



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## CIVIL ENGINEERING

### DEFINITIONS AND TERMINOLOGY QUESTION BANK

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| <b>Course Name</b>    | : | <b>TRANSPORTATION ENGINEERING</b>  |
| <b>Course Code</b>    | : | <b>ACE013</b>  |
| <b>Program</b>        | : | <b>B.Tech</b>  |
| <b>Semester</b>       | : | <b>VI</b>  |
| <b>Branch</b>         | : | <b>Civil Engineering</b>   |
| <b>Section</b>        | : | <b>A&amp; B</b>  |
| <b>Course Faculty</b> | : | <b>Dr. Shruthi Kaviti, Associate Professor<br/>Mr. B Suresh, Assistant Professor</b> |

### COURSE OBJECTIVES(COs):

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| <b>The course should enable the students to:</b> |  |
| I  | Understand the importance of highway development of India and classification of roads and road patterns. |
| II   | Design various geometric elements like curves, gradients, super elevation etc.                           |
| III  | Capable of performing various traffic surveys.   |
| IV   | Analyze traffic signals intersections and road markings and their designs.                               |

### DEFINITIONS AND TERMINOLOGY QUESTION BANK

| S.No          | QUESTION                                       | ANSWER  | Blooms Level | CO   | CLO   | CLO Code  |
|---------------|--|---|--------------|------|-------|-----------|
| <b>UNIT-I</b> |  |   |              |      |       |           |
| 1.            | Define transportation engineering?             | Transportation engineering is the application of technology and scientific principles to the planning, functional design, operation and management of facilities for any mode of transport in order to provide the safe, efficient, comfortable, economical, and environmentally compatible movement of people and goods from one place to the other. | Understand   | CO 1 | CLO 1 | ACE013.01 |
| 2.            | Why is there a necessity for highway planning? | Planning is a prerequisite for any engineering activity or project; this is particularly true for the development of a highway network or system in a country. Particularly planning is of great importance where funds available are limited whereas the total requirement is much higher.   | Understand   | CO 1 | CLO 2 | ACE013.02 |

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| 3. | What are National Highways?                          | National Highways are the main highways running through the length and breadth of India, connecting major parts, foreign highways, capital of large states and large industrial and tourist centers including roads required for strategic movements for the defence of India.  | Understand | CO 1 | CLO 1 | ACE013.01 |
| 4. | What is the purpose of Indian Road Congress?         | It is the central semiofficial body formed to provide national forum for regular pooling of experience and ideas on matters related to construction and maintenance of highways. It is a active body controlling the specification, standardization and recommendations on materials, design of roads and bridges.              | Remember   | CO 1 | CLO 1 | ACE013.01 |
| 5. | Why is road development necessary?                   | Roads make a crucial contribution to economic development and growth and bring important social benefits. They are of vital importance in order to make a nation grow and develop. In addition, providing access to employment, social, health and education services makes a road network crucial in fighting against poverty. | Understand | CO 1 | CLO 1 | ACE013.01 |
| 6. | What is meant by location survey?                    | Major and minor control points are established on the ground and centre pegs are driven, checking the geometric design requirements. Centre line stacks are driven at suitable intervals, say 50m interval in plane and rolling terrains and 20m in hilly terrain.  | Understand | CO 1 | CLO 3 | ACE013.03 |
| 7. | Define map study?                                    | From the map alternative routes can be suggested in the office, if the topographic map of that area is available. Map study gives a rough guidance of the routes to be further surveyed in the field.   | Understand | CO 1 | CLO 3 | ACE013.03 |
| 8. | Why was Central Road Research Institute established? | It was established to carry out research and development projects. Design, construction and maintenance of roads and runways, traffic and transportation planning of mega and medium cities, management of roads in different terrains.   | Remember   | CO 1 | CLO 5 | ACE013.05 |
| 9. | What is a survey?                                    | A survey is defined as a research method used for collecting data from a pre-defined group of respondents to gain information and insights on various topics of interest. Surveys have a variety  | Understand | CO 1 | CLO 5 | ACE013.05 |

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|     |   | of purposes and can be carried out in many ways depending on the methodology chosen and the objectives to be achieved.   |            |      |       |           |
| 10. | What are the methods of preliminary survey?       | Conventional approach: Survey party carries out surveys using the required field equipment, taking measurement, collecting topographical and other data. Modern rapid approach: By Aerial survey taking the required aerial photographs for obtaining the necessary topographic and other maps including details of soil and geology.  | Understand | CO 1 | CLO 4 | ACE013.04 |
| 11. | Define highway alignment?                         | The position or lay out of centre line of the highway on the ground is called the alignment. It includes straight path, horizontal deviation and curves. The alignment is the route of the road, defined as a series of horizontal tangents and curves.  | Understand | CO 1 | CLO 4 | ACE013.04 |
| 12. | What are the disadvantages of improper alignment? | Improper alignment increases construction cost, maintenance cost, vehicle operation cost and accident cost. Once the road is aligned and constructed, it is not easy to change the alignment due to increase in cost of adjoining land and construction of costly structure.   | Remember   | CO 1 | CLO 2 | ACE013.02 |
| 13. | Define Reconnaissance Survey?                     | A survey party may inspect along the proposed alternative routes of the map in the field with very simple instrument like abney level, tangent clinometer, barometer etc. to collect additional details.   | Understand | CO 1 | CLO 1 | ACE013.01 |
| 14. | What are the requirements of highway alignment?   | Short- desirable to have a short alignment between two terminal stations.<br>Easy- easy to construct and maintain the road with minimum problem also easy for operation of vehicle.<br>Safe- safe enough for construction and maintenance from the view point of stability of natural hill slope, embankment and cut slope also safe for traffic operation.<br>Economical- total cost including initial cost, maintenance cost and vehicle operation cost should be minimum. | Understand | CO 1 | CLO 4 | ACE013.04 |

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| 15.            | What are the various factors controlling alignment? | Origin and destination survey should be carried out in the area and the desire lines be drawn showing the trend of traffic flow. New road to be aligned should keep in view the desired lines, traffic flow patterns and future trends.  | Understand | CO 1 | CLO 2 | ACE013.02 |
| <b>UNIT-II</b> |   |  |            |      |       |           |
| 1.             | Define geometric design?                            | Thegeometricdesign of a highway deals with the dimensions and layout of visible features of the highway such as alignment, sight distance and intersection.  | Understand | CO 2 | CLO 7 | ACE013.07 |
| 2.             | What are the causes of pavement unevenness?         | Pavement unevenness is caused by the usage of inferior pavement material, improper surface and subsurface drainage, improper construction machinery and poor maintenance.  | Understand | CO 2 | CLO 7 | ACE013.07 |
| 3.             | Define carriageway?                                 | Width of carriageway is determined on the basis of the width of the vehicle and the minimum side clearance for safety. As per IRC specification, the maximum width of vehicle is 2.44m,minimum clearance of 0.68 in case of single lane and 1.02m in case of double lane.                                | Understand | CO 2 | CLO 7 | ACE013.07 |
| 4.             | What is meant by shoulder?                          | It is provided along the road edge to serve as an emergency lane for vehicle. It acts as a service lane for vehicles that have broken down. The minimum shoulder width of 4.6 m so that a truck stationed at the side of the shoulder would have a clearance of 1.85m from the pavement edge.            | Remember   | CO 2 | CLO 6 | ACE013.06 |
| 5.             | What are building lines?                            | In order to reserve sufficient space for future development of roads, It is desirable to control the building activities on either side of the road boundary, beyond the land width acquired for the land.   | Understand | CO 2 | CLO 6 | ACE013.06 |
| 6.             | What is the function of a median?                   | The main function is to prevent head on collision between the vehicles moving in opposite direction. Channelize traffic into streams at intersection. Segregate slow traffic and to protect pedestrians.   | Understand | CO 2 | CLO 9 | ACE013.09 |
| 7.             | What is meant by right-of-way?                      | It is the total area of land acquired for the road along its alignment. It depends on the importance of the road and possible future development. It is desirable to acquire more width of land as the cost of adjoining land invariably increases very much, soon after the new highway is constructed. | Understand | CO 2 | CLO 7 | ACE013.07 |

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| 8.  | Why is camber provided?                  | It is the slope provided to the road surface in the transverse direction to drain off the rain water from the road surface. To prevent the entry of surface water into the subgrade soil through pavement.   | Remember   | CO 2 | CLO 7 | ACE013.07 |
| 9.  | Define guard rail?                       | It is provided at the edge of the shoulder when the road is constructed on a fill exceeds 3 m. It is also provided on horizontal curve so as to provide a better night visibility of the curves under the head light of the vehicle.   | Understand | CO 2 | CLO 7 | ACE013.07 |
| 10. | Where are lay bays provided?             | Lay bays are provided near the public conveniences with guide map to enable driver to stop clear off the carriageway. It has 3m width, 30m length with 15m end tapers on both sides.   | Understand | CO 2 | CLO 6 | ACE013.06 |
| 11. | Define sight distance?                   | Sight distance available from a point is the actual distance along the road surface, which a driver from a specified height above the carriageway has visibility of stationary or moving objects.  | Understand | CO 2 | CLO 6 | ACE013.06 |
| 12. | What is meant by super elevation?        | In order to counteract the effect of centrifugal force and to reduce the tendency of the vehicle to overturn or skid, the outer edge of the pavement is raised with respect to the inner edge, thus providing a transverse slope throughout the length of the horizontal curve, this transverse inclination to the pavement surface is known as Superelevation or cant or banking. | Remember   | CO 2 | CLO 9 | ACE013.09 |
| 13. | Define off-tracking?                     | An automobile has a rigid wheel base and only the front wheels can be turned, when this vehicle takes a turn to negotiate a horizontal curve, the rear wheel do not follow the same path as that of the front wheels. This phenomenon is called off tracking.  | Understand | CO 2 | CLO 7 | ACE013.07 |
| 14. | What is meant by psychological widening? | Extra width of the pavement is also provided for psychological reasons to provide for greater manoeuvrability of steering at high speed, to allow for the extra space for overhangs of vehicles and to provide greater clearance for crossing and overturning vehicles on curve.   | Understand | CO 2 | CLO 7 | ACE013.07 |
| 15. | What are horizontal transition curves?   | When a non-circular curve is introduced between a straight and a circular curve has a varying radius which decreases from infinity at the straight end (tangent point) to the desired radius of the circular curve at the other end (curve point) for the gradual introduction of  | Understand | CO 2 | CLO 7 | ACE013.07 |

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|                 |  | centrifugal force is known as transition curve.   |            |      |        |           |
| <b>UNIT-III</b> |  |   |            |      |        |           |
| 1.              | Define Traffic Engineering?  | It is the science of measuring traffic and travel, the study of the basic laws relating to traffic flow and generation and application of this knowledge to the professional practice of planning, designing and operating traffic systems to achieve safe and efficient movement of persons and goods.             | Understand | CO 3 | CLO 10 | ACE013.10 |
| 2.              | What are the various phases of traffic engineering?                | Engineering (constructive i.e. geometric design of road); Enforcement (traffic laws, regulation and control); Education (publicity and through school and television).  | Understand | CO 3 | CLO 11 | ACE013.11 |
| 3.              | Why are traffic studies carried out?                               | Traffic studies are carried out to analyze the traffic characteristics. These studies helps in deciding the geometric design features traffic control for save and efficient traffic movement.  | Understand | CO 3 | CLO 10 | ACE013.10 |
| 4.              | What is meant by traffic volume study?                             | It is the number of vehicles crossing a section of road per unit time at any selected period. It is used as a quantity measure of flow: the commonly units are vehicles/day or vehicles/hour.   | Remember   | CO 3 | CLO 14 | ACE013.14 |
| 5.              | What are the uses of traffic volume study?                         | It is used in the analysis of traffic patterns and trends. It is also useful in structural design of pavement, planning one-way streets and other regulatory measure.   | Understand | CO 3 | CLO 10 | ACE013.10 |
| 6.              | Define design hourly volume?                                       | Design hourly volume is found from the plot between hourly volume and the number of hours in a year that the traffic volume is exceeded. The 30th highest hourly volume is the hourly volume that will be exceeded only 29 times in a year and all other hourly volumes of the years will be less than this volume. | Understand | CO 3 | CLO 12 | ACE013.12 |
| 7.              | What are the uses of spot speed study?                             | To use in planning traffic control and in traffic regulation. To use in geometric design for redesigning the existing highway. To use in accident studies. To study the traffic capacity.   | Understand | CO 3 | CLO 11 | ACE013.11 |
| 8.              | What kind of information is obtained from speed and delay studies? | The speed and delay studies give the running speeds, overall speeds, fluctuations in speeds and the delay between two stations of a road. It gives  | Remember   | CO 3 | CLO 10 | ACE013.10 |

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|     |  | the information such as the amount, location, duration and cause of delay in the traffic stream.   |            |      |        |           |
| 9.  | How is spot speed data presented?                    | A graph is plotted with the average value of each speed group on X-axis and the cumulative percent of vehicles travelled at or below the different speeds on Y-axis. From the graph (i.e. Cumulative frequency distribution curve) followings can be obtained.   | Understand | CO 3 | CLO 11 | ACE013.11 |
| 10. | Describe floating car method?                        | In the floating car method a test vehicle is driven over a given course of travel at approximately the average speed of the stream, thus trying to float with the traffic stream. A number of test runs are made along the study stretch and a group of observers record the various details.              | Understand | CO 3 | CLO 10 | ACE013.10 |
| 11. | What are the uses of origin and destination studies? | Plan the road network and other facilities for vehicular traffic. Plan the schedule of different modes of transportation for the trip demand of commuters.   | Understand | CO 3 | CLO 14 | ACE013.14 |
| 12. | Define basic capacity?                               | It is the maximum no. of passenger car that can be pass a given point on a roadway during one hour under the most nearly ideal roadway and traffic conditions. It is otherwise known as theoretical capacity.  | Remember   | CO 3 | CLO 10 | ACE013.10 |
| 13. | What is meant by practical capacity?                 | It is the maximum no. of vehicle that can pass a given point on a roadway during one hour, without traffic density being so great as to cause unreasonable delay, hazard or restriction to the driver freedom to maneuver under the prevailing roadway and traffic conditions.                             | Understand | CO 3 | CLO 12 | ACE013.12 |
| 14. | What is meant by peak-hour factor?                   | It is basically represent the variation in traffic flow within an hour. Observations of traffic flow consistently indicate that the flow rates are found in the peak. A 15 minute period within an hour is not sustained throughout the entire period and that is why we need to use the peak-hour factor. | Understand | CO 3 | CLO 11 | ACE013.11 |
| 15. | Define passenger car unit?                           | The different vehicle classes have a wide range of static characteristics and dynamic characteristics; apart from these the driver behavior of the different vehicle classes is also found to vary considerable. Therefore it is a   | Understand | CO 3 | CLO 10 | ACE013.10 |

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|                |  | common practice to consider the passenger car as the standard vehicle unit to convert the other vehicle classes and this unit is called passenger car unit.  |            |      |        |           |
| <b>UNIT-IV</b> |  |  |            |      |        |           |
| 1.             | Define rotary intersection?                            | Rotary intersections or roundabouts are special form of at-grade intersections laid out for the movement of traffic in one direction around a central traffic island. Essentially all the major conflicts at an intersection namely the collision between through and right-turn movements are converted into milder conflicts namely merging and diverging. The vehicles entering the rotary are gently forced to move in a clockwise direction in orderly fashion. | Understand | CO 4 | CLO 16 | ACE013.16 |
| 2.             | What are the advantages of rotary design?              | Rotaries are self-governing and do not need practically any control by police or traffic signals. They are ideally suited for moderate traffic, especially with irregular geometry, or intersections with more than three or four approaches.  | Understand | CO 4 | CLO 16 | ACE013.16 |
| 3.             | What are the guidelines for the selection of rotaries? | Rotaries are suitable when the traffic entering from all the four approaches are relatively equal. A total volume of about 3000 vehicles per hour can be considered as the upper limiting case and a volume of 500 vehicles per hour is the lower limit. A rotary is very beneficial when the proportion of the right-turn traffic is very high; typically if it is more than 30 percent.  | Understand | CO 4 | CLO 19 | ACE013.19 |
| 4.             | Define design speed for a rotary?                      | All the vehicles are required to reduce their speed at a rotary. Therefore, the design speed of a rotary will be much lower than the roads leading to it. Although it is possible to design roundabout without much speed reduction, the geometry may lead to very large size incurring huge cost of construction. The normal practice is to keep the design speed as 30 and 40 kmph for urban and rural areas respectively.   | Remember   | CO 4 | CLO 19 | ACE013.19 |



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| 5. | What are the traffic operations in a rotary?  | <p>Diverging: It is a traffic operation when the vehicles moving in one direction is separated into different streams according to their destinations.</p> <p>Merging: Merging is the opposite of diverging. Merging is referred to as the process of joining the traffic coming from different approaches and going to a common destination into a single stream.</p> <p>Weaving: Weaving is the combined movement of both merging and diverging movements in the same direction.</p>         | Understand | CO 4 | CLO 16 | ACE013.16 |
| 6. | What are the factors impacting island radius? | The radius of the central island is governed by the design speed, and the radius of the entry curve. The radius of the central island, in practice, is given a slightly higher radius so that the movement of the traffic already in the rotary will have priority. The radius of the central island which is about 1.3 times that of the entry curve is adequate for all practical purposes.  | Understand | CO 4 | CLO 16 | ACE013.16 |
| 7. | Define width of a rotary?                     | The entry width and exit width of the rotary is governed by the traffic entering and leaving the intersection and the width of the approaching road. The width of the carriageway at entry and exit will be lower than the width of the carriageway at the approaches to enable reduction of speed. IRC suggests that a two lane road of 7 m width should be kept as 7 m for urban roads and 6.5 m for rural roads.  | Understand | CO 4 | CLO 19 | ACE013.19 |
| 8. | What should be the entry and exit radius?     | <p>The entry to the rotary is not straight, but a small curvature is introduced. This will force the driver to reduce the speed. The entry radius of about 20 and 25 meters is ideal for an urban and rural design respectively.</p> <p>The exit radius should be higher than the entry radius and the radius of the rotary island so that the vehicles will discharge from the rotary at a higher rate. A general practice is to keep the exit radius as 1.5 to 2 times the entry radius.</p> | Remember   | CO 4 | CLO 16 | ACE013.16 |

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| 9.  | What is meant by capacity of a rotary?          | The capacity of rotary is determined by the capacity of each weaving section. Weaving length determines how smoothly the traffic can merge and diverge. It is decided based on many factors such as weaving width, proportion of weaving traffic to the non-weaving traffic etc.   | Understand | CO 4 | CLO 16 | ACE013.16 |
| 10. | Define channelization?                          | Channelization is included at intersections to reduce excessive pavement areas, to regulate traffic, and to indicate proper intersection use. Channelization can consist of pavement markings and/or raised islands. When raised islands are used to channelize traffic, islands less than 150-square feet should be paved.  | Understand | CO 4 | CLO 16 | ACE013.16 |
| 11. | What are the objectives of intersection design? | The main objective of intersection design is to reduce the severity of potential conflicts between passenger cars, buses, trucks, bicycles and pedestrians. In addition, the intersection design should facilitate the convenience, ease and comfort of people traveling through the intersection.   | Understand | CO 4 | CLO 19 | ACE013.19 |
| 12. | What are turn lanes?                            | Turn lanes allow vehicles to cross oncoming traffic (i.e., a left turn in right-side driving countries, or a right turn in left-side driving countries), or to exit a road without crossing traffic (i.e., a right turn in right-side driving countries, or a left turn in left-side driving countries). Absence of a turn lane does not normally indicate a prohibition of turns in that direction. Instead, traffic control signs are used to prohibit specific turns. | Remember   | CO 4 | CLO 19 | ACE013.19 |
| 13. | What is a traffic island?                       | Traffic Island can be a physical structure or a painted object found on roads and roadside. The primary purpose of a traffic island is better & orderly flow of traffic. These are also referred to as channelizers. These may be raised structures made up of concrete or a physical structure in form of boards, barricades, traffic cones etc.  | Understand | CO 4 | CLO 16 | ACE013.16 |

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| 14. | Define grade separation?                                  | It is a bridge that eliminates crossing conflicts at intersections by vertical separation of roadways in space. Grade separated intersections are otherwise known as Interchanges. Grade separated intersections cause less hazard and delay than grade intersections. Route transfer at grade separations is accommodated by interchange facilities consisting of ramps. Interchange ramps are classified as Direct, Semi-Direct and Indirect. Interchanges are described by the patterns of the various turning roadways or ramps. | Understand | CO 4 | CLO 16 | ACE013.16 |
| 15. | What are the objectives of grade separated intersections? | The ultimate objective of grade separated intersections is to eliminate all grade crossing conflicts and to accommodate other intersecting maneuvers by merging, diverging and weaving at low relative speed. The relative speed of the conflicting vehicle streams is an important factor affecting the significance of a conflict.   | Understand | CO 4 | CLO 16 | ACE013.16 |

### UNIT-V

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| 1. | Define highway pavement?                        | A highway pavement is a structure consisting of superimposed layers of processed materials above the natural soil sub-grade, whose primary function is to distribute the applied vehicle loads to the sub-grade.  | Understand | CO 5 | CLO 21 | ACE013.21 |
| 2. | What are the requirements of an ideal pavement? | The pavement structure should be able to provide a surface of acceptable riding quality, adequate skid resistance, favorable light reflecting characteristics, and low noise pollution. The ultimate aim is to ensure that the transmitted stresses due to wheel load are sufficiently reduced, so that they will not exceed bearing capacity of the sub-grade. | Understand | CO 5 | CLO 22 | ACE013.22 |
| 3. | Define flexible pavement?                       | Flexible pavements will transmit wheel load stresses to the lower layers by grain-to-grain transfer through the points of contact in the granular structure. The wheel load acting on the pavement will be distributed to a wider area, and the stress decreases with the depth.  | Understand | CO 5 | CLO 23 | ACE013.23 |

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| 4. | What are the types of flexible pavements?          | Conventional flexible pavements are layered systems with high quality expensive materials are placed in the top where stresses are high, and low quality cheap materials are placed in lower layers.<br>Full depth asphalt pavements are constructed by placing bituminous layers directly on the soil sub-grade. This is more suitable when there is high traffic and local materials are not available.              | Remember   | CO 5 | CLO 21 | ACE013.21 |
| 5. | Mention various layers of flexible pavements?      | Typical layers of a conventional flexible pavement includes seal coat, surface course, tack coat, binder course, prime coat, base course, sub-base course, compacted sub-grade, and natural sub-grade.   | Understand | CO 5 | CLO 22 | ACE013.22 |
| 6. | What are the major failures of flexible pavement?  | The major flexible pavement failures are cracking, rutting, and thermal cracking. The fatigue cracking of flexible pavement is due to horizontal tensile failures are fatigue strain at the bottom of the asphaltic concrete. The failure criterion relates allowable number of load repetitions to tensile strain and this relation can be determined in the laboratory fatigue test on asphaltic concrete specimens. | Understand | CO 5 | CLO 23 | ACE013.23 |
| 7. | What are the advantages of flexible pavements?     | Flexible pavements have sufficient flexural strength to transmit the wheel load stresses to a wider area below. Compared to flexible pavement, rigid pavements are placed either directly on the prepared sub-grade or on a single layer of granular or stabilized material.   | Understand | CO 5 | CLO 23 | ACE013.23 |
| 8. | Mention types of rigid pavements?                  | Rigid pavements can be classified into four types: Jointed plain concrete pavement (JPCP), Jointed reinforced concrete pavement (JRCP), Continuous reinforced concrete pavement (CRCP), and Pre-stressed concrete pavement (PCP).  | Understand | CO 5 | CLO 21 | ACE013.21 |
| 9. | What are the failure criteria for rigid pavements? | Traditionally fatigue cracking has been considered as the major or only criterion for rigid pavement design. The allowable number of load repetitions to cause fatigue cracking depends on the stress ratio between flexural tensile stress and concrete modulus of rupture. Of late, pumping is identified as an important failure criterion.   | Understand | CO 5 | CLO 22 | ACE013.22 |

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| 10. | What is highway drainage?                                     | Highway drainage includes collecting, transporting, and disposing of surface/subsurface water originating on or near the highway right of way or flowing in streams crossing bordering that right of way.  | Understand | CO 5 | CLO 21 | ACE013.21 |
| 11. | Explain penetration test?                                     | It measures the hardness or softness of bitumen by measuring the depth in tenths of a millimeter to which a standard loaded needle will penetrate vertically in 5 seconds. BIS had standardized the equipment and test procedure. The penetrometer consists of a needle assembly with a total weight of 100g and a device for releasing and locking in any position. | Understand | CO 5 | CLO 22 | ACE013.22 |
| 12. | Define highway maintenance?                                   | Preserving and keeping each type of roadway, roadside, structures as nearly as possible in its original condition as constructed or as subsequently improved and the operation of highway facilities and services to provide satisfactory and safe transportation, is called maintenance of Highways.  | Understand | CO 5 | CLO 23 | ACE013.23 |
| 13. | How is periodic maintenance done?                             | Thus for economy, they need maintenance before further deterioration. Under this category of maintenance generally following works are carried out.<br>Up keep of carriage way.<br>Maintenance of side drains as clearing of silt and maintain proper slope.<br>Maintain of shoulders and sub grade.   | Understand | CO 5 | CLO 23 | ACE013.23 |
| 14. | What are the problems caused by poor maintenance of drainage? | Problems caused by poor maintenance of highway drainage include rutting, cracking, potholes, erosion, washouts, heaving, flooding, and premature failure of roadway.   | Understand | CO 5 | CLO 23 | ACE013.23 |
| 15. | What are the advantages of the rigid pavements?               | Rigid lasts much longer i.e 30+ years compared to 5-10 years of flexible pavements. In the long run it is about half the cost to install and maintain. But the initial costs are somewhat high. Rigid pavement has the ability to bridge small imperfections in the subgrade.  | Understand | CO 5 | CLO 22 | ACE013.22 |

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