POLYTECHNIC ENGINEERING

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

Syllabus of Examination - AICTE Pattern

Undergraduate Diploma Courses in Engineering & Technology

Department of Diploma Civil Engineering

SEMESTER- III

Course Code	DCEA- 301
Course Title	Construction Material
Number of Credits	3 (L:3; T:0; P:0)

Course Objectives:

Following are the objectives of this course:
• To learn about various construction materials, and understand their relevant characteristics.
• To be able to identify suitability of various materials for different construction purposes.
• To know about natural, artificial, and processed materials available for various purposes of construction activities.

Course outcomes:

After competing this course, student will be able to:
• Identify relevant construction materials.
• Identify relevant natural construction materials.
• Select relevant artificial construction materials.
• Identify and use of processed construction materials.

UNIT – I: Overview of Construction Materials

Scope of construction materials in Building Construction, Transportation Engineering, Environmental Engineering, Irrigation Engineering (applications only). Selection of materials for different civil engineering structures on the basis of strength, durability, Eco friendly and economy.

UNIT – II: Natural Construction Materials

Requirements of good building stone; general characteristics of stone; quarrying and dressing methods and tools stone. Structure of timber, general properties and uses of good timber, different methods of seasoning for preservation of timber, defects in timber, use of bamboo in construction. Asphalt, bitumen and tar used in construction, properties and uses. Classification of coarse aggregate according to size.

UNIT - III: Artificial Construction Materials

Constituents of brick earth, Conventional / Traditional bricks, Modular and Standard bricks, Special bricks –fly ash bricks, Characteristics of good brick, Field tests on Bricks, Classification of burnt clay bricks and their suitability, Manufacturing process of burnt clay brick, fly ash bricks, Aerated concrete blocks. Flooring tiles – Types, uses. Manufacturing process of Cement - dry and wet (only flow chart), types of cement and its uses. field tests on cement. Pre-cast concrete blocks- hollow, solid, pavement blocks, and their uses.
Plywood, particle board, Veneers, laminated board and their uses.

UNIT – IV: Special Construction Materials

Types of material and suitability in construction works of following materials: Water proofing, Termite proofing; Thermal and sound insulating materials. Fibers – Types –Jute, Glass, Plastic Asbestos Fibers, (only uses). Geopolymer cement: Geo-cement: properties, uses.

UNIT – V: Processed Construction Materials

Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and uses. Paints- whitewash, cement paint, Distempers, Oil Paints and Varnishes with their uses. (Situations where used). Industrial waste materials- Fly ash, Blast furnace slag, Granite and marble polishing waste and their uses.

References:

1. Ghose, D. N., Construction Materials, Tata McGraw Hill, New Delhi.
2. S.K. Sharma, Civil Engineering Construction Materials, Khanna Publishing House, Delhi
3. Varghese, P.C. , Building Materials, PHI learning, New Delhi.
4. Rangwala, S.C., Engineering Materials, Charator publisher, Ahemdabad.
5. Somayaji, Shan, Civil Engineering Materials, Pearson education, New Delhi.
6. Rajput, R.K, Engineering Materials, S. Chand and Co., New Delhi.

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

Syllabus of Examination - AICTE Pattern

Undergraduate Diploma Courses in Engineering & Technology

Department of Diploma Civil Engineering

SEMESTER- III

Course Code	**DCEA- 301**
Course Title	**Construction Material Lab**
Number of Credits	**1 (L:0; T:0; P:2)**

List of practical:

1. Identify various sizes of available coarse aggregates from sample of 10 kg in laboratory and prepare report (60,40, 20,10 mm)
2. Identify the available construction materials in the laboratory on the basis of their sources.
3. Identify the grain distribution pattern in given sample of teak wood in the laboratory and draw the various patterns. (along and perpendicular to the grains)
4. Prepare the lime putty by mixing lime (1 kg) with water in appropriate proportion and prepare report on slaking of lime.
5. Select first class, second class and third-class bricks from the stake of bricks and prepare report on the basis of its properties.
6. Measure dimensions of 10 bricks and find average dimension and weight. Perform field tests - dropping, striking and scratching by nail and correlate the results obtained.
7. Identify different types of flooring tiles such as vitrified tiles, ceramic tiles, glazed tiles, mosaic tiles, anti- skid tiles, chequered tiles, paving blocks and prepare report about the specifications.

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Syllabus of Examination - AICTE Pattern

Undergraduate Diploma Courses in Engineering & Technology

Department of Diploma Civil Engineering

SEMESTER- III

Course Code	**DCEA- 302**
Course Title	**Basic Surveying**
Number of Credits	**3 (L:3; T:0; P:0)**

Course Objectives:

Following are the objectives of this course:
- To understand types of surveying works required.
- To know the types of method and equipments to be used for different surveys.
- To know the use and operational details of various surveying equipments.

Course outcomes:

After competing this course, student will be able to:
- Select the type of survey required for given situation.
- Compute area of open field using chain, tape and cross staff.
- Conduct traversing in the field using chain and compass.
- Use levelling instruments to determine reduced level for preparation of contour maps
- Use digital planimeter to calculate the areas.

UNIT – I: Overview and Classification of Survey

Survey- Purpose and Use, Types of surveying- Primary and Secondary, Classification: Plane, Geodetic, Cadastral, Hydrographic, Photogrammetry and Aerial, Principles of Surveying, Scales: Engineer's scale, Representative Fraction (RF) and diagonal scale.

UNIT – II: Chain Surveying

Instruments used in chain survey: Metric Chain, Tapes, Arrow, Ranging rod, Line ranger, Offset rod, Open cross staff, Optical square, Chain survey Station, Base line, Check line, Tie line, Offset, Tie station, Ranging: Direct and Indirect Ranging, Methods of Chaining, obstacles in chaining, Errors in length: Instrumental error, personal error, error due to natural cause, random error, Principles of triangulation, Types of offsets: Perpendicular and Oblique, Recording of measurements in a field book.

UNIT – III: Compass Traverse Survey

Compass Traversing- open, closed, Technical Terms: Geographic/ True Magnetic Meridians and Bearings, Whole Circle Bearing system and Reduced Bearing system and examples on conversion of given bearing to another bearing (from one form to another), Fore Bearing and Back Bearing, Calculation of internal and external angles from bearings at a station, Dip of Magnetic needle, Magnetic Declination, Components of Prismatic Compass and their Functions, Methods of using Prismatic Compass- Temporary adjustments and observing bearings, Local attraction, Methods of correction of observed bearings - Correction at station and correction to included angles, Methods of plotting a traverse and closing error, Graphical adjustment of closing error.

UNIT – IV: Levelling and Contouring

Basic terminologies: Level surfaces, Horizontal and vertical surfaces, Datum, Bench MarksGTS, Permanent, Arbitrary and Temporary, Reduced Level, Rise, Fall, Line of collimation, Station, Back sight, Fore sight, Intermediate sight, Change point, Height of instruments, Types of levels: Dumpy, Tilting, Auto level, Digital level, Components of Dumpy Level and its fundamental axes, Temporary adjustments of Level, Types of Leveling Staff: Self-reading staff and Target staff, Reduction of level by Line of collimation and Rise and Fall Method, Leveling Types: Simple, Differential, Fly, Profile and Reciprocal Leveling, Contour, contour intervals, Uses of contour maps, Characteristics of contours, Methods of Contouring: Direct and indirect.

UNIT – V: Measurement of Area and Volume

Components and use of Digital planimeter, Measurement of area using digital planimeter, Measurement of volume of reservoir from contour map.

Suggested learning resources

1. Punmia, B.C,; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications, New Delhi.
2. Basak, N. N., Surveying and Levelling, McGraw Hill Education, New Delhi.
3. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling volume I, Pune Vidyarthi Gruh Prakashan.
4. Duggal, S. K., Survey I, McGraw Hill Education, New Delhi.
5. Saikia, M D.; Das. B.M.; Das. M.M., Surveying, PHI Learning, New Delhi.
6. Subramanian, R., Fundamentals of Surveying and Levelling, Oxford University Press. New Delhi.

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POLYTECHNIC ENGINEERING

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

Syllabus of Examination - AICTE Pattern

Undergraduate Diploma Courses in Engineering & Technology

Department of Diploma Civil Engineering

SEMESTER- III

Course Code	**DCEA- 302**
Course Title	**Basic Surveying Lab**
Number of Credits	**1 (L:0; T:0; P:2)**

List of Practicals

1. Measure distance between two survey stations using chain, tape and ranging rods when two stations are inter visible. 2. Undertake reciprocal ranging and measure the distance between two stations.
3. Determine area of open field using chain and cross staff survey.
4. Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.
5. Measure Fore Bearing and back bearing of a closed traverse of 5 or 6 sides and correct the bearings and included angles for the local attraction.
6. Undertake fly leveling with double check using dumpy level/ Auto level and leveling staff.

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Syllabus of Examination - AICTE Pattern

Undergraduate Diploma Courses in Engineering & Technology

Department of Diploma Civil Engineering

SEMESTER- III

Course Code	DCEA- 303
Course Title	Geotechnical Engineering
Number of Credits	3 (L:3; T:0; P:0)

Course Objectives:

Following are the objectives of this course:
- To understand and determine physical and index properties and classification of soil
- To estimate permeability and shear strength of soil
- To know the load bearing capacity of soil
- To learn various soil stabilization and compaction methods

Course outcomes:

After completing this course, student will be able to:
- Identify types of rocks and sub soil strata of earth.
- Interpret the physical properties of soil related to given construction activities.
- Use the results of permeability and shear strength test for foundation analysis.
- Interpret soil bearing capacity results.
- Compute optimum values for moisture content for maximum dry density of soil through various tests.

UNIT – I Overview of Geology and Geotechnical Engineering

Introduction of Geology, Branches of Geology, Definition of a rock: Classification based on their genesis (mode of origin), formation. Classification and engineering uses of igneous, sedimentary and metamorphic rocks. Importance of soil as construction material in Civil engineering structures and as foundation bed for structures. Field application of geotechnical engineering for foundation design.

UNIT – II Physical and Index Properties of Soil

Soil as a three phase system, water content, determination of water content by oven drying method as per BIS code, void ratio, porosity and degree of saturation, density index. Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight. Determination of bulk unit weight and dry unit weight by core cutter and sand replacement method, Determination of specific gravity by pycnometer. Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit. Plasticity index. Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils, BIS classification of soil.

UNIT – III Permeability and Shear Strength of Soil

Definition of permeability, Darcy's law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and falling head tests, simple problems to determine coefficient of permeability. Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net, (No numerical problems). Shear failure of soil, concept of shear strength of soil. Components of shearing resistance of soil – cohesion, internal friction. Mohr-Coulomb failure theory, Strength envelope, strength equation for purely cohesive and cohesion less soils. Direct shear and vane shear test – laboratory methods.

UNIT – IV Bearing Capacity of Soil

Bearing capacity and theory of earth pressure. Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure. Introduction to Terzaghi's analysis and assumptions, effect of water table on bearing capacity. Field methods for determination of bearing capacity – Plate load and Standard Penetration Test. Test procedures as per IS:1888 & IS:2131. Definition of earth pressure, Active and Passive earth pressure for no surcharge condition, coefficient of earth pressure, Rankine's theory and assumptions made for non-cohesive Soils.

UNIT – V Compaction and stabilization of soil

Concept of compaction, Standard and Modified proctor test as per IS code, Plotting of Compaction curve for determining: Optimum moisture content(OMC), maximum dry density(MDD), Zero air voids line. Factors affecting compaction, field methods of compaction – rolling, ramming and vibration. Suitability of various compaction equipments-smooth wheel roller, sheep foot roller, pneumatic tyred roller, Rammer and Vibrator, Difference between compaction and consolidation. Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabiliza- tion. California bearing ratio (CBR) test - Meaning and Utilization in Pavement Construction Necessity of site investigation and soil exploration: Types of exploration, criteria for deciding the location and number of test pits and bores. Field identification of soil – dry strength test, dilatancy test and toughness test.

Suggested learning resources:

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.
2. Murthy, V.N.S., A text book of soil mechanics and foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Ramamurthy, T.N. & Sitharam,T.G., Geotechnical Engineering(Soil Mechanics), S Chand and Company LTD., New Delhi. 4. Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India, New Delhi.
5. Kasamalkar, B. J., Geotechnical Engineering, Pune Vidyarthi Griha Prakashan, Pune.
6. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.

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

Syllabus of Examination - AICTE Pattern

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Department of Diploma Civil Engineering

SEMESTER- III

Course Code	**DCEA- 303**
Course Title	**Geotechnical Engineering Lab**
Number of Credits	**1(L:0; T:0; P:2)**

List of Practicals

1. Identification of rocks from the given specimen.
2. Determine water content of given soil sample by oven drying method as per IS: 2720 (PartII).
3. Determine specific gravity of soil by pycnometer method as per IS 2720 (Part- III).
4. Determine dry unit weight of soil in field by core cutter method as per IS 2720 (Part- XXIX).
5. Determination of CBR value on the field as per IS2720 (Part - XVI).
6. Determine Plastic and Liquid Limit along with Plasticity Index of given soil sample as per IS 2720 (Part- V).
7. Determine Shrinkage limit of given soil sample as per IS 2720 (Part- V).
8. Determine grain size distribution of given soil sample by mechanical sieve analysis as per IS 2720 (Part- IV).

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Department of Diploma Civil Engineering

SEMESTER- III

Course Code	DCEA- 304
Course Title	Concrete Technology
Number of Credits	4 (L:3; T:1; P:0)

Course Objectives:

Following are the objectives of this course:
- To know properties of cement, aggregate and water used in concrete.
- To understand different characteristics of concrete.
- To learn about role of admixtures in concrete.

Course outcomes:

After completing this course, student will be able to:
- Use different types of cement and aggregates in concrete.
- Prepare concrete of desired compressive strength.
- Maintain quality of concrete under different conditions.

UNIT – I Cement, Aggregates and Water

Physical properties of OPC and PPC: fineness, standard consistency, setting time, soundness, compressive strength. Different grades of OPC and relevant BIS codes. Testing of cement: Laboratory tests-fineness, standard consistency, setting time, soundness, compressive strength. Storage of cement and effect of storage on properties of cement. BIS Specifications and field applications of different types of cements: Rapid hardening, Low heat, Portland pozzolana, Sulphate resisting, Blast furnace slag, High Alumina and White cement.

Aggregates: Requirements of good aggregate, Classification according to size and shape. Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand, silt content and their specification as per IS 383. Concept of crushed Sand. Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity and bulk density, fineness modulus of coarse aggregate, grading of coarse aggregates, crushing value, impact value and abrasion value of coarse aggregates with specifications.

Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456.

UNIT – II Concrete

Concrete: Different grades of concrete, provisions of IS 456. Properties of fresh concrete: Workability: Factors affecting workability of concrete. Determination of workability of concrete by slump cone, compaction factor, Vee-Bee Consistometer. Value of workability requirement for different types of concrete works. Segregation, bleeding and preventive measures. Properties of Hardened concrete: Strength, Durability, Impermeability.

UNIT – III Concrete Mix Design and Testing of Concrete

Concrete mix design: Objectives, methods of mix design, study of mix design as per IS 10262 (only procedural steps). Testing of concrete, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results. Non- destructive testing of concrete: Rebound hammer test, working principle of rebound hammer and factor affecting the rebound index, Ultrasonic pulse velocity test as per IS13311 (part 1 and 2), Importance of NDT tests.

UNIT – IV Quality Control of Concrete

Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete. Forms for concreting: Different types of form works for beams, slabs, columns, materials used for form work, requirement of good form work. Stripping time for removal of form works per IS 456. Waterproofing: Importance and need of waterproofing, methods of waterproofing and materials used for waterproofing. Joints in concrete construction: Types of joints, methods for joining old and new concrete, materials used for filling joints.

UNIT – V Chemical Admixture, Special Concrete and Extreme Weather concreting

Admixtures in concrete: Purpose, properties and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixtures, air entraining admixtures and super plasticizers. Special Concrete: Properties, advantages and limitation of following types of Special concrete: Ready mix Concrete, Fiber Reinforced Concrete, High performance Concrete Self-compacting concrete and light weight concrete.

Suggested learning resources:

1. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Publishing Co. Ltd., Delhi.
2. Shetty, M.S., Concrete Technology, S. Chand and Co. Pvt. Ltd., Ram Nagar, Delhi.
3. Santhakumar, A. R., Concrete Technology, Oxford University Press, New Delhi.
4. Neville, A. M. and Brooks, J.J., Concrete Technology, Pearson Education Pvt. Ltd.
5. Neville, A. M., Concrete Technology, Pearson Education Pvt. Ltd., New Delhi.
6. Sood, H., Kulkarni P. D., Mittal L. N., Laboratory Manual in Concrete Technology, CBS Publishers, New Delhi.

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Undergraduate Diploma Courses in Engineering & Technology

Department of Diploma Civil Engineering

SEMESTER- III

Course Code	DCEA- 305
Course Title	Mechanics of Materials
Number of Credits	4 (L:3; T:1; P:0)

Course Objectives:

Following are the objectives of this course:
- To learn properties of area and structural material properties.
- To understand the concept of stress and strain.
- To calculate shear force, bending moment for different shapes of structural elements and corresponding stresses.
- To understand the concept of buckling loads for short and long columns.

Course outcomes:

After competing this course, student will be able to:
- Articulate practical applications of moment of inertia of symmetrical and unsymmetrical structural sections.
- Analyse structural behaviour of materials under various loading conditions.
- Interpret shear force and bending moment diagrams for various types of beams and loading conditions.
- Determine the bending and shear stresses in beams under different loading conditions.
- Analyse the column for various loading and end conditions.

UNIT – I Moment of Inertia

Moment of inertia (M.I.): Definition, M.I. of plane lamina, Radius of gyration, section modulus, Parallel and Perpendicular axes theorems (without derivations), M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section (without derivations). M.I. of symmetrical and unsymmetrical I-section, Channel section, T-section, Angle section, Hollow sections and built up sections about centroidal axes and any other reference axis.

UNIT – II Simple Stresses and Strains

Definition of rigid, elastic and plastic bodies, deformation of elastic body under various forces, Definition of stress, strain, elasticity, Hook's law, Elastic limit, Modulus of elasticity. Type of Stresses-Normal, Direct, Bending and Shear and nature of stresses i.e. Tensile and Compressive stresses. Standard stress strain curve for tor steel bar under tension, Yield stress, Proof stress, Ultimate stress, Strain at various critical points, Percentage elongation and Factor of safety.

Deformation of body due to axial force, forces applied at intermediate sections, Maximum and minimum stress induced, Composite section under axial loading. Concept of temperature stresses and strain, Stress and strain developed due to temperature variation in homogeneous simple bar (no composite section). Longitudinal and lateral strain, Modulus of Rigidity, Poisson's ratio, Biaxial and tri-axial stresses, volumetric strain, change in volume, Bulk modulus (Introduction only). Relation between modulus of elasticity, modulus of rigidity and bulk modulus (without derivation).

UNIT – III Shear Force and Bending Moment

Types of supports, beams and loads. Concept and definition of shear force and bending moment, Relation between load, shear force and bending moment (without derivation). Shear force and bending moment diagram for cantilever and simply supported beams subjected to point loads, uniformly distributed loads and couple (combination of any two types of loading), point of contra flexure.

UNIT – IV Bending and Shear Stresses in beams

Concept and theory of pure bending, assumptions, flexural equation (without derivation), bending stresses and their nature, bending stress distribution diagram. Concept of moment of resistance and simple numerical problems using flexural equation. Shear stress equation (without derivation), relation between maximum and average shear stress for rectangular and circular section, shear stress distribution diagram. Shear stress distribution for square, rectangular, circle, hollow, square, rectangular, circular, angle sections, channel section, I-section, T section. Simple numerical problems based on shear equation.

UNIT – V Columns

• Concept of compression member, short and long column, Effective length, Radius of gyration, Slenderness ratio, Types of end condition for columns, Buckling of axially loaded columns. Euler's theory, assumptions made in Euler's theory and its limitations, Application of Euler's equation to calculate buckling load. Rankine' s formula and its application to calculate crippling load. Concept of working load/safe load, design load and factor of safety.

Suggested learning resources:

1. Bedi D.S. , Strength of Materials, Khanna Publishing House, Delhi, Ed. 2018
2. Timoshenko, S., Strength of Materials, Vol. I, CBS, New Delhi.
3. Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.
4. Ramamurtham, S, Strength of Materials, Dhanpat Rai and sons, New Delhi.
5. Punmia B C, Strength of Materials, Laxmi Publications (p) Ltd. New Delhi.
6. Rattan S.S., Strength of Materials, McGraw Hill Education; New Delhi.
7. Bansal R K, Strength of Materials, Laxmi Publications.
8. Subramaniam R, Strength of Materials, Oxford University Press.

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Undergraduate Diploma Courses in Engineering & Technology

Department of Diploma Civil Engineering

SEMESTER- III

Course Code	**DCEA- 306**
Course Title	**Summer Internship-I**
Number of Credits	**2(L:0; T:0; P:0)**

Course Objective:

The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. The student should take this course as a window to the real World and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an engineering problem .

Guidelines:

- The industrial training is also a kind of team activity. Here development and design work with a focus on learning application environment.
- The software analysis in industries should be 50% of the total work.
- Industrial training cater a system required in laboratory or real life.
- Student is expected to learn out specifications, methodology, resources required, critical issues involved in design and implementation of software.
- The student is expected to exert on testing of the proposed results as per the industry

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