Fluid Mechanics

**HYDRAULICS LAB VIVA Questions :-**

1. Specific Weight of Water?  
   2. Capillarity of Water  
   3. Fluid Pressure  
   4. Pascal’s law  
   5. Measurement of Liquid Pressure  
   6. Explain: Discharge, Velocity  
   7. Fundamental Equation or Continuity Equation of Liquid Flow  
   8. Types of Flow  
   9. Energy of Liquid in Motion  
   10. Total head?  
   11. Bernoulli’s Theorem  
   12. Measurements of Discharges in Pipes  
   13. Notch v/s Weir  
   14. Flow through Pipes  
   15. Flow through Open Channels  
   16. Chezy’s Equation  
   17. Types of Channels  
   18. Economical Cross Section of Channels  
   19. Importance of Reynolds Number  
   20. Specific Gravity and Critical Depth

## **AUTOCAD LAB VIVA**

**1. What is meant by AutoCAD?**  
**2. What is the diff between CAD & CADD?**  
**3. What are the applications of CAD?**

**4. Define absolute co-ordinates?**  
**5. Define polar co-ordinates.**  
**6. Define angular dimension?**  
**7. Define aligned dimension?**  
**8. What is Bylayer?**  
**9. What is command line?**  
**10. What is command: prompt:**

**11. What is cross hair cursor?**  
**12. Define current UCS?**

**13. What is. dwg?**.

**14. Define graphics window?**  
**15. Define line type?**  
**16. What is a hatch patterns?**  
**17. Define MIRROR?**  
**18. What is an ortho mode?**  
**19. What are the advantages of CAD?**  
**20. What is an object snap mode?**  
**21. Define block?**  
**22. Define relative co-ordinates?**

## **Questions and Answers**

## **HIGHWAY Engineering LAB VIVA Questions:-**

## **1. Explain Highway Engineering?**

## **Highway engineering is an engineering discipline branching from civil engineering that involves the planning, design, construction, operation, and maintenance of roads, bridges, and tunnels to ensure safe and effective transportation of people and goods.**

## **2. What Is The History Of Highway Engineering?**

## **History of highway engineering: The history of highway engineering gives us an idea about the roads of ancient times. Roads in Rome were constructed in a large scale and it radiated in many directions helping them in military operations. Thus they are considered to be pioneers in road construction. In this section we will see in detail about Ancient roads, Roman roads, British roads, French roads etc.**

## **3. Explain About Ancient Roads?**

## **Ancient Roads: The first mode of transport was by foot. These human pathways would have been developed for specific purposes leading to camp sites, food, streams for drinking water etc. The next major mode of transport was the use of animals for transporting both men and materials. Since these loaded animals required more horizontal and vertical clearances than the walking man, track ways emerged. The invention of wheel in Mesopotamian civilization led to the development of animal drawn vehicles. Then it became necessary that the road surface should be capable of carrying greater loads.**

## **Thus roads with harder surfaces emerged. To provide adequate strength to carry the wheels, the new ways tended to follow the sunny drier side of a path. These have led to the development of foot-paths. After the invention of wheel, animal drawn vehicles were developed and the need for hard surface road emerged. Traces of such hard roads were obtained from various ancient civilization dated as old as 3500 BC. The earliest authentic record of road was found from Assyrian empire constructed about 1900 BC.**

## **4. Explain Roman Roads?**

## **The earliest large scale road construction is attributed to Romans who constructed an extensive system of roads radiating in many directions from Rome. They were a remarkable achievement and provided travel times across Europe, Asia minor, and north Africa. Romans recognized that the fundamentals of good road construction were to provide good drainage, good material and good workmanship. Their roads were very durable, and some are still existing. Roman roads were always constructed on a firm – formed subgrade strengthened where necessary with wooden piles.**

## **The roads were bordered on both sides by longitudinal drains. The next step was the construction of the agger. This was a raised formation up to a 1 meter high and 15 m wide and was constructed with materials excavated during the side drain construction. This was then topped with a sand leveling course. The agger contributed greatly to moisture control in the pavement. The pavement structure on the top of the agger varied greatly. In the case of heavy traffic, a surface course of large 250 mm thick hexagonal flag stones were provided. A typical cross section of roman road is given in Figure 1. the main features of the Roman roads are that they were built straight regardless of gradient and used heavy foundation stones at the bottom. They mixed lime and volcanic pozzolana to make mortar and they added gravel to this mortar to make concrete. Thus concrete was a major Roman road making innovation.**

## **5. Explain French Roads?**

## **The next major development in the road construction occurred during the regime of Napoleon. The significant contributions were given by Tresaguet in 1764 and a typical cross section of this road is given in Figure 1. He developed a cheaper method of construction than the lavish and locally unsuccessful revival of Roman practice.**

## **The pavement used 200 mm pieces of quarried stone of a more compact form and shaped such that they had at least one flat side which was placed on a compact formation. Smaller pieces of broken stones were then compacted into the spaces between larger stones to provide a level surface. Finally the running layer was made with a layer of 25 mm sized broken stone. All this structure was placed in a trench in order to keep the running surface level with the surrounding country side.**

## **This created major drainage problems which were counteracted by making the surface as impervious as possible, cambering the surface and providing deep side ditches. He gave much importance for drainage. He also enunciated the necessity for continuous organized maintenance, instead of intermittent repairs if the roads were to be kept usable all times. For this he divided the roads between villages into sections of such length that an entire road could be covered by maintenance men living nearby.**

## **6. Explain British Roads?**

## **The British government also gave importance to road construction. The British engineer John Macadam introduced what can be considered as the first scientific road construction method. Stone size was an important element of Macadam recipe. By empirical observation of many roads, he came to realize that 250 mm layers of well compacted broken angular stone would provide the same strength and stiffness and a better running surface than an expensive pavement founded on large stone blocks. Thus he introduced an economical method of road construction.**

## **The mechanical interlock between the individual stone pieces provided strength and stiffness to the course. But the inter particle friction abraded the sharp interlocking faces and partly destroy the effectiveness of the course. This effect was overcome by introducing good quality interstitial finer material to produce a well-graded mix. Such mixes also proved less permeable and easier to compact.**

## **7. Explain Modern Roads?**

## **The modern roads by and large follow Macadam’s construction method. Use of bituminous concrete and cement concrete are the most important developments. Various advanced and cost-effective construction technologies are used. Development of new equipment helps in the faster construction of roads. Many easily and locally available materials are tested in the laboratories and then implemented on roads for making economical and durable pavements.**

## **Scope of transportation system has developed very largely. Population of the country is increasing day by day. The life style of people began to change. The need for travel to various places at faster speeds also increased. This increasing demand led to the emergence of other modes of transportation like railways and travel by air. While the above development in public transport sector was taking place, the development in private transport was at a much faster rate mainly because of its advantages like accessibility, privacy, flexibility, convenience and comfort.**

## **This led to the increase in vehicular traffic especially in private transport network. Thus road space available was becoming insufficient to meet the growing demand of traffic and congestion started. In addition, chances for accidents also increased. This has led to the increased attention towards control of vehicles so that the transport infrastructure was optimally used. Various control measures like traffic signals, providing roundabouts and medians, limiting the speed of vehicle at specific zones etc. were implemented.**

## **With the advancement of better roads and efficient control, more and more investments were made in the road sector especially after the World wars. These were large projects requiring large investment. For optimal utilization of funds, one should know the travel pattern and travel behavior. This has led to the emergence of transportation planning and demand management.**

## **8. Explain The Highway Planning In India?**

## **Highway planning in India: Excavations in the sites of Indus valley, Mohenjo-dero and Harappan civilizations revealed the existence of planned roads in India as old as 2500-3500 BC. The Mauryan kings also built very good roads. Ancient books like Arthashastra written by Kautilya, a great administrator of the Mauryan times, contained rules for regulating traffic, depths of roads for various purposes, and punishments for obstructing traffic.**

## **During the time of Mughal period, roads in India were greatly improved. Roads linking North-West and the Eastern areas through gangetic plains were built during this time.**

## **After the fall of the Mughals and at the beginning of British rule, many existing roads were improved. The construction of Grand-Trunk road connecting North and South is a major contribution of the British. However, the focus was later shifted to railways, except for feeder roads to important stations.**

## **9. Explain Jayakar Committee?**

## **The first World war period and that immediately following it found a rapid growth in motor transport. So need for better roads became a necessity. For that, the Government of India appointed a committee called Road development Committee with Mr.M.R. Jayakar as the chairman. This committee came to be known as Jayakar committee.**

## **Jayakar Committee : In 1927 Jayakar committee for Indian road development was appointed. The major recommendations and the resulting implementations were:**

## **Committee found that the road development of the country has become beyond the capacity of local governments and suggested that Central government should take the proper charge considering it as a matter of national interest.**

## **They gave more stress on long term planning programme, for a period of 20 years (hence called twenty year plan) that is to formulate plans and implement those plans with in the next 20 years.**

## **One of the recommendations was the holding of periodic road conferences to discuss about road construction and development. This paved the way for the establishment of a semi-official technical body called Indian Road Congress (IRC) in 1934**

## **The committee suggested imposition of additional taxation on motor transport which includes duty on motor spirit, vehicle taxation, license fees for vehicles plying for hire. This led to the introduction of a development fund called Central road fund in 1929. This fund was intended for road development.**

## **A dedicated research organization should be constituted to carry out research and development work. This resulted in the formation of Central Road Research Institute (CRRI) in 1950.**

## **10. Explain About Nagpur Road Congress?**

## **Nagpur road congress 1943: The second World War saw a rapid growth in road traffic and this led to the deterioration in the condition of roads. To discuss about improving the condition of roads, the government convened a conference of chief engineers of provinces at Nagpur in 1943. The result of the conference is famous as the Nagpur plan.**

## **A twenty year development programme for the period (1943-1963) was finalized. It was the first attempt to prepare a co-ordinated road development programme in a planned manner.**

## **The roads were divided into four classes:**

## **National highways which would pass through states, and places having national importance for strategic, administrative and other purposes.**

## **State highways which would be the other main roads of a state.**

## **District roads which would take traffic from the main roads to the interior of the district. According to the importance, some are considered as major district roads and the remaining as other district roads.**

## **Village roads which would link the villages to the road system.**

## **The committee planned to construct 2 lakh kms of road across the country within 20 years.**

## **They recommended the construction of star and grid pattern of roads throughout the country.**

## **One of the objectives was that the road length should be increased so as to give a road density of 16kms per 100 sq.km.**

## **11. Explain Bombay Road Congress?**

## **The length of roads envisaged under the Nagpur plan was achieved by the end of it, but the road system was deficient in many respects. The changed economic, industrial and agricultural conditions in the country warranted a review of the Nagpur plan. Accordingly a 20-year plan was drafted by the Roads wing of Government of India, which is popularly known as the Bombay plan. The highlights of the plan were:**

## **It was the second 20 year road plan (1961-1981)**

## **The total road length targeted to construct was about 10 lakhs.**

## **Rural roads were given specific attention. Scientific methods of construction were proposed for the rural roads. The necessary technical advice to the Panchayats should be given by State PWD’s.**

## **They suggested that the length of the road should be increased so as to give a road density of 32kms/100 sq.km**

## **The construction of 1600 km of expressways was also then included in the plan.**

## **12. Explain Lucknow Road Congress ?**

## **Lucknow road congress 1984: This plan has been prepared keeping in view the growth pattern envisaged in various fields by the turn of the century. Some of the salient features of this plan are as given below:**

## **This was the third 20 year road plan (1981-2001). It is also called Lucknow road plan.**

## **It aimed at constructing a road length of 12 lakh kilometres by the year 1981 resulting in a road density of 82kms/100 sq.km**

## **The plan has set the target length of NH to be completed by the end of seventh, eighth and ninth five year plan periods.**

## **It aims at improving the transportation facilities in villages, towns etc. such that no part of country is farther than 50 km from NH.**

## **One of the goals contained in the plan was that expressways should be constructed on major traffic corridors to provide speedy travel.**

## **Energy conservation, environmental quality of roads and road safety measures were also given due importance in this plan.**

## **13. What Is The Sequence Of Four Stages Of Survey In A Highway Alignment?**

## **Map study**

## **Reconnaissance**

## **Preliminary survey**

## **Detailed survey**

## **14. What Is The Effect Of Grade On Safe Overtaking Sight Distance?**

## **To increase it on both descending and ascending grades.**

## **1. Classification of Roads**

## **2. Express ways vs National Highways**

## **3. Factors affecting alignment of Roads**

## **4. Factors affecting alignment of Hill Roads**

## **5. Economical Route**

## **6. Gradient vs Super elevation**

## **7. Sight Distance and Types**

## **8. Curves**

## **9. Transition Curves vs Vertical Curves**

## **10. Road Patterns**

## **11. Road Intersections**

## **12. Components of City Road**

## **13. WBM Road**

## **14. Camber v/s Super Elevation**

## **15. Grade Separators**

## **STRENGTH OF MATERIALS LAB VIVA Questions :-**

**1. Define Hooke’s Law.**  
It states that when the material is loaded within the elastic limit the stress is directly proportional to strain.  
i.e. Stress α strain. or Stress = constant x Strain

**2. Define Strength of materials.**  
The strength of a material is its ability to withstand an applied stress without failure.

**3. What is stress?**  
When load is applied on any object then a resisting force is induced, that resisting or reacting per unit area of cross-section is called stress.

**4. What is strain?**  
Stress is change in dimensions upon original dimensions.

**5. What is deformation?**  
Deformation is change in dimensions of any object due to applied load.

**6. On which steel you have performed tension test. What is its carbon content?**  
On mild steel (0.3 to 0.6% carbon).

**7. What kind of fracture has occurred in tensile specimen?**  
Ductile fracture.

**8. Define temperature stress.**  
Stress introduced by uniform or non-uniform temperature change in a structure or material which is constrained against expansion or contraction.

**9. What is hardness?**  
Hardness is the resistance of a material to localized deformation.  
Or  
Hardness is the mechanical resistance which a material asserts against the mechanical penetration of a harder test body.

**10. What is toughness?**  
Toughness is the amount of energy per volume that a material can absorb before rupturing.  
It is also defined as the resistance to fracture of a material when stressed.

**11. Types of stresses.**  
Normal stresses (tensile & compressive), shear stresses

**12. Types of strains.**  
Longitudinal strain (tensile & compressive), shear strain, volumetric strain.

**13. What is volumetric strain?**  
Volumetric strain is change in volume upon original volume.

**14. What is poisson’s ratio?**  
It is the ratio of lateral (or transverse) strain to longitudinal strain.

**15. Define longitudinal strain and lateral (transverse) strain.**  
Longitudinal strain is change in length upon original length.  
Lateral strain is change in lateral dimensions (i.e. dimensions perpendicular to length) upon  
original lateral dimensions.

**16. Differentiate Shear Strain and Shear stress.**  
Stress is a measure of how much force is taken by an object of particular size. shear stress is therefore shear force divided by area under shear. Clearly, increasing the force and/or decreasing the size or cross sectional area will result in larger stresses.  
Shear strain is a measure of the deflection caused by a shear stress, and is related via the shear modulus (or modulus of rigidity) G, where G= shear stress/shear strain.

**17. What is factor of safety?**  
The ratio of the breaking stress of a structure to the estimated maximum stress.

**18. What is Ultimate strength?**  
Absolute maximum compressive, shear, or tensile stress a material can bear without failure  
is called ultimate strength.

**19. Define elastic constants E,K & G.**  
Young’s modulus of elasticity (E) is the ratio of normal stress to normal strain.  
Bulk modulus of elasticity (K) is the ratio of normal stress to volumetric strain.  
Shear modulus of elasticity or modulus of rigidity (C or G) is the ratio of shear stress to shear  
strain.

**20. What is Yield Strength?**  
The ability of a metal to tolerate gradual progressive force without permanent  
deformation. Yield strength is the stress at which a specified amount of permanent deformation  
of a material occurs.

**21. Define impact strength.**  
The ability of a material to withstand shock loading.

**22. What is beam?**  
A beam is a horizontal structural element in which longitudinal dimensions are very large  
in comparison of lateral dimensions and that is capable of withstanding load primarily by  
resisting bending.

**23. What is difference between force and load?**  
Force is a push or pull applied on a body to change its state.  
Load is the combined effect of external applied forces at any point.

**24. Types of Loads.**  
Point load, uniformly distributed load, uniformly varying load.

**25. What is torque?**  
Torque is the tendency of a force to cause or change rotational motion of a body. A force applied at a right angle to a lever multiplied by its distance from the lever’s fulcrum (the length of the lever arm) is its torque.

**26. What is Torsional force?**  
A force acting on a body that tends to twist the body.

**27. What is torsional rigidity?**  
The applied torque needed to produce a unit angle of twist in a circular elastic material; it is a measure of a body’s resistance to torsion.

**28. Types of beams.**  
Simply supported beam, over hanging beam, Cantilever beam, continuous beam, fixed  
beam.

**29. Define shear force and bending moment.**  
Shear force is the algebraic sum of all the vertical forces acting on either side of the section.  
Bending moment is the algebraic sum of all the moments of the forces acting on either side of the  
section.

**30. What is point of inflection?**  
The point on beam at which the moment is zero is called point of inflection or point of contra flexure.

**31. What are sagging and hogging moments?**  
If clockwise bending moments are taken as negative, then a negative bending moment within an element will cause “sagging”, and a positive moment will cause “hogging”. It is therefore clear that a point of zero bending moment within a beam is a point of contra flexure that is the point of transition from hogging to sagging or vice versa.

**32. When bending moment will be maximum?**  
Bending moment is maximum when shear force is zero.

**33. What is Moment of inertia?**  
Moment of inertia is second moment of area or second moment of mass.

**34. What is Polar moment of inertia?**  
The Polar Moment of Inertia is a geometric property of a cross section. Physically, it is a measure of how difficult it is to turn a cross-section about an axis perpendicular to it.

**35. Define slope and deflection.**  
The deflection at any point on the axis of the beam is the distance between its position before and after loading. Slope at any section in a deflected beam is defined as the angle in radians which the tangent at the section makes with the original position.

**36. Explain about Principal plane.**  
The planes on which shearing stresses are zero are called principal planes.

**37. Explain about Principal stresses.**  
The stresses normal to principal planes are known as principal stresses

**38. Units of force, deflection, stress, strain, E, K, G.**

* SI Unit of force is Newton,
* SI unit of deflection is meter,
* SI unit of stress,E,K&G is N/m2,
* Strain is unitless quantity.

**39. Purpose of UTM.**  
UTM is used to test the tensile stress and compressive strength of materials.

**40. What are lifting machines?**  
Lifting machines are devices which are used to lift heavy load by applying less effort.

**41. What is torsion equation?**  
T/J = τ/R = Gθ/L

**42. What is flexural rigidity?**  
The product EI is called flexural rigidity.

**43. Define Mechanical Advantage, velocity ratio & efficiency.**

1. M.A. is the ratio of load lifted to effort applied.
2. V.R. is the ratio of distance moved by effort to distance moved by load.
3. Efficiency is the ratio of mechanical advantage to velocity ratio.

**44. Define Section modulus.**  
The elastic section modulus is defined as S = I / y, where I is the second moment of area (or moment of inertia) and y is the distance from the neutral axis to any given fiber.

**45. What is a composite beam?**  
A structural member composed of two or more dissimilar materials joined together to act as a unit in which the resulting system is stronger than the sum of its parts.

1. Define Hooke’s Law.  
2. Define Strength of materials  
3. What is stress?  
4. What is strain?  
5. What is deformation?  
6. How is deformation calculated?  
7. Say something on Rigid Body.  
8. Say something on deformable solids.  
9. Differentiate simple and compound stress.  
10. What is stiffness?  
11. Types of stresses.  
12. Types of strains.  
13. What is volumetric strain?  
14. Differentiate Tensile Strain and Tensile stress.  
15. Differentiate Compressive Strain and Compressive stress.  
16. Differentiate Shear Strain and Shear stress.  
17. What is factor of safety?  
18. What is Ultimate strength?  
19. What is working stress?  
20. What is Yield Strength?  
21. Define Stiffness of a helical spring.  
22. Differentiate between closed and open coil helical spring.  
23. Principle of Superposition in bars of varying cross section.  
24. Types of Load.  
25. Explain torque.  
26. What is Torsional force?  
27. What is torsional rigidity?  
28. Define Centripetal force.  
29. Define Centrifugal force.  
30. Explain Radius of gyration.  
31. What is calibration?  
32. Tell About Moment of inertia.  
33. What is Inertia?  
34. Polar moment of inertia.  
35. Say something on Traction.  
36. Explain about Principal plane.  
37. Explain about Principal axis.  
38. Draw Shear force diagram for a cantilever beam with udl and point load.  
39. Draw Shear force diagram for a SSB with udl and point load  
40. What are SSB, Fixed Beams, Hinged Beams.  
41. Explain the equilibrium condition for a body.  
42. Differentiate between Bar and column  
43. Types of beams.  
44. What is Shear centre?  
45. Tell something on elastic constants.  
46. What is Poisson’s ratio?  
47. Differentiate Longitudinal and Lateral Strain.  
48. Relation between Bulk Modulus and Young’s modulus.  
49. Explain about modulus of rigidity.  
50. What is Strain energy?  
51. What is Resilience?  
52. Define proof of resilience.  
53. Define modulus of resilience.  
54. How is potential energy related to strain energy.  
55. Explain Castigliano’s Theorem.  
56. What is slenderness ratio?  
57. When do we call the failure to be fatigue?  
58. Explain sudden impact.  
59. Explain about buckling in a beam.  
60. Why is it necessary to check hardness?  
61. Enumerate the advantages of Rockwell Hardness test over Brinell hardness test.  
62. Differentiate between pneumatic and hydraulic pumps.  
63. Unit of force, deflection, stress, strain, E, K, G.  
64. Purpose of UTM.

65. Define a Hydraulic jack.  
66. What is torsional bending?  
67. What is axial load?  
68. Say something on ageing factor.  
69. Define Section modulus.  
70. What is a composite beam.