POLYTECHNIC ENGINEERING

Sri Satya Sai University of Technology And Medical Sciences, Sehore (M.P.)

Syllabus of Examination - AICTE Pattern

Undergraduate Diploma Courses in Engineering & Technology

Department of CIVIL Engineering

Semester-VI

Course Code	DCEA- 601
Course Title	**Public Health Engineering**
Number of Credits	4 (L:3; T:1; P:0)

Course Objectives:

• To learn the concept of limit state design for tension and compression steel members.
• To learn the concept of limit state design of steel beams.
• To understand design of RCC elements.
• To know the design of short and long RCC columns.

Course outcomes:

After competing this course, student will be able to perform:
• Design of steel tension and compression member.
• Design of steel I and Channel 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.

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

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, Design compressive stress. Introduction to built up sections, lacing and battening (Meaning and purpose), Diagrams of single and double lacing and battening system. (No numerical problems). Design of 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, Bending stress calculations. Design of simple I and channel section. Check for shear as per IS 800.

Unit– III Design of Reinforced Concrete Beams by Limit State Method

Concept of Limit state, Stress block diagram, Introduction to singly and doubly reinforced sections, IS 456. Design of singly reinforced beam, concept of under reinforced, over reinforced and balanced
section, Simple numerical problem on ultimate 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, Minimum Shear Reinforcement, Provisions of IS 456, forms of shear reinforcement. Types of bond, Bond stress, check for bond stress, Determination of Development length in tension and compression members and check as per codal provisions, Anchorage value of 900 hook, Lapping of bars. Simple numericals on: Shear reinforcement, Adequacy of section for shear. Introduction to serviceability limit state check.

Unit– V Design of axially loaded RCC Column

Definition and classification of column, Limit state of compression members, Effective length of column. Provisions of IS 456 for minimum steel, cover, maximum steel, spacing of ties etc. Design of axially loaded short column - Square, Rectangular, and Circular only.

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.
• Sinha N.C., and Roy S.K., Fundamentals of Reinforced Concrete, S. Chand & Co., New Delhi.
• Krishna Raju, and N. Pranesh, R.N., Reinforced Concrete Design Principles and Practice, New Age International, Mumbai.
• Pillai, S.U., and Menon, Devdas, Reinforced concrete Design, McGraw Hill Publications, New Delhi.
• Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall India Learning Private Limited, Delhi.

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Undergraduate Diploma Courses in Engineering & Technology

Department of CIVIL Engineering

Semester-VI

Course Code	**DCEA- 601**
Course Title	**Public Health Engineering**
Number of Credits	1 (L:0; T:0; P:2)

Course Objectives:

- To learn the concept of limit state design of tension and compression steel members.
- To understand design of steel beams.
- To learn the concept of limit state design of RCC beams.
- To know the limit state design of RCC columns.

Course outcomes:

After competing this course, student will be able to perform:

- Design of steel tension and compression member.
- Design of steel beams including check for shear.
- Design of singly and doubly reinforced RCC beam.
- Design of shear reinforcement in RC beams.
- Design of RCC column as per IS 456.

List of Practical to be performed:

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.

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Semester-VI

Course Code	**DCEA- 602**
Course Title	**Elective IV (A) Repairs and Maintenance Of Structures**
Number of Credits	4 (L:3; T:1; P:0)

Course Objectives:

- To learn the procedure for estimating and costing of Civil Engineering works.
- To perform rate analysis for different items associated with construction projects.
- To use software for detailed estimate related to civil infrastructural projects.

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.

Unit – I Fundamentals of Estimating and Costing

Estimating and Costing – Meaning, purpose, Administrative approval, Technical Sanction and Budget provision. Types of estimates – Approximate and Detailed estimate. Types and Uses of Estimates: Revised estimate, Supplementary estimate, 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, Face sheet. Modes of measurement and desired accuracy in measurements for 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 numericals). 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 numericals). 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 /softwares / programmes 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 charges and contractors' profit, Procedure for rate analysis. Task work- Definition, types. Task work of different skilled labour for different items. Categories of labours, their daily wages, types and number of labours for different items of work. Transportation charges of materials - Lead and Lift, Hire charges of machineries and equipments. Preparing rate analysis of different items of work pertaining to buildings and roads.

Suggested learning resources

1. Datta, B.N., Estimating and Costing in Civil engineering, UBS Publishers Distributors Pvt. Ltd. New Delhi.
2. Peurifoy,Robert L. Oberlender,Garold, Estimating construction cost (fifth edition), McGraw Hill Education, , New Delhi.
3. Rangwala,S.C., Estimating and Costing, Charotar Publishing House PVT. LTD., Anand.
4. Birdie,G.S., Estimating and Costing, Dhanpat Rai Publishing Company(P) Ltd. New Delhi.
5. Patil,B.S., Civil Engineering Contracts and Estimates, Orient Longman, Mumbai.
6. Chakraborti,M., Estimating and costing, specification and valuation in civil engineering, Monojit Chakraborti, Kolkata.
7. PWD Schedule of Rates.
8. Ministry of Road Transport and Highways (MORT&H) Specifications and Analysis of Schedule of Rates.
9. Manual of Specifications and Standards for DBFOT projects, EPC works.

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Department of CIVIL Engineering

Semester-VI

Course Code	**DCEA- 602**
Course Title	**Elective IV (B) Advanced Design of Structures**
Number of Credits	4 (L:3; T:1; P:2)

Course Objectives:

- To learn the procedure for estimating and costing of Civil Engineering works.
- To perform rate analysis for different items associated with construction projects.
- To use software for detailed estimate related to civil infrastructural projects.

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.

List of Practical to be performed:

1. Prepare the list of items to be executed with units for detailed estimate of a given structure from the given drawing.
2. Prepare a report on market rates for given material, labour wages, hire charges of tools & equipments 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 face sheet 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, slab).
10. Prepare rate analysis for the given five item of works.
11. Prepare detailed estimate of road of one kilometre 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.

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Semester-VI

Course Code	**DOE- 603**
Course Title	**Open Elective-II (A) Artificial Intelligence**
Number of Credits	4 (L:3; T:1; P:0)

Course Objectives

1. To develop an understanding of intelligent agents and environments, including their types, behaviors, and properties.
2. To provide foundational knowledge of AI methodologies, including search algorithms, fuzzy logic systems, and neural networks, and how these can be applied to problem-solving.

Course outcomes:

At the end of the course, the student will be able to:

CO1: Define Artificial Intelligence, describe its goals, and outline its historical evolution and applications in various fields.
CO2: Analyze the types and characteristics of intelligent agents and the environments in which they operate.
CO3: Apply various search algorithms, including brute-force and heuristic strategies, to solve real-world AI problems.
CO4: Explain the working of fuzzy logic systems, including membership functions, fuzzification, and defuzzification processes.
CO5: Describe the structure and functioning of neural networks and implement basic models like the perceptron for classification tasks.

Unit 1 – Introduction to Artificial Intelligence
• Artificial Intelligence (AI) definition
• Goals of AI
• History of AI
• Applications of AI

Unit 2 – Agents and Environments
• Agent Terminology, Types of Agents – Simple Reflex Agents, Model Based Reflex Agents, Goal Based Agents
• Nature of Environments, Properties of Environments

Unit 3 – Search Algorithms
Terminology
• Brute Force Search Strategies – Breadth First Search, Depth First Search.
• Heuristic Search Strategies, Local Search Algorithms.

Unit 4 – Fuzzy Logic Systems
Introduction to Fuzzy Logic and Fuzzy systems,
• Membership functions,
• Fuzzification/Defuzzification

Unit 5 – Neural Networks
Basic structure of Neural Networks
• Perceptron
• Back-propagation

Suggested Learning Resources:
Artificial Intelligence By Example:Develop machine intelligence from scratch using real artificial intelligence use cases Denis Rothman Packt Publishing ISBN – 978-1788990547

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Semester-VI

Course Code	**DOE- 603**
Course Title	**Open Elective-II (B) Renewable Energy Technology**
Number of Credits	4 (L:3; T:1; P:0)

Course Objectives

Maintain the renewable energy technology equipment.

Course outcomes:

At the end of the course, the student will be able to:

CO1: Explain the working principles, construction, and site-specific implications of various ocean energy technologies such as tidal, wave, marine current, and OTEC systems.
CO2: Analyze different types of solar energy systems, including PV and concentrated solar power technologies, and evaluate their components, layout, and functioning.
CO3: Compare the configurations and components of large wind power plants and differentiate between constant speed and variable speed generator systems.
CO4: Illustrate the working of small wind turbines of various types and describe installation methods and suitable electric generators for rooftop and field applications
CO5: Evaluate the properties of biomass fuels and describe the layout and functioning of biochemical, thermochemical, and agrochemical biomass-based power plants.

Unit – I Ocean Energy Technologies
Ocean energy map of India and its implications; Specification, Construction and working of the following ocean energy technologies:
- Tidal power technologies
- Wave power technologies
- Marine current technologies
- Ocean Thermal Energy Conversion (OTEC) technologies

Unit – II Solar PV and Concentrated Solar Power Plants
- Solar Map of India: Global solar power radiation, Solar PV
- Concentrated Solar Power (CSP) plants, construction and working of: Power Tower, Parabolic Trough, Parabolic Dish, Fresnel Reflectors
- Solar Photovoltaic (PV) power plant: components layout, construction, working.
- Rooftop solar PV power system

Unit – III Large Wind Power Plants
Wind Map of India: Wind power density in watts per square meter, Lift and drag principle; long path theory, Geared type wind power plants: components, layout and working, Direct drive type wind power plants: components, layout and working, Constant Speed Electric Generators: Squirrel Cage Induction Generators (SCIG), Wound Rotor Induction Generator (WRIG), Variable Speed Electric Generators: Doubly-fed induction generator (DFIG), wound rotor synchronous generator (WRSG), permanent magnet synchronous generator (PMSG).

Unit– IV Small Wind Turbines

Horizontal Unit– IV Small Wind Turbines

- Horizontal axis small wind turbine: direct drive type, components and working.
- Horizontal axis small wind turbine: geared type, components and working.
- Vertical axis small wind turbine: direct drive and geared, components and working.
- Types of towers and installation of small wind turbines on roof tops and open fields.
- Electric generators used in small wind power plants.

Unit– V Biomass-based Power Plants

- Properties of solid fuel for biomass power plants: bagasse, wood chips, rice husk, municipal waste.
- Properties of liquid and gaseous fuel for biomass power plants: Jatropha, bio-diesel gobar gas.
- Layout of a Bio-chemical based (e.g. biogas) power plant.
- Layout of a Thermo-chemical based (e.g. Municipal waste) power plant.
- Layout of a Agro-chemical based (e.g. bio-diesel) power plant.

Reference Books:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi
2. Neill, Simon P.; Hashemi, M. Reza: Fundamentals of Ocean Renewable Energy: Generating Electricity from the Sea, Academic Press, ISBN:978-0-12-810448-4
3. David M. Buchla, Thomas E. Kissell, Thomas L. Floyd, Renewable Energy Systems, Pearson Education New Delhi , ISBN: 9789332586826,
4. Rachel, Sthuthi, Earnest, Joshua; -Wind Power Technologies, PHI Learning, New Delhi, ISBN: 978-93-88028-49- 3; E-book 978-93-88028-50-9
5. Deambi, Suneel: From Sunlight to Electricity: a practical handbook on solar photovoltaic application; TERI, New Delhi ISBN:9788179935736
6. Gipe, Paul: Wind Energy Basics, Chelsea Green Publishing Co; ISBN: 978-1603580304
7. Wizelius, Tore, Earnest, Joshua - Wind Power Plants and Project Development, PHI Learning, New Delhi, ISBN:978-8120351660
8. Kothari, D.P. et aL: Renewable Energy Sources and Emerging Technologies, PHI Learning, New Delhi, ISBN: -978-81-203-4470-9
9. Bhadra, S.N., Kastha, D., Banerjee, S, Wind Electrical Systems installation; Oxford University Press, New Delhi, ISBN: 9780195670936.

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Semester-VI

Course Code	**DHS- 604**
Course Title	**Entrepreneurship and Start-ups**
Number of Credits	3 (L:3: T:0: P:0)

Course Objectives:

1. Acquiring Entrepreneurial spirit and resourcefulness.
2. Familiarization with various uses of human resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation.
4. Acquiring entrepreneurial quality, competency, and motivation.
5. Learning the process and skills of creation and management of entrepreneurial venture.

Course Outcome:

At the end of the course, the student will be able to:

1. Understanding the dynamic role of entrepreneurship and small businesses
2. Organizing and Managing a Small Business
3. Financial Planning and Control
4. Forms of Ownership for Small Business
5. Strategic Marketing Planning

Unit 1 - Introduction to Entrepreneurship and Start – Ups

- Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation
- Types of Business Structures, Similarities/differences between entrepreneurs and managers.

Unit 2 – Business Ideas and their implementation

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

Unit 3 – Idea to Start-up

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

Unit 4 – Management

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

Unit 5 - Financing and Protection of Ideas

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

Reference Books:

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

SUGGESTED SOFTWARE/LEARNING WEBSITES:

a. https://www.fundable.com/learn/resources/guides/startup
b. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporatestructure/
c. https://www.finder.com/small-business-finance-tips
d. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

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Semester-VI

Course Code	**DCEA- 605**
Course Title	**Seminar**
Number of Credits	1 (L:0: T:0: P:2)

Course Objectives:

The objective of the seminar is to inculcate self-skill, involve in group discussion and present and exchange ideas.
Each student, under the guidance of a Faculty, shall choose preferably a relevant to the Course of Specialization.
Carryout literature survey, organize the seminar content in a systematic manner. Prepare the report with own sentences, avoiding cut and paste act.
Type the matter to acquaint with the use of Micro facilities.
Present the seminar topic orally and/or through power point slides.
Answer the queries and involve in debate/discussion.
Submit typed report with a list of references.
The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards.

Course outcomes:

1 At the end of the course the student become self-Attain,
2 Use and develop knowledge in the field of engineering and other disciplines through independent learning and collaborative study.
3 Identify, understand and discuss current, real Improve oral and written communication skills.
4 Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
5 Apply principles of ethics and respect in interaction with other

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Semester-VI

Course Code	**DCEA- 606**
Course Title	**Major Project-II (Project Execution)**
Number of Credits	3 (L:0: T:0: P:3)

After completion of this course, students will be able to:

Course outcomes:

CO1: Identify and execute civil engineering projects addressing industry and societal requirements.

CO2: Apply engineering knowledge for design, analysis, and implementation of civil systems.

CO3: Use modern tools and techniques for modeling, simulation, and testing.

CO4: Demonstrate teamwork, project management, and professional ethics.

CO5: Prepare effective technical documentation, reports, and presentations.

Course Guidelines:

Students shall execute the project approved in Project Phase I through design, analysis, modeling, experimentation, construction, or simulation, as relevant to civil engineering applications.

The project work shall emphasize the practical implementation of theoretical concepts to develop a working model, structural system, infrastructure component, or analytical study. Activities include survey and data collection, material selection and procurement, design calculations, preparation of drawings, construction/fabrication, testing, quality control, troubleshooting, and performance evaluation.

Students may use appropriate software tools such as AutoCAD, STAAD Pro, ETABS, SAFE, ANSYS, Primavera, or equivalent for analysis and planning.

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Semester-VI

Course Code	**DEA- 607**
Course Title	Indian Constitution (Mandatory Course)
Number of Credits	0 (L:2: T:0: P:0)

Unit 1 – The Constitution - Introduction
- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

Unit 2 – Union Government
- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

Unit 3 – State Government
- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

Unit 4 – Local Administration
- District Administration
- Municipal Corporation
- Zila Panchayat

Unit 5 – Election Commission
- Role and Functioning
- Chief Election Commissioner
- State Election Commission

Reference Books:

1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi,2008
2. The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition

Suggested Software/Learning Websites:

a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/