

Assistant Engineer-(Syllabus)

MODIFIED APPENDIX

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% will be objective and 50% subjective. The optional two papers of which 50% will be objective and 50% 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.	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	100
	Part-II	Subjective	2 Hours	100

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(B) OPTIONAL PAPERS.

Paper no.	Subject	Objective/subjective	Duration	Aggregate Marks.
5. Civil Engineering				
	Section-1	Objective	1 Hour	100
	Section-2	subjective	2. Hours	100
6. Civil Engineering				
	Section-1	Objective	1. Hours	100
	Section-2	subjective	2. Hours	100
or .5 Mechanical Engineering.				
	Section-1	Objective	1. Hour	100
	Section-2	Subjective	2. Hours	100
6. Mechanical Engineering.				
	Section-1	Objective	1. Hour	100
	Section-2	Subjective	2. Hours	100
or.5. Electrical Engineering.				
	Section-1	Objective	1. Hour	100
	Section-2	Subjective	2. Hours	100
6. Electrical Engineering.				
	Section-1	Objective	1. Hour	100
	Section-2	Subjective	2. Hours	100
				900-
				100
Total-				1000

STANDARD AND SYLLABUS.

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

COMPULSORY PAPERS.

Paper-1 General English
 Paper-2 General Hindi
 The question papers on General English and General Hindi will be designed to test the candidates understanding on use of language.

Paper-III General Studies. The paper on General Studies will inculcate knowledge of current events and of matter of everyday observation and experience in their scientific aspects.

The paper will inculcate matters of scientific, social economic and-----

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Political mature 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- This 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 each carrying 200 marks of subjective & Objective tests.

Paper V- CIVIL ENGINEERING.

Hydrology and water resources open channel flow, Design of Hydraulic structure, etc. Engineering, Public Health Engineering. Detail syllabus appended.)

OPTIONAL PAPER

MECHANICAL ENGINEERING.

Mechanical Engineering shall have two papers each carrying 200 marks of subjective & Objective tests.

PAPERS V- MECHANICAL ENGINEERING.

Thermodynamics, I. C. Engines, Steam Boilers and all other steam operated equipments. Gas Turbines, compressors, Reheating and Regeneration Heat Transfer, Refrigeration & air Conditioning. Properties and clarification of fluids etc (Detail syllabus appended).

Paper VI-

MECHANICAL ENGINEERING

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

OPTIONAL PAPERELECTRICAL ENGINEERING.

Two papers 200 marks each of subjective & Objective tests.

Paper V-

Electrical Circuits, E.M. Theory, Material Science (Ferrous Materials) Electrical measurements etc.

Paper VI-

Elements of computation, power apparatus & systems, control systems electronics and Communication systems etc.

ANNEXURE IIINSTRUCTIONS NON OF ECTIVE TEST

- A. For the examination in the objective papers (test) under civil Mechanical & Electrical Engineering discipline, a candidate is not required to write detail answers. For each question several suggested answer shall be given and the candidate is required to chose 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 chose the correct answer from among them. If a candidate selects more than one answer, his answer will not be considered.

DETAIL SYLLABUS.GENERAL ENGINEERING SCIENCES.

1. Engineering Mechanics:- Simple application of equilibrium equations, equation of motion, work, power, Energy.

2. SURVEYING AND MEASUREMENT.

DISTANCE and Area measurement, measurement of direction and angles measurement of slopes, Elevation and Height, Common survey instruments, Electrical shop measurements such as ammeter, Note meter, Chameter, egger, Insulation Tester, Energy meter and their principles of working, Mechanical shop Measurement Instruments, linear and angular measurement, straightness, Flatness and roundness measurement.

- 2) **MECHANIC OF SOLIDS:-** Generalised stress, Strain & constituting laws, Transformation of Stress & Strain, Strain Energy, analysis of beams, Columns & shafts, unsymmetrical bending, shear centre, Theories of failure.
3. **ENGINEERING MATERIALS AND CONSTRUCTIONS:-** Bricks, lime, cement aggregate Cast Iron and steel, Non ferrous metals, Timber, Paints and miscellaneous Engineerings Materials, Testing of Engineering materials, considerations in construction of masonry floors and walls
4. **ENGINEERING ECONOMY AND MANAGEMENT:-** Principles of Engineering economy, project planning C.P.M. and P.S.R.T. techniques, construction equipments and safety. Analysis of rates of important construction items.
5. **TRANSPORT PHENOMENON:-** Laminar and turbulent flow, concept of boundary layer, continuity equation, Bernoulli's theorem, Energy equation, Flow measurement, dimensional analysis and modelling one dimensional study, conduction of heat through single and multi layers bodies including walls and cylinders, Natural and forced convective heat transfer, concept of thermal boundary layer, Stefan boltzman law of radiation, kirchoff's law, concept of black and grey bodies.
6. **ENERGY CONVERSION:-** Thermodynamic processes, First and second law of thermodynamics, Carnot cycle, Rankine cycle, Otto cycle, Diesel cycle, impulse and Reaction water turbines- pelton francis Turbine Reciprocating and centrifugal pumps.
7. **ELEMENTARY ENGINEERING:-** Electric circuits, circuit law principle of superposition, Thevenin's theorem, Introduction to periodic function, series and parallel connection in steady A.C. circuit having induction, resistance and capacitance junction Transistor, Junction diodes, Equivalent circuit. common Emitter Equivalent circuit, Magnetic effect of an Electric current, Magnetic circuits, Ideal Transformer, Transformer as a circuit element, Electromagnetic 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, Ecological balance.

PAPER-5- CIVIL ENGINEERING.1. STRUCTURAL ANALYSIS.

Structural determinate 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 and 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 flexural members, Roof Trusses plate girders, brackets and connections.

(c) Elements of pre-Stressed concrete structures.

3. SOIL MECHANICS AND FOUNDATIONS.

Geological forces and formations, 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 walls 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 formula, probabilistic hydrological analysis, Management of surface and ground water, Irrigation Engineering principles, water requirement for crops general description of Irrigation work flood causes, damage and control, River behaviour, Drainage practices and Design of both surface and underground drainage channels, General Principles of water power Engineering

2. OPEN CHANNEL FLOW:-

Description, Energy and momentum principles, uniform, gradual and rapidly varying flow, elements of fluvial flow sediments transportation.

3. DESIGN OF HYDRAULIC STRUCTURES.

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 p.

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, Type 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 sanitation, surface drainage. Storm drainage and soil sewerage, Design of Trickling filter, Design of Septic tank, Design of Imhoff tank. Detail of sanitary installation.

MECHANICAL ENGINEERING.PAPER V.1. Thermodynamics.

- 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 carburettor Performance and Testing. Turbojet and Turbo-prop. Engines, Rocket Engines Elementary knowledge of Nuclear power plants and Nuclear Fuels.

3. Steam Boilers, Engines Nozzles and steam Turbines Modern Boilers, Steam Turbines Type, 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 Mach number on flow, Isentropic flow. Normal shocks and flow through nozzles. Gas Turbine cycle with multi stage compressing, 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 psychrometrics and psychrometric chart. Comfort indices. Cooling and dehumidification methods

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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. Laminar and turbulent flows. Boundary layer theory. Flow over-immersed bodies. Flow through pipes and open Channels. Dimensional analysis and similitude technique.

Non-dimensional specific speed and classification of fluid machines in general. Energy transfer relation performance and operation of pump and of impulse and reaction water turbines. Hydraulic power transmission.

PAPER VI.

7. Theory of Machines

~~Velocity and acceleration (i) of moving bodies, (ii) machines~~

Klien 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 whirling of shafts.

8. Machine Design.

Design of: Joints-Threaded fasteners and power Screws-Keys, Cotter, Coupling-welded joints-Transmission system, Belt and chain drives-wire ropes-shafts.

Gears-siding and Rolling bearings.

9. Strength of Materials.

Stress and strain in two dimensions, Mohr's circles, relations between Elastic Constants.

Beams: Bending moments shearing forces and deflection.

Shafts: Combined bending, direct and torsional stresses.

Thick walled cylinders and spheres 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 Mechanability measurement of cutting forces.

Process, Machining-Grinding, Drilling, Gear, Manufacturing, Metal

forming metal casting and jointing, Dams, Special purpose,

programme and numerically controlled machine tools, dies and fixtures (Joining elements).

12. Industrial Engineering.

work study and work measurement wage Incentive. Design of

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Production system and product cost, Principles of plant layout, Production planning and control. Material handling. Operations research. Linear programming queuing. Theory. Value Engineering Network Analysis, CPM and PERT Use of computers.