C U R R I C U L U M

Diploma Program

in

C I V I L E N G I N E E R I N G

(Academic Year: 2021-22 onwards)

THIRD YEAR

Arunachal Pradesh State Council for Technical Education

(APSCTE)

(Under the Directorate of Higher and Technical Education)
Government of Arunachal Pradesh

Sample Path: FIFTH Semester

Sl. No.	Category of Course	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
1	Program Core	CEPC301	Design of Steel and RCC & Lab	3	1	2	6	5
2		CEPC303	Estimating, Costing and Valuation & Lab	3	1	2	6	5
3	Program Elective	CEPE303	Solid Waste Management	3	0	0	3	3
4		CEPE307	Pavement Design and Maintenance	3	0	0	3	3
5	Open Elective	CEOE301	Economic Policies in India	3	0	0	3	3
6	Summer Internship	SI301	Summer Internship-II	0	0	0	0	3
7	Project	PR302	Major Project	0	0	0	0	0
			Total	**15**	**2**	**4**	**21**	**22**

Course Code: CEPC301
Course Title: Design of Steel and RCC & Lab

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
3	1	2	6	5	60	40	100	40	60	100
ET: End Term		PA: Progressive Assessment			Total marks (Th+Pr) = 200					

Rationale:

A structure's safety and durability are dependent on its proper design, accurate detailing, and construction in accordance with specifications. Design of steel and RCC structures is therefore a crucialsubject for a civil engineering diploma holder. The majority of the time to serve in a supervisory capacity on building projects. Diploma holders are also required to help designers, provide suggestionsfor design basic structural parts. The topic tries to address the aforementioned civil engineering aspects.

Course Outcomes:

After competing this course, student will be able to:

- Design of steel tension and compression member.
- Design of steel I sections.
- Design of singly and doubly reinforced RCC beam.
- Design of RCC beam for shear and development length.
- Design of short and long RCC columns.

Course Content

Unit-I: Design of Steel Tension and Compression Members (Limit State Method)

- Basic concepts of bolted and welded connection.
- Types of sections used for Tension members.
- Strength of tension member by- yielding of section, rupture of net cross-section and block shear.
- Design of axially loaded single angle and double angle tension members with bolted and welded connections.
- Types of sections used as compression member, Calculation of effective length, Radius of gyration and slenderness ratio, Permissible values of slenderness ratio as per IS 800.
- Axially loaded single and double angle struts connected by bolted and welded connections with gusset plate.

Unit-II: Design of Steel beams (Limit State Method)

- Standard beam sections, Design of simple I section.
- Provisions of flexure and shear design as per IS 800 2007.Standards cross-sections of national highway in embankment andcutting.

Unit-III: Design of Reinforced Concrete Beams by Limit State Method

- Concept of Limit state, Stress block diagram, Introduction to singlyand doubly reinforced sections, IS 456 2000
- Design of singly reinforced beam, concept of under reinforced, overreinforced and balanced section, Simple numerical problem onultimate moment of resistance and design of beam section
- Design of doubly reinforced sections, stress and strain diagrams, depth of neutral axis, simple numerical problems on ultimate moment of resistance of reinforced beam, Calculation of Ast and Asc.

Unit-IV: Shear, Bond and Development length in Design of RCC member

- Nominal shear stress in RCC section, Design shear strength of concrete, Design of shear reinforcement, forms of shear reinforcement, Minimum Shear Reinforcement.
- Determination of Development length in tension and compression members and check as per Codal provisions, lapping of bars.
- Introduction to serviceability limit state and IS 13920-2016.

Unit-V: Design of axially loaded RCC Column

- Definition and classification of column, Limit state of compressionmembers, Effective length of column.
- Provisions of IS 456 2000 for minimum steel, cover, maximumsteel, spacing of ties etc.
- Design of axially loaded short column - Square, Rectangular, andCircular only.

List of Experiments

1 Draw any five commonly used rolled steel sections and five built up sections.
2 Summarize the provisions of IS 800 required for the design of tension member in report form.
3 Compile relevant clauses from IS 800 required for the design of a compression member and submit it in report form.
4 Draw sketches for single & double lacing of given built up columns.
5 Draw sketches for battening of given built up columns.
6 Prepare a report on the IS 800 provisions pertaining to design of lacing & battening along with its significance.
7 Draw cross section, strain diagram & stress diagram for singly reinforced section.
8 Draw cross section, strain diagram & stress diagram for doubly reinforced section.
9 Design simply supported I section steel beam for UDL.
10 Design beams section for shear as per IS 800 provisions.
11 Draw sketches of different types of column footings.
12 Interpret the actual RCC Structural Drawings used on site with reference to reinforcement details of various structural elements.
13 Prepare a checklist for reinforcement provided from actual drawings used on site for various structural elements.
14 Prepare a detailed report of site visit for reinforcement detailing of structural elements like beams, columns, staircase & footing.
15 Prepare a detailed report of site visit for study of rolled steel tension & compression members used in various structures.

Suggested Learning Resources:

- Shah, V. L., and Gore, V., Limit State Design of Steel Structures, Structures Publications, Pune.
- Dayarathnam P., Design of Steel Structures, S. Chand and Company, Delhi.
- Subramanian N., Design of Steel Structures, Oxford University Press.
- Sairam, K.S., Design of Steel Structures, Pearson Publication, Chennai, Delhi.
- Shah, V. L., and Karve, S.R., Limit State Theory and Design of Reinforced Concrete Structures, Structures Publications, Pune, 2014.

Course Code: CEPC303
Course Title: Estimating, Costing and Valuation & Lab

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
3	1	2	6	5	60	40	100	40	60	100
ET: End Term		PA: Progressive Assessment			Total marks (Th+Pr) = 200					

Rationale:

The subject of estimating costing and valuation is very important for the diploma holders in Civil Engineering.In order to construct any item, pertaining to Civil Engineering, one should have knowledge of resource requiredfor the works as also the money required for completion of the job.

Course Outcomes:

After competing this course, student will be able to:

- Select modes of measurements for different items of works.
- Prepare approximate estimate of a civil engineering works.
- Prepare detailed estimate of a civil engineering works.
- Use relevant software for estimating the quantities and cost of items of works.
- Justify rate for given items of work using rate analysis techniques.

Course Content

Unit-I: Fundamentals of Estimating and Costing

- Estimating and Costing – Meaning, purpose, administrative approval, technical sanction & budget provision.
- Types of estimates – Approximate and Detailed estimate.
- Types and Uses of Estimates: Revised estimate, Supplementaryestimate, Repair and maintenance, estimate, renovation estimate.
- Roles and responsibility of Estimator.
- Checklist of items in load bearing and framed structure.
- Standard formats of Measurement sheet, Abstract sheet, Facesheet.
- Modes of measurement and desired accuracy in measurementsfor different items of work as per IS: 1200.
- Rules for deduction in different category of work as per IS: 1200.
- Description / specification of items of building work as per PWD/DSR.

Unit-II: Approximate Estimates

- Approximate estimate- Definition, Purpose.
- Methods of approximate estimate - Service unit method, Plinth area rate method, Cubical content method, Typical Bay method,Approximate quantity method (with simple numerical)
- Approximate estimate for roads, Railways, bridges/culvert, irrigation projects and water supply projects.

Unit-III: Detailed Estimate

- Detailed Estimate- Definition and Purpose, Data required for detailed estimate - Civil cost, GST, Contingencies, Supervision charges, Agency charges, Procedure for preparation of detailed estimate- Taking out quantities and Abstracting.
- Methods of Detailed Estimate- Unit quantity method and total quantity method (with simple numerical)
- Long wall and short wall method, Centre line method.
- Bar bending schedule for footing, column, beam, Lintel, chajja and slab elements
- Provisions in detailed estimate: contingencies, work charged establishment, percentage charges, water supply and sanitary Charges and electrification charges etc.
- Prime cost, Provisional sum, Provisional quantities, Bill of quantities, Spot items or Site items.

Unit-IV: Estimate for Civil Engineering Works

- Earthwork - Quantities for roads, Embankment and canal by – Mid sectional area method, mean sectional area method, Prismoidal and trapezoidal formula method.
- Detailed estimate for septic tank, Community well.
- Use of computer /software / programs for detailed estimate Preparation of Civil Engineering Works.

Unit-V: Rate Analysis

- Rate Analysis: Definition, purpose and importance.
- Lead (Standard and Extra), lift, overhead charges, water chargesand contractors' profit, procedure for rate analysis.
- Task work- Definition, types. Task work of different skilledlabour for different items.
- Categories of labour, their daily wages, types and number of labour for different items of work.
- Transportation charges of materials - Lead and Lift, Hire chargesof machineries and equipment.
- Preparing rate analysis of different items of work pertaining tobuildings and roads.

List of Experiments

1 Prepare the list of items to be executed with units for detailed estimate of a given structurefrom the given drawing.
2 Prepare a report on market rates for given material, labour wages, hire charges of tools &equipment's required to construct the given structure as mentioned in at Serial number 1 above.
3 Study of items with specification given in the DSR (for any ten item).
4 Recording in Measurement Book (MB) for any four items.
5 Prepare bill of quantities of given item from actual measurements. (Any four items).
6 Prepare approximate estimate for the given civil engineering works.
7 Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR(1BHK Building with staircase).
8 Prepare detailed estimate from the given set of drawings using "standard measurement and abstract format" for RCC framed structure using description of item from DSR along with facesheet and prepare quarry chart, lead statement (G+1 Building)
9 Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m x 4 m with bar bending schedule (footing, column, beam, lintel with chajja, lab).
10 Prepare rate analysis for the given five items of works.
11 Prepare detailed estimate of road of one kilometer length from the given drawing.
12 Prepare detailed estimate of small Septic tank from the given set of drawings
13 Prepare detailed estimate of well from the given set of drawing
14 Use the relevant software to prepare detailed estimate of a Road.
15 Use the relevant software to prepare detailed estimate of a residential building.

Suggested Learning Resources:

1. Datta, B.N., Estimating and Costing in Civil engineering, UBS Publishers Distributors
2. Peurifoy, Robert L. Oberlender, Garold, Estimating construction cost, McGraw-Hill, Education, New Delhi.
3. Rangwala,S.C., Estimating and Costing, Charotar Publishing House, Anand.
4. Birdie,G.S., Estimating and Costing, Dhanpat Rai Publishing Company(P) Ltd. Delhi.
5. Patil,B.S., Civil Engineering Contracts and Estimates, Orient Longman, Mumbai.

Course Code: CEPE303
Course Title: Solid Waste Management

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
3	0	0	3	3	60	40	100	-	-	-
ET: End Term		PA: Progressive Assessment			Total marks (Th) = 100					

Rationale:

Urbanization and industrialization are both accelerating day by day. Because of this, the production of solid waste is a significant issue in both urban and rural areas of the country, and it is getting worse every day. Fromthis vantage point, managing solid waste is a crucial component of maintaining a healthy and safe environment.Therefore, a civil engineer with a diploma should be properly knowledgeable about managing solid waste, asthe concepts of recycling, recovery, and reuse will result in proper disposal that is acceptable and economic.

Course Outcomes:

After competing this course, student will be able to:

- Identify the sources of solid waste.
- Select the relevant method of collection and transportation of solid waste.
- Suggest an action plan for composting of solid waste.
- Devise suitable disposal technique for solid waste
- Use the relevant method for disposal of bio-medical and e-waste.

Course Content

Unit-I: Introduction

- Definition of solid waste, different solid wastes: domestic waste,commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste, etc.
- Sources of solid waste, Classification of solid waste – hazardousand non- hazardous waste.
- Physical and chemical characteristics of municipal solid waste.

Unit-II: Storage, Collection and Transportation of Municipal Solid Waste

- Collection, segregation, storage and transportation of solidwaste.
- Tools and Equipment-Litter Bin, Broom, Shovels, Handcarts,Mechanical Road sweepers,
- Community bin - like movable and stationary bin.
- Transportation vehicles with their working capacity -Animal carts, Auto vehicles, Tractors or Trailers, Trucks, Dumpers, Compactor vehicles. Transfer station- meaning, necessity, location.
- Role of rag pickers and their utility for society.

Unit-III: Composting of Solid Waste

- Concept of composting of waste, Principles of compostingprocess. Factors affecting the Composting process.
- Methods of composting: Manual Composting–Bangaloremethod, Indore Method, Mechanical Composting – Dano Process, Vermi composting

Unit-IV: Techniques for Disposal of Solid Waste

- Solid waste management techniques – solid waste management hierarchy, waste prevention and waste reduction techniques
- Land filling technique, Factors to be considered for site selection, Land filling methods-Area method, Trench method and Ramp method, Leachate and its control, Biogas from landfill,
- Advantages and disadvantages of landfill method, Recycling of municipal solid waste
- Incineration of waste: Introduction of incineration process, Types of incinerators - Flash, Multiple chamber Incinerators, Products of incineration processwith their use, Pyrolysis of waste – Definition, Methods

Unit-V: Biomedical and E-waste management

- Definition of Bio medical Waste.
- Sources and generation of biomedical waste and its classification
- Bio medical waste management technologies.
- Definition, varieties and ill effects of E- waste, recycling and disposal of E- waste.

Suggested Learning Resources:

1. Gupta O.P, Elements of Solid Hazardous Waste Management, Khanna Book Publishing Co.,
2. Bhide, A. D., Solid Waste Management, Indian National Scientific Documentation Centre, New Delhi.
3. George Techobanoglous, Kreith, Frank., Solid Waste, McGraw Hill Publication, New Delhi.
4. Sasikumar, K., Solid Waste Management, PHI COURSE, Delhi.
5. Hosetti, B.B., Prospect and Perspectives of Solid Waste Management, New Age International Publisher.

Course Code: CEPE307
Course Title: Pavement Design and Maintenance

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
3	0	0	3	3	60	40	100	-	-	-
ET: End Term		PA: Progressive Assessment			Total marks (Th) = 100					

Rationale:
The subject of pavement design and maintenance is very important as it deals essentially with road transportation. It is essential for the students to get a through input into the different components of road constructions, maintenance and drainage.

Course Outcomes:
After competing this course, student will be able to:

- Identify the components of the given type of pavement.
- Suggest the type of pavement for the given situation.
- Design the flexible pavement using the provisions of IRC
- Design the concrete pavement using the provisions of IRC
- Decide type of maintenance required under different damaged conditions

Course Content

Unit-I: Basics of pavement Design

- Types of pavements - Flexible, Rigid and Semi Rigid
- Comparison of Rigid and flexible pavement according to Design precision, life maintenance, initial cost, stages of construction, availability of materials, surface characteristic, penetration of water in the pavement, utility location, glare andnight visibility.
- Functions and characteristics of pavement.
- Factors affecting selection of type of pavement.

Unit-II: Fundamentals of pavement design

- Factors affecting pavement design-design wheel load, Trafficfactors, Environmental factors,
- Road geometry and material, Characteristics of soil and drainage situation.

Unit-III: Design overview of Flexible and Concrete pavement

- Methods of flexible pavement design-Theoretical method, Empirical method with & without soil strength test.
- IRC37 guidelines for design of flexible pavement (overviewonly)
- Factors affecting design of concrete pavement.
- IRC58 guidelines for design of concrete pavement (overviewonly)
- Joints-Need, Types, requirements, spacing of joints

Unit-IV: Pavement evaluation

- Definition and purpose of pavement evaluation
- Methods of Pavement evaluation –Visual rating, Pavement serviceability index, Roughness measurements, Benkelman Beam deflection method

Unit-V: Pavement Maintenance

- Types of pavement maintenance-routine, periodic, and special. Need for inspection and maintenance schedule.
- Causes of pavement failure and remedial measures. Typical flexible and rigid pavement failures
- Types and causes of damages in flexible pavement, surfacedefects, cracks.
- Deformations: Rutting, fatigue, settlement and upheaval. Disintegration- lossof aggregate, stripping, pothole.
- Remedial measures - slurry seal, liquid seal, fog seal, andpatching, ready mix patch.

- Types of damages to rigid pavement - cracking, spalling, slabrocking, settlement, joint sealant failure.
- Methods of repair: repair of spalled joints, full depth reconstruction, andreplacement of dowel bars.

Suggested Learning Resources:

1. Kadiyali, L.R., Highway Engineering, Khanna Book Publishing House, New Delhi (ISBN: 978-93-86173-133)
2. Chakroborty, Partha Das, Animesh., Principles of Transportation engineering, Prentice-Hall of IndiaPvt.Ltd
3. Vazirani, V N, Chaondola, S P., Transportation Engineering Vol. I & II, Khanna Publishers. Delhi
4. Yoder, E J, Principles of Pavement Design, Wiley India Pvt Ltd.
5. Bindra, S P., Highway Engineering, Dhanpat Rai Publications (P) Ltd

Course Code: CEOE301
Course Title: Economic Policies in India

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
3	0	0	3	3	60	40	100	-	-	-
ET: End Term		PA: Progressive Assessment			Total marks (Th) = 100					

Rationale:

This course provides the idea to the students about the Indian economy and to describe various Policies regarding the economy of India, like trade policy, export-import policy, agricultural policy and allwhich are essential to know for the diploma holder.

Course Outcomes:

After competing this course, student will be able to:

- Use of Indian economics policy, planning strategies
- Develop the economics as a discipline encompasses of different approaches to the problems of unemployment poverty, income generation, industrialization from different perspectives
- Identify the problems and capable to decide the application for future development
- Analyze economic issues and find solutions to complex economic problems and take correct economic judgment.

Course Content

Unit-I: Introduction

- The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy

Unit-II: Basic features and problems of Indian Economy:

- Economic History of India;
- Nature of Indian Economy, demographic features and HumanDevelopment Index,
- Problems of Poverty, Unemployment, Inflation, Income inequality,Black money in India.

Unit-III: Sectorial composition of Indian Economy:

- Issues in Agriculture sector in India, land reforms Green Revolution andagriculture policies of India

Unit-IV: Industrial development:

- Small scale and cottage industries, industrial Policy,
- Public sector in India, service sector in India.

Unit-V: External sector in India:

- India's foreign trade value composition and direction, India Balance ofpayment since 1991, FDI in India, Impact of Globalization on Indian Economy, WTO and India.

Suggested Learning Resources:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy. S Chand & Co. Ltd. New Delhi.
2. Mishra S.K; V.K Puri (2017). Indian Economy and –Its Development Experience.Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, New Delhi

Course Code: SI301
Course Title: Summer Internship-II

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
0	0	0	0	3	-	-	-	40	60	100
ET: End Term		PA: Progressive Assessment			Total marks (Pr.) = 100					

Rationale:
The rationale for a summer internship is to offer a structured and practical COURSE experience that prepares individuals for their future careers, helps them make informed career choices, and equips them with the skillsand knowledge necessary to succeed in their chosen field. This course provides opportunities to students for hand on industry experience.

Course Outcomes:
After competing this course, student will be able to:

- Apply theoretical knowledge gained in their academic coursework to real-world situations.
- Develop and refine specific skills relevant to the field.
- Gains hands-on experience in a professional network by interacting with mentors and industryprofessionals.
- Learn to manage their time effectively.
- Clarify career goals.

Course Content

1. Orientation:

- Introduction to the organization's mission, values, and culture.
- Familiarization with workplace policies, procedures, and safety guidelines.
- Orientation to the team and organizational structure.

2. Project-Based Course:

- Description of the main project or tasks the intern will be working on during the internship.
- Detailed project goals and objectives.
- Training and guidance on project-specific tools, technologies, or methodologies.

3. Technical and Skill Development:

- Training sessions or workshops to enhance technical skills relevant to the internship role(e.g., programming languages, software tools, laboratory techniques).
- Soft skills development, including communication, teamwork, problem-solving, and timemanagement.

4. Mentorship and Supervision:

- Regular meetings with a designated mentor or supervisor for guidance, feedback, andsupport.
- Mentorship objectives and expectations.

5. Professional Development:

- Sessions on professional etiquette, networking, and building a personal brand
- Resume writing and interview preparation workshops.

6. Industry and Field-Specific Knowledge:

- Lectures, seminars, or presentations on industry trends, best practices, and emergingtechnologies.
- Guest speakers from the field to share insights and experiences.

7. Reporting and Documentation:

- Training on how to document project progress, results, and findings.
- Practice in creating reports, presentations, or other deliverables.

8. Ethics and Professionalism:

- Discussions on ethical considerations within the field.
- Scenarios and case studies related to ethical decision-making.
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9. Feedback and Evaluation:

- Regular performance evaluations and feedback sessions.
- Self-assessment and goal-setting exercises.

10. Networking and Industry Exposure:

- Opportunities to attend industry conferences, webinars, or networking events.
- Encouragement to connect with professionals in the field.

Sample Path: SIXTH Semester

Sl. No.	Category of Course	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
1	Program Core	CEPC302	Public Health Engineering & Lab	2	0	2	4	3
2	Program Elec	CEPE302	Repair & Maintenance of Structure	3	0	0	3	3
3	Hum. & Soc. Sci.	HS302	Entrepreneurship & Startups	3	1	0	4	4
4	Open Elective	HSOE302	History of Science & Engineering	3	0	0	3	3
5		HSOE306	Sustainable Development	3	0	0	3	3
6	Major Project	PR302	Major Project	0	0	6	6	4
7	Seminar	SE302	Technical Seminar	0	0	2	2	1
			Total	**14**	**1**	**10**	**25**	**21**

Course Code: CEPC302
Course Title: Public Health Engineering & Lab

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
2	0	2	4	3	60	40	100	40	60	100
ET: End Term		PA: Progressive Assessment			Total marks (Th.+ Pr.) = 200					

Rationale:

This course public health engineering focuses on providing water supply and, in some cases, sewerage operations.The diploma civil engineers should have knowledge about the different techniques, challenges and need to improvethe public health by expanding their activities in coordination with the public health engineering department,

Course Outcomes:

After competing this course, student will be able to:

- Identify the sources of surface and subsurface water
- Estimate the quantity of drinking water required for a population
- Draw labelled layout for water supply scheme.
- Device suitable water treatment technique.
- Evaluate the characteristics and suggest treatment of sewage.

Course Content

Unit-I: Sources, Demand and Quality of water

- Water supply schemes - Objectives, components,
- Sources of water: Surface and Subsurface sources of water, Intake Structures, Definition and types, Factors governing the location of an intake structure.
- Demand of water: Factors affecting rate of demand, Variationsof water demands, forecasting of population, Methods of forecasting of population, (Simple problems on forecasting of population), Design period, estimating of quantity of water supply required for city or town.
- Quality of water**:** Need for analysis of water, Characteristics ofwater- Physical, Chemical and
- Biological, Testing of water for Total solids, hardness, chlorides, dissolved Oxygen, pH, Fluoride,
- Nitrogen and its compounds, Sampling of water, Water qualitystandards as per IS 10500.

Unit-II: Purification of water

- Purification of Water: Objectives of water treatment, Aeration-objects and methods of aeration,
- Plain sedimentation, Sedimentation with coagulation, principles of coagulation, types of coagulants, Jar Test, processof coagulation, types of sedimentation tanks, Clari flocculator.
- Filtration - mechanization of filtration, classification of filters:slow sand filter, rapid sand filter, pressure filter. Construction and working of slow sand filter and rapid sand filter, operational problems in filtration. Disinfection: Objects, methods of disinfection, Chlorination-
- Application of chlorine, forms of chlorination, types of chlorination practices, residual chlorine and its importance, Flow diagram of water treatment plants.
- Miscellaneous water Treatments: Introduction to water softening, De fluoridation techniques.

Unit-III: Conveyance and Distribution of water

- Conveyance: Types of Pipes used for conveyance of water, choice of pipe material, Types of joints & Types of valves- their use, location and function on a pipeline.
- Distribution of water: Methods of distribution of water- Gravity, pumping, and combined system, Service reservoirs - functions and types, Layouts of distribution of Water-Dead endsystem, grid iron system, circular

system, radial system; their suitability, advantages and disadvantages.

Unit-IV: Domestic sewage and System of Sewerages

- Building Sanitation: Necessity of sanitation, Necessity to treatdomestic sewage, Definitions Sewage, sullage, types of sewage. Definition of the terms related to Building Sanitation
- Water pipe, Rain water pipe, Soil pipe, Sullage pipe, Vent pipe.Building Sanitary Fittings-Water
- closet – Indian and European type, flushing cistern, wash basin,sinks, Urinals. Traps types, qualities of good trap. Systems of plumbing - one pipe, two pipe, single stack, choice of system. Principles regarding design of building drainage, inspection and junction chambers, their necessity, location, size and shape.
- Systems of Sewerage and Sewer Appurtenances: Types ofSewers, Systems of sewerage, self-cleansing velocity and non-scouring velocity, Laying, Testing and maintenance of sewers,
- Manholes and Drop Manhole-component parts, location, spacing, construction details, Sewer Inlets, Street Inlets.

Unit-V: Characteristics and treatment of Sewage

- Analysis of sewage: Characteristics of sewage, B.O.D., C.O.D.and its significance, Central Pollution Control Board Norms fordischarge of treated sewage, Objects of sewage treatment and flow diagram of conventional sewage treatment plant.
- Treatment of Sewage: Screening, Types of screens, Grit removal, Skimming, Sedimentation of sewage, Aerobic and anaerobic process, Sludge digestion, trickling filters, Activated sludge process with basic numerical, Septic tank with design,

List of Experiments:

1. Determine pH value of given sample of water.
2. Determine the turbidity of the given sample of water.
3. Determine residual chlorine in a given sample of water.
4. Determine suspended, dissolved solids and total solids of given sample of water.
5. Determine the dissolved oxygen in a sample of water.
6. Undertake a field visit to water treatment plant and prepare a report.
7. Determine the optimum dose of coagulant in a given raw water sample by jar test.
8. Draw sketches of various valves used in water supply pipe line
9. Draw a sketch of one pipe and two pipe system of plumbing.
10. Determine B.O.D. of given sample of sewage.
11. Determine pH value of given sample of sewage.
12. Determine suspended solids dissolved and total solids for sample of sewage.
13. Determine C.O.D. of given sample of sewage.
14. Prepare a report of a field visit to sewage treatment plant.
15. Determine the iron content of the given sample of water.
16. Determine the Nitrate content of the given sample of water.
17. Determine the Sulfate content of the given sample of water.

Suggested Learning Resources:

1. Sharma S.C, Environmental Engineering, Khanna Publishing House, New Delhi
2. Garg, S.K., Environmental Engineering Vol. I and Vol. II, Khanna Publishers
3. Birdie, G. S. and Birdie, J. S. Water Supply and Sanitary Engineering, Dhanpat Rai
4. Gupta, O.P., Elements of Environmental Pollution Control, Khanna Publishing House, Delhi
5. Rao, C.S., Environmental Pollution Control Engineering, New Age International

Course Code: CEPE302
Course Title: Repair & Maintenance of Structure

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
3	0	0	3	3	60	40	100	-	-	-
ET: End Term		PA: Progressive Assessment			Total marks (Th) = 100					

Rationale:

The appropriate design, exact detailing, and construction in compliance with certain designs and specificationsare requirements for a structure's safety and durability. Therefore, a civil engineering professional should knowthe repair and maintenance of structures. Diploma holders must also assist designers, make recommendationsfor renovation and repair projects. The subject aims to cover the aforementioned aspects of civil engineering.Profession

Course Outcomes:

After competing this course, student will be able to:

- Decide which type of maintenance is needed for a given damaged structure
- Assess causes of damages various types of structures.
- Select the relevant material for repair of the given structure.
- Apply relevant method of retrofitting for re-strengthening of structures.
- Suggest relevant technique to restore the damages of the given structural elements

Course Content

Unit-I: Basics of maintenance

- Types of Maintenances - repair, retrofitting, re-strengthening,rehabilitation and restoration.
- Necessity, objectives and importance of maintenance.
- Approach of effective management for maintenance.
- Periodical maintenance: check list, maintenance manual containing building plan, reinforcement details, material sources, maintenance frequency, corrective maintenance procedures and sources. Pre- and post-monsoon maintenance

Unit-II: Causes and detection of damages

- Causes of damages due to distress, earthquake, wind, flood, dampness, corrosion, fire, deterioration, termites, pollution and foundation settlement.
- Various aspects of visual observations for detection of damages.
- Load test and non-destructive tests (brief description). NDT tests on damaged structure such as rebound hammer, ultrasonic pulse velocity, rebar locator, crack detection micro- scope, digital crackmeasuring gauge.
- Chemical test - Chloride test, sulphate attack, carbonation test, pHmeasurement, resistivity method, Half-cell potential meter (Introduction and demonstration only).

Unit-III: Materials for maintenance and repairs

- Types of repair material, material selection.
- Essential parameters for maintenance and repair materials such -bond with substrate, durability.
- Waterproofing materials based on polymer modified cement slurry,UV resistant acrylic Polymer, ferro-cement.
- Repairing materials for masonry: plastic/aluminum nipples, non- shrink cement, polyester putty or 1:3 cement sand mortar, galvanized steel wire fabrics and clamping rods, wire nails, ferro-cement plates.
- Repairing materials for RCC: epoxy resins, epoxy mortar, and cement mortar impregnated with polypropylene, silicon, polymer concrete composites, sealants, fiber reinforcement concrete, emulsions and paints.

Unit-IV: Maintenance and repair methods for masonry Construction

- Causes of cracks in walls - bulging of wall, shrinkage, bonding, shear, tensile, vegetation.
- Probable crack location: junction of main and cross wall, junctionof slab and wall, cracks in masonry joints.
- Repair methods based on crack type - For minor & medium cracks(width 0.5 mm to 5mm): grouting and for major cracks (width morethan 5mm): fixing mesh across cracks, RCC band, installing ferro-cement plates at corners, dowel bars, propping of load bearing.
- Remedial measures for dampness & efflorescence in wall.

Unit-V: Maintenance and repair methods for RCC Construction

- Repair stages such as concrete removal and surface preparation, fixing suitable formwork, bonding/passive coat and repair application, various methods of surface preparation Repair options such as grouting, patch repairs,carbonated concrete, cleaning the corroded steel, concreteoverlays, latex concrete, epoxy bonded mortar and concrete, polymer concrete, corrosion protection such as jacketing.
- Building cracks and its prevention, common methods for dormantcrack repairs such as Epoxy injection, grooving and sealing, stitching, grouting and guniting/shotcreting.
- Strengthening methods for live cracks such as addition of reinforcements, Jacketing, brackets, collars, supplementary members i.e. shoring, underpinning and propping of framed structure.

Suggested Learning Resources:

1. Gahlot, P. S., Sharma, S., Building Repair and Maintenance Management, CBSPublishers & Distributors Pvt. Ltd., New Delhi
2. Guha, P. K., Maintenance and Repairs of Buildings, New Central Book Agencies
3. Hutchin Son, B. D., Maintenance and Repairs of Buildings, Newnes-Butterworth
4. Relevant BIS code

Course Code: HS302
Course Title: Entrepreneurship & Startups

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
3	1	0	4	4	60	40	100	-	-	-
ET: End Term		PA: Progressive Assessment			Total marks (Th) = 100					

Rationale:

This course aims to motivate students and assist them in developing an entrepreneurial mind-set. The subject of entrepreneurship and start-up will be taught to the students. They will be given the chance to evaluate theirown strengths and spot any gaps that need to be filled in order to become successful entrepreneurs, as well asbe introduced to important characteristics of an entrepreneur. The course focuses on a certain knowledge or skill necessary for entrepreneurs, such as creative thinking, communication, risk taking, and resilience. Thesecourses also assist students in becoming career-ready for either entrepreneurship or any other career.

Course Outcomes:

After competing this course, student will be able to:

- Apply the dynamic role of entrepreneurship and small businesses
- Manage Small Business
- Handle the Financial Planning and Control
- Forms of Ownership for Small Business Strategic Marketing Planning
- Develop new product or service
- Create the business plan

Course Content

Unit-I: Introduction to Entrepreneurship and Start – Ups

- Definitions, Traits of an entrepreneur, entrepreneurship, motivation
- Types of Business Structures, Similarities/differencesbetween entrepreneurs and managers.

Unit-II: Business Ideas and their implementation

- Discovering ideas and visualizing the business
- Activity map
- Business Plan

Unit-III: Idea to Start-up

- Market Analysis – Identifying the target market,
- Competition evaluation and Strategy Development,
- Marketing and accounting,
- Risk analysis

Unit-IV: Management

- Company's Organization Structure,
- Recruitment and management of talent.
- Financial organization and management

Unit-V: Financing and Protection of Ideas

- Financing methods available for start-ups in India
- Communication of Ideas to potential investors
- Investor Pitch, Patenting and Licenses, Common Courses 436.

Unit-VI: Exit Strategies:

- Exit strategies for entrepreneurs, bankruptcy, and succession andharvesting strategy

Suggested Learning Resources:

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company Steve Blankand Bob Dorf K & S Ranch ISBN – 978-0984999392
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create RadicallySuccessful Businesses Eric Ries Penguin UK ISBN – 978-0670921607
3. Demand: Creating What People Love Before They Know They Want It Adrian J. Slywotzky withKarl Weber Headline Book Publishing ISBN – 978-0755388974
4. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do BusinessClayton M. Christensen Harvard business; ISBN: 978-142219602

Course Code: HSOE302
Course Title: History of Science & Engineering

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
3	0	0	3	3	60	40	100	-	-	-
ET: End Term		PA: Progressive Assessment			Total marks (Th) = 100					

Rationale:
The course "History of Science and Engineering" is designed to provide students with a comprehensive understanding of the development and evolution of science and engineering throughout history. The rationale for offering such a course is multi-faceted, encompassing academic, cultural, and practical considerations.

Course Outcomes:
After competing this course, student will be able to:

- Demonstrate Historical Mastery: Exhibit a comprehensive understanding of key historical events, figures, and movements that have shaped the evolution of science and engineering over time.
- Apply Critical Analysis: Develop critical thinking skills to analyze and evaluate the historical contexts influencing scientific and engineering developments, recognizing the reciprocal relationship with societal changes.
- Appreciate Diversity and Inclusion: Identify and appreciate the diverse contributions from individuals and cultures, fostering a more inclusive perspective on the history of science and engineering.
- Anticipate Future Implications: Analyze and articulate potential future implications of historical scientific and engineering advancements, preparing for the evolving challenges and opportunities in these fields

Course Content

Unit-I:

- Introduction. Theoretical and methodological foundations of "History of Science and Technology"
- Accumulation of knowledge, techniques and technologies in prehistoric times and times of ancient civilizations. Development of Astronomy, Mathematics, Engineering and Medicine,
- Developments in metallurgy: Use of Copper, Bronze and Iron in Ancient India. Development of Geography

Unit-II:

- Development of Science and Technology in 16^{th} – 19^{th} centuries.
- Developments in different branches of Science and Technology, Innovations in the field of agriculture.

Unit-III: Idea to Start-up

- Development of Science and Technology and new discoveries in the field of physics, mathematics and natural sciences in the 20^{th} century.
- Development of research organizations like CSIR DRDO, Establishment of Atomic Energy Commission and Development of ISRO
- Development of Science and Technology in 21^{st} century.

Unit-IV: Management

- Prominent scientists of India since ancient India and their contributions: Introduction
- Mathematics and Astronomy: Baudhayan, Aryabhtatta, Brahmupta, Bhaskaracharya, Varahamihira, Nagarjuna.
- Medical Science of Ancient India (Ayurveda & Yoga): Susruta, Charak, Yoga and Patanjali;
- Scientists of Modern India: Srinivas Ramanujan, C.V. Raman, Jagdish ChandraBose, Acharya Prafulla Chandra Roy, Satyendra Nath Bose, Meghnad Saha, Homi Jehangir Bhabha and Dr. Vikram Sarabhai

Suggested Learning Resources:

1. "The Structure of Scientific Revolutions" by Thomas S. Kuhn.
2. "Engineering in History" by Richard Shelton Kirby.
3. “History Of Science and Technology In India” by Binod Bihari Satpathy
4. G. Kuppuram. 1990. “History of Science and Technology in India”. South Asia Books.
5. M. Bhardwaj. 2010. “History of Science and Technology in Ancient India”, Bookwin

Course Code: HSOE306
Course Title: Sustainable Development

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
3	0	0	3	3	60	40	100	-	-	-
ET: End Term		PA: Progressive Assessment			Total marks (Th) = 100					

Rationale:

The aim of this course is to have an increased awareness among students on issues in areas of sustainability, to know the methods, tools and incentives for sustainable product-service system development & to establish a clear understanding of the role and impact of various aspects of engineering and engineering decisions on environmental, societal and economic problems

Course Outcomes:

After competing this course, student will be able to:

- Explain the different types of environmental pollution problems and their sustainable solutions.
- Identify the area of sustainability for research and education.
- Reflect thinking for sustainable practices by utilizing the engineering knowledge and principles gained from this course.

Course Content

Unit-I: Concept of Sustainable Development

- Introduction, need and concept of sustainability.
- Social environment & economic sustainability, sustainable development and its major components
- Nexus between technology & sustainable development, challenges for sustainable development
- Environmental legislations in India-water act and air act.

Unit-II: Development, Sustainability and Climate Change

- Concept of global commons and climate change,
- International conventions on sustainable development.
- Interrelationship among development, sustainability, and climate change.

Unit-III: Sustainable Methods

- Sustainable habitat, green buildings, green materials for building construction, green material selection, green building design and certification.
- Sustainable urbanization, sustainable transport, green engineering, industrialization and poverty reduction, social and technological change.

Unit-IV: Sustainable Development: A Way Forward

- Role of education in sustainable development,
- Role of policy innovations in sustainable development.
- Recognition of ecological limits of equity and justice.
- Alternative ways of resource generation and capacity enhancement.

Suggested Learning Resources:

1. Allen, D.T. and Shonnard, D.R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley, A.S; Adebayo, A.O., Maria, P. Engineering Applications in Sustainable Design and Development, Cengage Learning.
3. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.
4. M. Gereluk, W. and Royer, L. (2001). Sustainable Development of the Global Economy: A trade Union Perspective. Geneva: ILO

Course Code: PR302
Course Title: Major Project

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
0	0	6	6	4	-	-	-	40	60	100
ET: End Term		PA: Progressive Assessment			Total marks (Pr) = 100					

Rationale:
Major projects in civil engineering offer a comprehensive learning experience, combining theory with practice, and preparing students for the challenges and opportunities they will encounter in their future careers. This course has been designed for students to develop skills in problem solving, interdisciplinary learning, research, innovation and preparation for the job market.

Course Outcomes:
After competing this course, student will be able to:

- Develop practical skills in setting up experiments.
- Identify and overcome challenges and obstacles.
- Design the proper experimentation and methodology.
- Develop critical thinking skills to interpret results, draw conclusions and make connections to the project's objective.
- Develop skills in communication, technical writing, documentation and presentation.

Course Content

Unit-I: Experimentation

- Detailed description of the experimental setup or methodology used.
- Explanation of data collection techniques and instruments employed.
- Record of data, observations, and measurements taken during theproject.
- Any modifications or adjustments made to the experimental processduring the project.

Unit-II: Results and Discussions

- Presentation of the collected data, often through tables, graphs, orfigures.
- Analysis and interpretation of the results.
- Comparison of the obtained results with expected outcomes orhypotheses.
- Discussion of any unexpected findings or discrepancies.
- Exploration of the significance of the results in the context of theproject objectives and the broader field of engineering.

Unit-III: Conclusion

- Summarization of the key findings and results.
- Recapitulation of how the project objectives were achieved.
- Addressing any limitations or constraints encountered during theproject.
- Insights into the practical implications of the project's outcomes.

Unit-IV: Report Writing

- Structured and organized documentation of the entire project.
- Clear and concise presentation of the project's background, objectives,and methodology.
- Inclusion of references and citations for any prior research or literaturesurveyed.
- Proper formatting and adherence to academic writing conventions.
- Appendices for supplementary information, such as raw data oradditional details.

Unit-V: Presentation

- Oral presentation of the project's objectives, methods, and results.
- Effective communication of key findings to an audience.
- Use of visual aids (e.g., slides or posters) to support the presentation.
- Addressing questions and engaging in discussions with the audience.
- Demonstrating the significance and practical applications of the project.

Course Code: SE302
Course Title: Technical Seminar

Contact Hours per Week					Evaluation Scheme					
Lecture	Tutorial	Practical	Total	Credits	Theory			Practical		
(L)	(T)	(P)	L+T+P	(C)	ET	PA	Total	ET	PA	Total
0	0	2	2	1	-	-	-	40	60	100
ET: End Term		PA: Progressive Assessment			Total marks (Pr.) = 100					

Rationale:

Technical seminars serve as a vital mechanism for knowledge sharing, skill development, networking, and professional growth within various fields and industries. They provide a structured platform for individuals toengage with their peers, experts, and the latest advancements in their respective domains.

Course Outcomes:

After competing this course, student will be able to:

- Collect the necessary information from relevant sources.
- Develop effective communication skills and confidence.
- Develop critical thinking and interdisciplinary awareness.
- Learn current trend and developments in the field of engineering.
- Share the knowledge with the peer group.

Course Content

Unit-I: Introduction to the topic and Literature review

- Provide an overview of the seminar's theme and its relevance to thefield of study.
- Review existing research and literature related to the topic to provide context and background information.

Unit-II: Current trends, development and case studies

- Discuss the latest trends, innovations, and developments in thefield related to the seminar topic.
- Analyze real-world case studies or projects that illustrate theapplication of the seminar topic.

Unit-III: Research methods and ethical consideration

- Introduce research methods and techniques relevant to the topic,including data collection and analysis.
- Explore ethical issues and considerations related to the topic, especially if it has implications for society or the environment.

Unit-IV: Presentation, group discussion and Q&A session

- Participants to present their research or findings related to theseminar topic.
- Facilitate group discussions and brainstorming sessions toencourage active engagement and critical thinking.
- Provide opportunities for participants to ask questions and seek clarifications on the seminar content.

Unit-V: Assessment, Evaluation, Conclusion and Summary

- Assessment of the students based on presentation, report and vivavoce.
- Recap the key takeaways from the seminar and highlight its significance.
- Addressing questions and engaging in discussions with the audience.
- Demonstrating the significance and practical applications of the project.