SYLLABUS FOR COMBINED COMPETITIVE ENGINEERING SERVICE EXAMINATION IN CIVIL, MECHANICAL, ELECTRICAL ENGINEERING TO BE CONDUCTED BY BIHAR PUBLIC SERVICE COMMISSION.

The syllabus is for civil Engineering , Mechanical Engineering and Electrical Engineering. The combined competitive Engineering Service Examination will be conducted on the basis of this syllabus by the Bihar Public Service Commission for direct recruitment of Graduate Civil Engineers, Mechanical Engineers and Electrical Engineers for the Departments of the State Government or other organisations as may be notified from time to time by the State Government in consultation with the Bihar Public Service Commission.

The examination is to be conducted in six papers of which four papers will be compulsory and two papers will be optional. The first three papers i.e. General English, General Hindi and General Studies will be compulsory for Civil, Mechanical and Electrical Engineering and will be objective type. The fourth paper i.e. General Engineering Science will be also compulsory for Civil, Mechanical and Electrical Engineering of which 50 per cent will be objective and 50 per cent subjective. The optional two papers of which 50 per cent will be objective and 50 per cent subjective will be separate for Civil Engineering, Mechanical Engineering and Electrical Engineering.

Subject/papers, duration and aggregate marks for each paper of the written Examination will be as under.—

(A) **Compulsory Papers.—**

Paper no.	Subject	Objective/ Subjective.	Duration	Aggregate Marks.
1	2	3	4	5
1	General English	Objective		100
2	General Hindi	Objective	3 Hours	100
3	General Studies	Objective		100
4	General Engineering.—			
	Science			
	Part-I	Objective	1 Hour Three	100 } 200
	Part-II	Subjective	2 Hours Hours	100 }
(B)	**Optional Papers.—**			
5	Civil Engineering.—			
	Section-I	Objective	1 Hour Three	100 } 200
	Section-II	Subjective	2 Hours Hours	100 }

Price—1.70

1	2	3	4	5
6	Civil Engineering.—			
	Section-1	Objective	1 Hour (Three Hours)	100 } 200
	Section-2	Subjective	2 Hours (Three Hours)	100 } 200
Or 5	Mechanical Engineering.—			
	Section-1	Objective	1 Hour (Three Hours)	100 } 200
	Section-2	Subjective	2 Hours (Three Hours)	100 } 200
6	Mechanical Engineering.—			
	Section1	Objective	1 Hour (Three Hours)	100 } 200
	Section-2	Subjective	2 Hours (Three Hours)	100 } 200
Or 5	Electrical Engineering.—			
	Section-1	Objective	1 Hour (Three Hours)	100 } 200
	Section-2	Subjective	2 Hours (Three Hours)	100 } 200
6	Electrical Enginering.—			
	Section-1	Objective	1 Hour (Three Hours)	100 } 200
	Section-2	Subjective	2 Hours (Three Hours)	100 } 200
				900
(C)	Viva Voce.			+100
			Total ..	1000

STANDARD AND SYLLABUS

The Standard of papers within the following syllabus will such as may be expected of an Engineering Graduate of an Indian University.

COMPULSORY PAPERS

Paper-I (General English)
Paper-II (General Hindi)

The question papers on General English/General Hindi will be designed to test the candidates understanding on use of the language.

Paper III (General Studies)—The paper on General Studies will include knowledge of current events and of matter of everyday observation and experience in their scientific aspects.

The paper will include matters of scientific, social, economic and political nature with emphasis on development of Engineering Science including such research and innovations, informations which are important for the development of Technology in different disciplines of Engineering.

Paper IV—There shall be one paper of 200 marks. The paper on General Engineering Science will include knowledge of Engineering Mechanics.

Methodology—General Engineering Science—Mechanics of Solids Engineering Materials and Methodology of constructions, Engineering Economy and Management, Transport phenomenon, Energy conversion, Environment Engineering, Survey Electrical Shop Measuring instrument Mechanical shop Measuring instrument, Elementary Engineering Common to different disciplines of Engineering (Detail syllabus appended).

(D) Optional paper—civil Engineering—Civil Engineering shall have two papers eazh carrying 200 marks of subjective and objective tests.

Paper V—CIVIL ENGINEERING

Structure analysis, structure Design and soil mechanics and foundation (Detail Syllabus appended).

Paper VI—CIVIL ENGINEERING

Hydrology and water resources open Channel flow. Design of Hydraulic structure, Transport Engineering, Public Health Engineering (Detail syllabus appended).

Optional paper—Mechanical Engineering—Mechanical Engineering shall have two Papers each carrying 200 marks of Subjective and objective tests.

Paper V—MECHANICAL ENGINEERING.

Thermodynamics, i.e. Enghines, steam Boilers and all other steam operated equipments. Gas Turbines, Compressors, Reheating and Regeneration, Heat transferl, Refrigeration and Air Conditioning Properties and classification of Fluids etc. (Detail Syllabus appended).

Paper VI—MECHANICAL ENGINEERING

Theory of mechanics, Machine design, strength of materials, Engineering materials. Production Engineering, Industrial Engineering etc. (Detail Syllabus appended).

PaperaV—Optional paper Electrieal Engineering

Two papers and 200 marks each of subjective and obective tests. Electrical Circuits, E.M. Theory, Material Science (Electrical Materials), Electrical measurements etc.

Paper VI—Elements of computation, power Apparatus and systems, control systems Electronics and Communication systems etc.

ANNEXURE—II

INSTRUCTION FOR OBJECTIVE TEST

A. For the examination in the objective papers (test) under Civil, Mechanical and Electrical Engineering descipline, a candidate is not required to write detail answers. For each question several suggested answer shall be given and the candidate is required to choose the appropriate answer from among them.

B. The question paper will be in the form of test Booklet. The Booklet will contain items bearing numbers 1, 2, 3, 4, etc. under each item suggested answers will be given and marked as a, b, c, d, etc. The task of the candidate will be to choose the correct answer from among them, if a candidate selects more than one answer, his answer will not be considered.

DETAIL SYLLABUS

GENERAL ENGINEERING SCIENCE

1. **Engineering Mechanics.**—Simple application of equilibrium equations, equation of motion, works, power, Energy.

2. **Surveying and Measurements.**—Distance and Area measurement, measurement of direction and angles measurement of slopes, Elevation and Height, Common Survey instruments, Electrical shop measurments such as Ammeter, Voltmeter, Chameter, Megger, Insulation Tester, Energy meter and their Principle of working, Mechanical shop Measurements, Instruments, linear and angular measurments straightness, Flatness and roundness measurement.

2. **Mechanic of Solids.**—Generalised stress, strain and constituting laws Transformation of Stress and Strain, Strain Energy, Analysis of beams Columns and Shafts, unsymmetrical bending Sheer centres, Theories of failure.

3. **Engineering Materials and constructions.**—Bricks, lime, cement, aggregate Castairon and Steel, Nonferrous metals, Timber, Paints and miscellaneous Engineering Materials, Testing of Engineering Materials considerations in construction of masoary floors and walls.

4. **Engineering Economy and Management.**—Principles of Engineering Economy, Project planning C.P.M. and P.E.R.T. technique, construction equipments and safety Analysis of rates of important construction items.

5. **Transport Phenomenon.**—Laminer and turbuland flow, concept of boundary layer, continuity equation, Bernoulli's theorem. Energy equation, flow measurement, dimensional analysis and modelling. One dimensional study state conduction of heat through single and multilayers bodies including walls and cylinders, Natural and forced convective heat transfer, concept of thermal boundary layer, step Bfenvoly-man law of radiation, Kirchoff's law, concept of black and grey bodies.

6. **Energy Conversion.**—Thermodynamic processes, First and Second law of thermodynamics, carnet cycle, Ranking Cycle, Offo cycle, Diesel cycle, impulse and Reactions water turbines pelton wheel and Francis Turbine Reciprocating and centrifugal Pumps.

7. **Elementary Engineering.**—Electric circuits, circuit law principles of superposition, Thevenin's theorem, Introductions to periodic function. Series and parallel connection in steedy AC. circuit having inductions, resistance and capacitance, Transister Junction diodes. Equivalent circuit. Common Emitter Equivalent circuit, magnetic effect of an electric current, Magnetic circuits, Ideal Transformer, transformer as a circuit element, Electromagnatic energy conversion, D.C. Motors and Generator performance A.C. Motor and Generator performance.

8. **Environmental Engineering.**—Water pollution and purification, waste water treatment, Air pollution and its control, Ecoligical balance.

PAPER 5—CIVIL ENGINEERING

1. **Structural Analysis.**—Structural determinacy and stability, Internal and external force and deflection, Analysis of statically determinate and indeterminate beams trusses, Frames and arches, Structural theorems, Stiffeners and flexibility methods, Matrix methods, Elastic stability of columns, Influence lines for determinate and indeterminate structures. Plastic analysis of beams slabs.

2. **Structural Design.**—(*a*) R.C.C.—Beams, slabs and columns, shear diagonal tension, concrete technology—

Ultimate load design and limit State Design, consideration in building frame design for vertical and seismic force.

(*b*) **Steel.**—Tension, Compression and flexual members, Proof Trussees Plate girders, Brackets and connections.

(*c*) Elements of Pre-stressed concrete structures.

3. **Soil Mechanics and Foundations.**—Geological forces and formation, Rock formation and classification, Nature and formation of soil, Properties and behaviour, Seepage consolidation and compaction, Shear strength, Stability of slopes, Soil stresses, Bearing capacity, Footings, Earth pressure retaining wells and sheet piles.

Shallow and deep foundation including pile, Raft and well foundation, Machine foundation, Expansive Soils, soil stabilisation.

PAPER 6—CIVIL ENGINEERING

1. **Hydrology and Water Resources.**—General hydrologic processes, Run-off estimation use of hydrographs, Empirical formulas preballistic hydrological analysis; Management of surface and ground water, irrigation engineering principles water requirement for crops, General description of irrigation works. Flood causes, Damage and control, River behaviour, Drainage, Practices and Design of both surface and underground drainage channels, General Principle of water power Engineering.

2. **Open Channel Flow.**—Description, Energy and momentum principles, Uniform gradually and rapidly varying flow. Elements of fluvial flow, Sediment transportation.

3. **Design of Hydraulic Structurer.**—Design of dams, weirs, barrages, canal and canal structures viz. falls cross drainage works, cross regulators, head regulators and canal outlet design of embankments and hydro-electric power plants.

4. **Transportation Engineering.—**

Geometric design of highway.
Elements of traffic Engineering.
Pavement Design.
Highway materials.
Highway maintenance.

Elements of Bridge Engineering I.R.C. Classification, Loads and considerations in the design of superstructure.

5. **Public Health Engineering.**—(*i*) Water Supply—Population forecast, Types of pipes used for water supply, Construction of tube-wells and dug wells, Design of slow sand filter and rapid gravity filter, Design of underground and overhead water reservoir, Details of water supply installation.

(*ii*) Drainage and sanitations, Surface drainage, Storm drainage and soil sewerage, Design of trickling filter, Design of septic tank, Design of imhoff tank, Details of sanitary installation.

MECHANICAL ENGINEERING

Paper-V

1. Thermodynmics.—Laws, Properties of ideal gases and vapours, power cycles, Gas power cycles, Gas Turbine cycles, Fuels and combustion.

2. I.C. Engines.—C.I. and S.I. Engines Detonation, Fuel injection and carburation performance and testing, Urbojet and turbo-prop, Engines, Rocket ngines elementary knowledge of nuclear power plants and nuclear Fuels.

3. Steam Boilers, Engines, Nozzles and steam Turbines Modern Boilers. Steam Turbines Types, Flow of Steam through Nozzles, Velocity diagrams for impulse and Reaction Turbines. Efficiencies and Governing.

4. Compressors Gas, Dynamics and Gas Turbines, Reciprocating, Centrifugal and axial flow compressors. Velocity diagrams, Efficiency and performance effect of Mech. number on flow Isentropic flow, Normal shocks and flow through Nozzles. Gas Turbine Cycle with multistage Comperessing Reheating and Regeneration.

5. Heat Transfer, Refrigeration and Air-Conditioning Conduction Convection and Radiation, Heat exchangers, types combined Heat Transfer Over all Heat transfer coefficient. Refrigeration and Heat pump cycles refrigeration systems. Coefficient of performance, Psychromatric and psychromatric cphart. Comfort indices Cooling and dehumidification methods. Industrial Air-conditioning processes. Cooling and heating loads calculations.

6. Properties and classifications of fluids.— Fluid statics, Kinematics and dynamics, principles and applications, Manometry and Buoyancy. Flow of ideal fluids. Laminer and Tubulent flows. Boundary layer theory. Flow over immersel bodies. Flow through pipes and open Channels. Dimensional analysis and similitude technique. Nondimensional specific speed and classification of fluid machines in general Energy transfer relation performance and operation of pumps and of impulse and reaction water turbines, Hydronamic power transmission.

Paper-VI

7. Theory of Machines

Velocity and acceleration—(*i*) of moving bodies, (*ii*) Machines Kliens construction Inertia forces in machines. Cams, Gears and Gearing Fly wheels and Governors. Balancing of Rotating and Reciprocating masses. Free and forced vibrations of systems. Critical speeds and whiriling of shafts.

8. Machine Disign

Design of Joints.—Threaded fasteners and power screws-keys, kotters coupling welded joints-Transmission system Belt and chain drices wire ropes-shafts.

Gears—Siding and Rolling bearings.

9. Strength of Materials.

Stress and strain in two dimensions Mohrs Circles, relations between Elastic Constant.

Beams—Bending moments, shearing foreces and reflection.

Shafts—Combined bending, direct and torsional stresses. Thick walled cylinders Spleres under pressure. Spring struts and columns, Theories of failure.

10. Engineering Materials

Alloys and Alloying Materials, heat treatment, Composition, properties and uses, plastics and other newer engineering Materials.

11. Production Engineering

Metal, Machining, Cutting Tools, Tool Materials, water and Mechinability, Measurement of cutting forces.

Process, Machining—Grinding, Boring, Gear Manufacturing, Metal forming, Metal Casting and jointing, Basic Special Purpose, Programme and numerically controlled machine tools, Jigs and fixtures (locating elements).

12. Industrial Engineering.

Work study and work measurement, wage incentive, Design of production system and product cost, Principles of plant layout, Production plannig and control, Material handling, Operations Research, Linear programming queuing, Theory, Value Engineering Network Analysis, CPM and Pert. Use of Computers.

ELECTRICAL ENGINEERING

Paper-V

1. Electrical Circuits

Network theorems, Response of network to step, ramp, impulse and sinusoidal inputs, Frequency domain analysis. Two port networks elements of network synthesis Signal-flow graphs.

2. E.M. Theory

Electrostatics magetorstatics using vector methods, Fields in dielectrics in conductors and in magnetic materials. Time varying fields. Maxwell,s equations. Plane-wave propagation in conducting and dielectirc media, Properties of Transmission lines.

3. Material Science (Electric Materilas)

Band Theory, Behaviour or dielectrics in static and alternating fields, Piezo-electricity, conductivity of Metals. Super conductivity, Magnetic Propoerties of Materials, Ferro and ferrimagnetism, Conduction in semiconductors, Hall effect.

4. Electrical Measurements

Principles of Measurement, Bridge measurement of Circuit parameters Measuring Instruments, VTVMQ and CRO, meter, Spectrum analyser, Transducers and measurement of non-electrical quantities, digital measurment telemeterring data recording and display.

Paper-VI

5. Elements of Camputation

Digital system algerithms, Flow charting, Storage, Type Statements array storage Arithmatic oprossion. Logical expressions, Assignments statements. Programme structure scientific and Engineering applications.

6. Power Apparatus and Systems

Electromechanics—Principles of electromechanical energy conversion, Analysis of D.C. synchrimous and Induction Machines, Fractional horse power Motors, Machines in control system. Transformer Magnetic Circuits and Selection of motors for drives Power System. Power generation, Thermal Hydro and Nuclear, power Transmission, Coromabundle, Conductors, Power Systems, Protection Economic operation Load frequency control, Stability analysis.

7. Control Systems

Open-Loop and closed Loop systems, Response analysis Rootlocus technique, stability, compensation and design techniques. State variable approach.

8. Electronics and Communications

Electronics—Solid state devices and Circuits small signal amplifier design, feedback amplifiers oscillaters and operational amplifiers. FET Circuit and linear I.C.S. switching circuits Boolean Algebra, Logic circuits. Combinational and sequential digital circuit. Communicantios, Signal analysis, Transmission of signals, Modulation Detection, Vasious Types of communication systems. Performance of communication systems.

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