Question Paper Code | **12976**

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024
Fourth Semester
Civil Engineering
20CEPC404 - HIGHWAY ENGINEERING
Regulations - 2020

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)
Answer ALL Questions

	Marks	K-Level	CO

1. What is the primary purpose of highway planning? — 1, K1, CO1
   (a) To reduce traffic congestion (b) To increase land value
   (c) To improve aesthetic value   (d) To enhance environmental impact
2. The process of determining the best route for a highway is known as: — 1, K2, CO1
   (a) Geotechnical investigation (b) Highway alignment
   (c) Land acquisition   (d) Traffic forecasting
3. Which of the following is NOT a classification of highways in India? — 1, K1, CO1
    (a) National Highways (b) State Highways (c) Urban Highways (d) Rural Highways
4. Which of the following is an essential element of a road's cross section? — 1, K1, CO2
   (a) Pavement structure (b) Right-of-way (c) Drainage system (d) All of the above
5. What is the purpose of super elevation in road design? — 1, K2, CO2
   (a) To reduce construction costs
   (b) To facilitate drainage
   (c) To counteract the lateral acceleration of vehicles on curves
   (d) To increase road width
6. A horizontal curve in road design is characterized by: — 1, K2, CO2
   (a) A straight path with no change in direction
   (b) A gradual transition from one direction to another
   (c) A sharp turn
   (d) A constant speed requirement
7. What is the primary purpose of a transition curve in road design? — 1, K1, CO3
   (a) To reduce construction costs
   (b) To allow vehicles to smoothly change direction
   (c) To increase road width
   (d) To provide pedestrian pathways
8. When widening a curve, the main objective is to: — 1, K2, CO3
   (a) Decrease the radius of the curve   (b) Improve the alignment of the road
   (c) Increase the super elevation   (d) Enhance vehicle stability and comfort
9. Stopping sight distance is defined as: — 1, K1, CO3
   (a) The distance a vehicle travels while the driver reacts to a hazard
   (b) The distance needed to bring a vehicle to a complete stop
   (c) The distance from the driver's eye to the road surface
   (d) The distance a vehicle can travel at maximum speed
10. What is the primary purpose of pavement design? — 1, K1, CO4
    (a) To enhance aesthetic appeal
    (b) To provide a smooth surface for vehicles
    (c) To support traffic loads while ensuring durability
    (d) To reduce construction costs
11. What type of joint is commonly used in rigid pavements to control cracking? — 1, K1, CO4
    (a) Expansion joint (b) Construction joint (c) Contraction joint (d) Control joint

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   ***12976***

12. In flexible pavements, the surface course is primarily responsible for: *1*   *K2*   *CO4*
    (a) Distributing loads to the sub grade   (b) Providing a smooth and skid-resistant surface
    (c) Enhancing drainage   (d) Supporting underlying layers
13. Which of the following is a commonly used material for flexible pavements?   *1*   *K1*   *CO5*
    (a) Concrete   (b) Asphalt   (c) Brick   (d) Stone
14. What property of asphalt is primarily responsible for its durability in pavements?   *1*   *K1*   *CO5*
    (a) Density   (b) Viscosity   (c) Elasticity   (d) Thermal conductivity
15. In highway drainage systems, the primary function of drainage pipes is to: *1*   *K2*   *CO5*
    (a) Improve aesthetics   (b) Control surface water
    (c) Increase load-bearing capacity   (d) Support landscaping
16. For hilly roads, what is a critical consideration in design?   *1*   *K1*   *CO5*
    (a) Maximum speed limits   (b) Environmental impact
    (c) Stability of slopes and erosion control   (d) Proximity to urban areas
17. Public-Private Sector Participation (PPP) in highway projects is beneficial because: *1*   *K1*   *CO6*
    (a) It reduces public accountability
    (b) It encourages private investment and innovation
    (c) It eliminates the need for public funding
    (d) It focuses solely on profit generation
18. What is a common method for selecting a contractor during the bidding process?   *1*   *K1*   *CO6*
    (a) Lottery system   (b) Lowest bid evaluation
    (c) Random selection   (d) Direct appointment by government officials
19. In highway finance, what is a "toll road"?   *1*   *K1*   *CO6*
    (a) A road financed entirely by public funds
    (b) A road that requires users to pay a fee for usage
    (c) A road maintained by private volunteers
    (d) A road that is free to all users
20. Which of the following is NOT typically a source of funding for highway projects?   *1*   *K2*   *CO6*
    (a) Federal and state grants   (b) Local taxes
    (c) Private donations   (d) Personal loans from banks

PART - B (10 × 2 = 20 Marks)
Answer ALL Questions

21. What are the contributions made by Jayakar committee for the road development in India?   *2*   *K1*   *CO1*
22. Classify the different urban roads.   *2*   *K2*   *CO1*
23. What are the different Sight Distances?   *2*   *K1*   *CO2*
24. Draw a typical Transition curve and show all its zones.   *2*   *K2*   *CO2*
25. Define gradient.   *2*   *K1*   *CO3*
26. Compare summit and valley curves.   *2*   *K2*   *CO3*
27. Compare between flexible and rigid pavements.   *2*   *K2*   *CO4*
28. What is meant by ESWL?   *2*   *K1*   *CO4*
29. Define flakiness index.   *2*   *K1*   *CO5*
30. Define highway finance.   *2*   *K1*   *CO6*

PART - C (6 × 10 = 60 Marks)
Answer ALL Questions

31. a) Explain detail about the engineering surveys conducted for highway alignment.   *10*   *K2*   *CO1*

OR

    b) Write some brief notes on: *10*   *K2*   *CO1*
       1. Central Road Fund
       2. Indian Roads Congress
       3. National Highway Authority of India.

32.	a)	The speed of overtaking and overtaken vehicles is 80 and 50 kmph respectively. On a two way traffic road, the acceleration of overtaking vehicle is 0.99 m/sec2	10	K3	CO2

32. a) The speed of overtaking and overtaken vehicles is 80 and 50 kmph respectively. On a two way traffic road, the acceleration of overtaking vehicle is 0.99 m/sec2 — *10 K3 CO2*
      (i) Calculate safe OSD
      (ii) Mention the minimum length of overtaking zone
Draw the sketch of overtaking zone with all details.

<div align="center">OR</div>

b) The radius of the horizontal curve is 120 m, The design speed is 60 kmph and the design coefficient of lateral friction is 0.15. — *10 K3 CO2*
(i) Calculate the super elevation required
(ii) Calculate the Coefficient of friction if no super elevation is provided.

33. a) A valley curve is formed due to two gradients +2.5% and –1.75%. If the design speed of this highway is 80 kmph, determine the stopping sight distance and design the valley curve to fulfill both comfort and head light sight distance conditions. — *10 K2 CO3*

<div align="center">OR</div>

b) Develop on the steps involved in the design of hill roads. — *10 K2 CO3*

34. a) Construct in detail about the IRC method of flexible pavement design. Discuss the limitation of this method. — *10 K3 CO4*

<div align="center">OR</div>

b) Calculate the stress at the interior, edge and corner regions of the CC pavement using Westergaard's stress equation where wheel load P=6100kg, Pavement thickness h=18cm, Modulus of subgrade reaction k=6kg/cm^2 , Radius of contact area a=15 cm^2. — *10 K3 CO4*

35. a) Briefly explain the ductility test and softening point test. — *10 K2 CO5*

<div align="center">OR</div>

b) Outline how the Benkelman Beam is used to design the thickness of the overlay. — *10 K2 CO5*

36. a) Explain the various methods of economic analysis in highway projects. — *10 K2 CO6*

<div align="center">OR</div>

b) Calculate the benefit cost ratio and feasibility of a project for widening a stretch of single lane road of length 60km to two lanes with earthen shoulders at a total cost of Rs.120 lakhs per km and the rate of interest is 10% per year . the annual cost of maintenance of the existing single lane road is Rs.20,000 per km and that of the improved two lane is Rs. 70,000 per km. the average vehicle operation cost on the existing road is Rs.5 per vehicle-km and that on the widened road is estimated to be Rs.4 per vehicle-km. if the traffic is 6000 motor vehicles per day, determine whether the investment on the improvement of the road is economically viable , during the 10 years period. — *10 K2 CO6*