



Department of Civil Engineering
GITAM Institute of Technology
GITAM (DEEMED TO BE UNIVERSITY)
(Estd. u/s 3 of the UGC Act, 1956), NAAC Accredited with 'A+' Grade
Gandhinagar Campus, Rushikonda, Visakhapatnam-530 045, A.P., India

Ph.D. Entrance Test - 2019-20 (Phase-II)

Part – A: Research Methodology

Syllabus:

What is Research; Objectives, Motivation, Types of Research. Literature Review and Technical Reading, Attributions and Citations, Building Intellectual Property Rights: Codes and Standards, Ethics in Engineering Research, Technical Writing and Publishing, Communicating Research Work: Presentation Skills, Assessing Research Quality.

Reference Books:

1. Dipankar Deb, Rajeeb Dey, Valentina E. Balas, Engineering Research Methodology, A Practical Insight for Researchers, Springer Publications, 2019
2. C. R. Kothari, Research Methodology – Methods and Techniques, New Age International Publishers, 2004.
3. David V. Thiel, Research Methods for Engineers, Cambridge University Press, 2014.

Part- B: Civil Engineering

Syllabus:

Section 1: Structural Engineering

Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Friction and its applications; Kinematics of point mass and rigid body; Centre of mass; Euler's equations of motion; Impulse-momentum; Energy methods; Principles of virtual work.

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Theories of failures; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, buckling of column, combined and direct bending stresses.

Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

Construction Materials and Management: Construction Materials: Structural steel - composition, material properties and behaviour; Concrete - constituents, mix design, short-term and long-term properties; Bricks and mortar; Timber; Bitumen. Construction Management: Types of construction projects; Tendering and construction contracts; Rate analysis and standard specifications; Cost estimation; Project planning and network analysis - PERT and CPM.

Concrete Structures: Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete; Analysis of beam sections at transfer and service loads. Steel Structures: Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Plastic analysis of beams and frames.

Section 2: Geotechnical Engineering

Soil Mechanics: Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and quicksand condition; Compaction in laboratory and field conditions; One dimensional consolidation, time rate of consolidation; Mohr's circle, stress paths, effective and total shear strength parameters, characteristics of clays and sand.

Foundation Engineering: Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes - finite and infinite slopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, pressure bulbs; Shallow foundations - Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction.

Section 3: Water Resources Engineering

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; Potential flow, applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines, specific speed of pumps and turbines; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow.

Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, flood estimation and routing, reservoir capacity, reservoir and channel routing, surface run-off models, ground water hydrology -steady state well hydraulics and aquifers; Application of Darcy's law.

Irrigation: Duty, delta, estimation of evapo-transpiration; Crop water requirements; Design of lined and unlined canals, head works, gravity dams and spillways; Design of weirs on permeable foundation; Types of irrigation systems, irrigation methods; Water logging and drainage; Canal regulatory works, cross-drainage structures, outlets and escapes.

Section 4: Environmental Engineering

Water and Waste Water: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.

Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

Noise Pollution: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

Section 5: Transportation Engineering

Transportation Infrastructure: Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments; Geometric design of railway track; Airport runway length, taxiway and exit taxiway design.

Highway Pavements: Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in concrete pavements.

15. Conference proceedings are considered as.....documents.
 a) Conventional b) Primary c) Secondary d) Tertiary
16. Which of the following is not a "Graphic representation" ?
 a) Pie Chart b) Bar Chart c) Table d) Histogram
17. One of the following search engine is exclusively meant for scientific information :
 a) Google b) Yahoo c) SCIRUS d) Altavista
18. What is full form of IPR
 a) Intellectual property rights b) Intelligent property right
 c) Intellectual property right d) Intelligent property rotation
19. Protocol means..... .
 a) Interchange of data between two devices b) Interchange of data between two computers
 c) Linkage between two computers d) Linkage between two devices
20. Questionnaire is
 a) Research method b) Measurement technique
 c) Tool for data collection d) Data analysis technique
21. A Research Report is a formal statement of
 a) Research process c) Data collection b) Research Problem d) Data Editing
22. A short summary of technical report is called
 a) Article b) Research Abstract c) Publication d) Guide
23. Ethical Neutrality is a feature of
 a) Deduction b) Scientific method c) Observation d) experience
24. Scientific method is committed to
 a) Objectivity b) Ethics c) Proposition d) Neutrality
25. Research method is a part of
 a) Problem b) Experiment c) Research Techniques d) Research Methodology

Section-B

**Answer the following each question carries 2 Marks
15 questions × 2 marks= 30 Marks**

26. Before searching you should define the timeframe of your search. Why?

- a) So you don't find the library busy
- b) So you find the most articles
- c) So you work when you are most efficient
- d) So you do not incur unnecessary costs

27. Why is it important for a researcher to review the literature?

- a) Because it is traditional
- b) Because it will find if anyone has done the work before
- c) Because it identifies like-minded researchers
- d) Because it shows time has been spent on the subject

28. The literature review will examine:

- a) all aspects of a topic
- b) only facts
- c) only one side of the main argument
- d) only opinions

29. Writing your research objectives clearly helps to

- a) Define the focus of your study
- b) Clearly identify variables to be measured
- c) Indicate the various steps to be involved
- d) Establish the limits of the study
- e) All of the above

30. The starting point for a literature search is

- a) tertiary data
- b) secondary data
- c) primary data
- d) some other data

31. Researchers need to be cautious of some material, particularly material found online. Why?

- a) It has been used before
- b) The quality is unknown
- c) The authors name often does not appear
- d) It is too recent

32. What do you mean by citation

- a) A citation allows authors to provide the source of any quotations, ideas, and information on the copyrighted works of other authors
- b) A citation allows authors to provide the source of any quotations, ideas, and information on the copyrighted works of own work
- c) Citation is not typically related to copy right works
- d) none of the above

33. When you discover that an author has, (1) cited another author (2) it is good practice to:

- a) not to use the work
- b) use the work and attribute it to author 1
- c) use the work and attribute it to author 2
- d) locate and read the original, then attribute it to author 2

34. What are the important things when giving a presentation
 a) Introduce yourself by name b) Slow down when you are speaking
 c) Make eye contact with the audience d) Ask for questions from the audience at the conclusion of presentation
 e) All of the above
35. The objective of the communication is
 a) Specific b) Measurable c) Attainable
 d) Results – oriented and Time-limited e) All of the above
36. A side bar is used to
 a) Useful way of physically framing the text and giving shape to the document.
 b) Highly necessary c) Used to provide extra information such as organization, or publication; copyright, contact information d) both a& b is correct e) both a&c is correct
37. Which is the major disadvantage of using peer-reviewed journals in literature reviews?
 a) The information is too recent b) Humans control the quality
 c) Subscription fees are high d) Information could be as old as four years
- 38 Which of these will NOT help you to decide whether a publication is reputable?
 a) Advertising inside b) Citation rate
 c) Audience d) Importance to peers
39. When you cite Internet resources, you do not need to find
 a) date created b) date of birth of the author
 c) date last updated d) date of access
40. Which of these is the most efficient way to locate relevant journals?
 a) Searching using tertiary sources b) Browsing the shelves in the library
 c) Browsing in a newsagents d) Following up references in articles

Section- C

**Answer the following each question carries 3 Marks
 5 questions × 3 marks= 15 Marks**

41. What do you think might happen if you started a research project, but hadn't written any clear research objectives?
 a) Confusion about the limits of study b) Collection of data is unlimited c) identify barriers and concerns d) only a is correct e) both a & b is correct
42. Surveying the literature involves
 a) Narrow the problem itself b) identify the gaps c) limited information about the existing theories d) b is correct e) both a& b is correct

43. The purpose of attribution is
 a) similar to citation b) not similar to citation c) Used to quote (or paraphrase **all or a portion** of an openly licensed work d) both a & c e) none of the above
44. Who is responsible for plagiarism?
 a) Lecturers and supervisors b) The participant c) Institution
 d) The researcher e) All of the above
45. How do you prepare for presentation?
 a) Writing main argument or conclusion b) Writing the main points as headings
 c) Timing the presentation & discuss the main issue by clear opening and closing line remarks d) all of the above e) only a& b

Part B: Civil Engineering

- Section - A contains : 25 questions × 1 mark = 25 Marks**
Section- B contains : 15 questions × 2 marks = 30 Marks
Section-C contains : 5 questions × 3 marks = 15 Marks

Section-A

Answer the following each question carries 1 Mark
25 questions × 1 mark = 25 Marks

1. The Star and Grid pattern of road network was adopted in
 (a) Nagpur Road Plan (b) Luck now Road Plan
 (c) Bombay Road Plan (d) Delhi Road Plan

2. The value of lateral friction or side friction used in the design of horizontal curve as per India Roads Congress guidelines is
 (a) 0.40 (b) 0.35 (c) 0.24 (d) 0.15 2

3. Road roughness is measured using
 a) Benkelman beam b) Bump integrator
 c) Dynamic cone penetrometer d) Falling weight deflectometer
4. Camber on high way pavement is provide to care of
 a) Centrifugal force b) Drainage c) Sight distance d) Off-tracing

5. The reaction time for calculating SSD may be assumed as
 a) 5 sec b) 2.5 sec c) 0.5 sec d) 10.0 sec

6. The average quantity of water (in lpcd) required for domestic purposes according to IS code is
 a)100 b)120 c)70 d) 135

7. Which method is used to measure the color of water?
 a) Gravimetric b) Chromatography c) Tintometer d) Hydrometer analysis
8. Which of the following represents the physical characteristics of water?
 a) Chlorides b) BOD c) Turbidity d) COD
9. Which of the following is the final stage in the sludge treatment process?
 a) Digestion b) Dewatering c) Drying d) Thickening
10. Which of the following is known as Shut off valve?
 a) Air relief valve b) Sluice valve c) Pressure relief valve d) Altitude valve
11. If the porosity of the sample is 20%, the voids ratio is
 a) 0.2 b) 1 c) 0.8 d) 0.75
12. In a compaction test, as the compaction effort is increased, OMC will
 a) decrease b) remains same c) increases d) increase and then decrease
13. Vane tester is normally used for finding in situ shear strength
 a) soft clay b) sand c) stiff clays d) gravel
14. Principle involved in the relationship between submerged unit weight and saturated weight of a soil is based on
 a) Equilibrium of floating bodies b) Archimede's principle
 c) Stoke's law d) darcy's law
15. A soil sample has a void ratio of 0.5 and its porosity will be closed to
 a) 50% b) 66% c) 100% d) 30%
16. Cavitation is caused by
 a) high velocity b) low pressure c) high pressure d) high temperature
17. If, for a fluid in motion, pressure at a point is same in all directions then the fluid is
 a) a real fluid b) a newtonian fluid c) an ideal fluid d) a non-newtonian fluid
18. An isohyet is a line joining points of
 a) equal temperature b) equal humidity c) equal rainfall depth d) equal evaporation

19. A sprinkler irrigation system is suitable when
 a) deep slope land b) soil with low permeability
 c) water table is low d) crops with deep roots
20. The ratio of actual evapo-transpiration to potential evapo-transpiration is in the range
 a) 0-0.4 b) 0.6-0.9 c) 0-1.0 d) 1-2
21. The number of independent elastic constants for a linear elastic isotropic and homogeneous material is
 a) 1 b) 2 c) 3 d) 4
22. A cantilever beam curved in plan and subjected to lateral loads will develop at any section
 a) Bending Moment & Shear Force b) bending moment & twisting moment
 c) twisting and shear force d) BM, SF & Twisting moment
23. The first moment of area about the axis of bending for a beam cross-section is
 a) Moment of Inertia b) section modulus c) shape factor d) polar moment of inertia
24. Poisson's ratio of steel is _____
 a) 0.1 b) 1.0 c) 0.3 d) 2.0
25. The _____ is used to measure the workability of concrete mixture which is commonly used in the field.
 a) Vee-bee test b) Slump test c) Compaction factor d) Workability test

Section-B

**Answer the following each question carries 2 Marks
 15 questions × 2 marks = 30 Marks**

1. Center of gravity of a solid cone lies on the axis at the height
 A. One-fourth of the total height above base B. One-third of the total height above base
 C. One-half of the total height above base D. three-eighth of the total height above the base

9. A closed tank contains 0.5 m thick layer of mercury (specific gravity = 13.6) at the bottom. A 2.0 m thick layer of water lies above the mercury layer. A 3.0 m thick layer of oil (specific gravity = 0.6) lies above the water layer. The space above the oil layer contains air under pressure. The gauge pressure at the bottom of the tank is 196.2 kN/m². The density of water is 1000 kg/m³ and the acceleration due to gravity is 9.81 m/s². The value of pressure in the air space is
- A. 92.214 kN/m² B. 95.644 kN/m²
 C. 98.922 kN/m² D. 99.321 kN/m²
10. A metal bar of length 100mm is inserted between two rigid supports and its temperature is increased by 10°C. If the coefficient of thermal expansion is 12 x 10⁻⁶ per °C and the Young's modulus is 2 x 10⁵ MPa, the stress in the bar is
- A. ZERO B. 24MPa
 C. 12MPa D. 2400MPa
11. Some of the structural strength of a clayey material that is lost by remoulding is slowly recovered with time. This property of soils to undergo an isothermal gel-to-soil-to-gel transformation upon agitation and subsequent rest is termed
- a. Isotropy B. Anisotropy
 C. Thixotropy D. Allotropy
12. According to Robert E. Horton, the equation of infiltration capacity curve, is (where letters carry their usual meanings)

A. $f = f_c (f_o - f_c) e^{-kt}$

B. $f = f_t - (f_o - f_c) e^{-kt}$

C. $f = f_t + (f_o - f_c) e^{-kt}$

D. $f = f + (f_o - f_c) e^{-kt}$

13. A pin-jointed plane frame is unstable if
- A. (m + r) < 2j B. m + r = 2j C. (m + r) > 2j D. None

14. The expression of the recirculation factor F is given by
- $F = 1 / (1+0.1 (R/I)) ^ 2$
 - $F=(1+R)/(1+0.1(R/I)) ^ 2$
 - $F=(1+I/R)/(1+0.1(R/I))^2$
 - $F = (1+ R/I) / (1+0.1(R/I))^2$
15. An automobile with projected area 2.6 m^2 is running on a road with a speed of 120 km per hour . The mass density and the kinematic viscosity of air are 1.2 kg/m^3 and $1.5 \times 10^{-5} \text{ m}^2/\text{s}$, respectively. The drag coefficient is 0.30 . The drag force on the automobile is
- A. 600N B. 620N C. 520N D. 580N

Section- C

**Answer the following each question carries 3 Marks
5 questions \times 3 marks= 15 Marks**

- A brass bar, having cross sectional area of 100mm^2 , is subjected to axial force of 50kN . The length of two sections is 100mm and 200mm respectively. What will be the total elongation of bar if $E= 1.05 \times 10^5 \text{ N/mm}^2$?
 - 1.21mm
 - 2.034 mm
 - 2.31 mm
 - 1.428 mm
- In falling head permeability test the initial head of 1.0 m dropped to 0.35 in 3 hours , the diameter of the standpipe being 5 mm . The soil specimen was 200 mm long and of 100 mm diameter. The coefficient of the probability of the soil is
 - $4.86 \times 10^{-5} \text{ cm/s}$
 - $4.86 \times 10^{-6} \text{ cm/s}$
 - $4.86 \times 10^{-7} \text{ cm/s}$
 - $4.86 \times 10^{-8} \text{ cm/s}$
- The alkalinity and hardness of a water sample are 250 mg/L and 350 mg/L as CaCO_3 , respectively. The water has
 - 350 mg/L carbonate hardness and zero non-carbonate hardness.
 - 250 mg/L carbonate hardness and zero non-carbonate hardness.
 - 250 mg/L carbonate hardness and 350 mg/L non-carbonate hardness.
 - 250 mg/L carbonate hardness and 100 mg/L non-carbonate hardness.
- The speeds of overtaking and overtaken on a highway are 85 kmph and 70kmph respectively. Calculate the overtaking sight needed for two way traffic. Assume the acceleration of the overtaking vehicle as 2.5 kmph/sec and speed of vehicle in opposite direction is 85 kmph .
 - 657 m
 - 768 m

c. 536 m

d. 346 m

5. For a 2-D flow field, the stream function Ψ is given as $\frac{3}{2}(y^2-x^2)$. The magnitude of discharge occurring between the stream line passing through points (0, 3) and (3, 4) is

A. 6 units

B. 1.5 units

C. 2 units

D. 3 units