**

Hazardous Waste Management:- Hazardous wastes – Physico chemical treatment – solidification – incineration – Secure land fills

Reference Books:

(i) Rao M. N. & Dutta A. K. , "Wastewater Treatment", Oxford – IBH Publication, 1995.
(ii) Eckenfelder W.W. Jr., "Industrial Water Pollution Control", McGraw Hill Book Company, New Delhi, 2000.
(iii) Patwardhan. A.D., Industrial Wastewater Treatment", Prentice Hall of India, New Delhi 2010.

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Open Core Elective – II

CEA-605(A)	**Structural Design & Drawing – I (STEEL)**	**3L:0T:0P**	**3credits**	**3Hrs/Week**

Preamble:-

•To study the behaviour of members and connections, analysis and design of Industrial buildings and to study the design of with cold formed steel and plastic analysis of structures.

Outcome:-

On completion of the course, the student is expected to be able to

•Design the steel members such as purlins, gable wind girders, base plates subjected to combined forces

•Explain and design the different types of steel connections such as welded, bolted and moment resisting connections

•Analyse and design the industrial structures such as trusses, portal frames subjected to seismic forces.

•Explain the effect of axial force and shear force on steel structures and analyse the continuous beams, frames using plastic theory

•Evaluate the behaviour and design of compression and flexural members

UNIT - I **8Hr**

Various loads and mechanism of the load transfer, partial load factors, structural properties of Steel, Design of structural connections -Bolted, Riveted and Welded connections.

UNIT - II **8Hr**

Design of compression members, Tension members, Roof Trusses - Angular & Tubular, Lattice Girders.

UNIT- III **9Hr**

Design of simple beams, Built-up beams, Plate girders and gantry girders.

UNIT – IV **10Hr**

Effective length of columns, Design of columns-simple and compound, Lacings & battens. Design of footings for steel structures, Grillage foundation.

UNIT – V **10Hr**

Design of Industrial building frames, multistory frames, Bracings for high rise structures, Design of transmission towers. NOTE: - All the designs for strength and serviceability should strictly be as per the latest version Of IS:800.

Reference Books :-

i) Design of steel structures by Arya & Azmani Nemchand & Bros, Roorkee

ii) Design of steel structures by P.Dayaratnam
iii) Design of steel structures Vol. I & II by Ramchandra
iv) Design of steel structures by L.S. Negi
v) Design of steel structures by Ramammutham
vi) Design of steel structures by Punmia

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Open Core Elective-II

CEA-605(B)	**Highway Geometric Design**	**3L:0T:0P**	**3credits**	**3Hrs/Week**

Preamble:-

•To give an overview on the basics of highway engineering and to impart the various process and methods involved in the planning, development, design, construction and maintenance of highways.

Outcome:-

On completion of the course, the student is expected to be able to

•Understand the concepts and standards adopted in Planning, Design and construction of Highways and its related infrastructures.

•Apply the knowledge of science and engineering fundamentals in designing the geometrics for an efficient Highway network and design concepts.

•Designing various types of pavements to meet specified needs of safety, efficiency and long time sustainability by adopting various design standards.

•Select appropriate methods for construction, evaluation and maintenance of roadways.

•Understand the bidding processes and types of highway projects and analyze the economic, financial aspects of the highway projects.

UNIT-I **8Hr**

Introduction: Geometric Control factors like Topography –design speed – design vehicle – Traffic – Capacity – volume – environment and other factors as per IRC and AASHTO standards and specifications- PCU concept – factors controlling PCU for different design purpose

UNIT-II **8Hr**

Cross Sectional Elements: Pavement surface characteristics –friction – skid resistance – pavement unevenness-light reflecting characteristics – camber – objectives – types of camber – methods of providing cambers in the field – problems – carriage way – kerb – median –shoulder – foot path – parking lanes – service roads – cycle tracks – Driveways – Right of way – Factors influencing right of way – Design of Road humps as per latest I RC provisions

UNIT-III **5Hr**

Sight Distance Important, types, Side distance at uncontrolled intersection, derivation, factors affecting side distance, IRC, AASHTO standards, problems on above.

UNIT-IV **12Hr**

Horizontal Alignment Definition, Checking the stability of vehicle, while moving on horizontal curve, Super elevation, Ruling minimum and maximum radius, Assumptions – problems – method of providing super elevation for different curves – Extra widening of pavement on curves –objectives – Mechanical widening – psychological widening – Transition curve – objectives – Ideal requirements – Types of transition curve – Method of evaluating

length of transition curve – Setting the transition curve in the field, set back distance on horizontal curve and problems on above

UNIT-V **12Hr**

Vertical Alignment Gradient – Types of gradient – Design criteria of summit and valley curve – Design of vertical curves based on SSD – OSD– Night visibility considerations – Design standards for hilly roads –problems on the above. Principle – At grade and Grade separated junctions – Types – channelization – Features of channelizing Island –median opening – Gap in median at junction.

REFERENCE BOOKS:-

1. Khanna, S.K. & Justo, C.E.G., Highway Engineering, NemChand & Bros, Roorkee (U.A).
2. Kadiyali, L.R., Traffic Engineering & Transport Planning, Khanna Publishers, New Delhi.
3. Kadiyali, L.R. & Lal, N.B., Principles & Practices of Highway Engineering, Khanna Publishers, New Delhi. 4. Sharma, S.K., Principles, Practice and Design of Highway Engineering, S. Chand & Co., New Delhi.
5. IRC – 37 "Guidelines for Design of flexible Pavements", IRC, New Delhi, 2001.
6. IRC – 67 "Code of Practice for Road Signs", IRC, New Delhi – 2001. 30
7. IRC: 58, 2002: "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways", IRC, N. Delhi, December, 2002.
8. IRC:70, 1977: "Guidelines on Regulation and Control of Mixed Traffic in Urban Areas"
9. IRC:106, 1990: "Guidelines for Capacity of Urban Roads in Plain Areas"

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

Objectives of the course Minor Project are :

To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses. To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems. To give students an opportunity to do something creative and to assimilate real life work situation in institution. To adapt students for latest development and to handle independently new situations. To develop good expressions power and presentation abilities in students.

The focus of the Minor Project is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same with a demonstration of the working system (if any)

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.