EASWARI ENGINEERING COLLEGE (Autonomous)

Department of Civil Engineering

CE 8604 HIGHWAY ENGINEERING

Question Bank

UNIT – I: HIGHWAY PLANNING AND ALIGNMENT

PART -A (2 Marks)

1. What is meant by "TRANSPORTATION".

2. List twenty-year road development plans.

3. What is "Jayakar committee"?

4. Mention any four Recommendation of Jayakar committees.

5. What are the functions of CRRI?

6. What are the objectives of Highway Research Board? **(AUC Apr/May 2012)**

7. State the classification of roads according to Nagpur road plan **(AUC Apr/May 2012)**

8. Write any four recommendations of third 20 year plan.

9. Write short notes on Second twenty year road plan (1961-81).

10. What are the modified classifications of Road system by Third RDP (1981 - 2001)?

11. What are classified roads in Nagpur plan?

12. How are urban roads classified? **(AUC Nov/Dec 2010)**

13. What is the role of MORTH? **(AUC Nov/Dec 2011)**

14. What are BOT projects? **(AUC Nov/Dec 2011)**

15. What is CRF?

16. Define NHAI.

17. What are the objectives of IRC?

18. Write Short notes on Highway Research Board?

19. What are the important modifications made in macadam's method of construction? **(AUC Apr/May 2011)**

20. Tabulate any two points of difference in the construction methods of Telford and Macadam.

21. What are the objectives of the engineering surveys?

22. List the stages of development of roads in India.

23. State the various engineering surveys to determine the highway alignment.

24. Write any two On-going highway projects in Tamilnadu and in India

25. What is road ecology?

PART –B (16 Marks)

1. Write notes on the following :   **(AUC Nov/Dec 2010)**
       a. Indian Road Congress
       b. Highway Research Board
       c. National Highway Authority of India
       d. Nagpur road plan

2. (i) Describe the requirements of ideal highway alignment   **(AUC Nov/Dec 2011)**
  (ii) Explain the different components of the national highway development programme.
(NHDP)

                                                        (AUC Nov/Dec 2011)

3. (i) Explain the activities of national highway authority of India.   **(AUC Apr/May 2011)**
  (ii) Explain the procedure for carrying out road alignment using remote sensing & GIS
technique.

4. (i) Discuss how modern methods such as GIS & GPS may be used for the recognized survey
for highway alignment.

  (ii) Explain the historical development of road construction in India.

5. Explain in detail about second twenty year road plan   **(AUC Apr/May 2012)**

6. Write brief notes on   **(AUC Apr/May 2012)**
       a. Central road fund (CRF)
       b. Indian Road Congress (IRC)
       c. Central road research institute (CRRI)
       d. National Highway Authority of India (NHAI)

7. (i) Describe the development of roads in India during British period.
  (ii)How reconnaissance survey may be carried out?

8. Explain how the master plan is prepared and the road development programme is phased.
Explain various steps involved in a new highway project.

UNIT – II: GEOMETRIC DESIGN OF HIGHWAYS

PART -A (2 Marks)

1. what is geometric design of highways, list the various cross sectional elements in a highway

2. Define : Camber

3. State the purpose served by camber. **(AUC Nov/Dec 2010)**

4. Mention the functions of medians in urban roads. **(AUC Apr/May 2011)**

5. What is Highway Alignment

6. List four factors controlling highway alignment.

7. What are special considerations for hill road alignment?

8. What are the functions which control the selection of alignment?

9. What are the fundamental principles of alignment?

10. Define obligatory point?

11. What is meant by off tracking? **(AUC Nov/Dec 2010)**

12. State the objectives of providing transition? **(AUC Nov/Dec 2010)**

13. Define limiting gradient? **(AUC Nov/Dec 2011)**

14. What is extra widening? **(AUC Nov/Dec 2011)**

15. What is meant by minimum gradient in highway? Why it is provided? **(AUC Apr/May 2011)**

16. What are the factors governing the super elevation of a road surface? **(AUC Apr/May 2011)**

17. What is meant by super elevation? **(AUC Apr/May 2012)**

18. Define 'stopping site distance' ? **(AUC Apr/May 2012)**

19. What is PIEV theory?

20. Define 'overtaking site distance' ?

21. Write a short note on overtaking zones.

22. What is headlight sight distance?

23. Define ruling gradient?

24. What is the absolute minimum radius for a NH passing through a rolling terrain?

25. What is the mechanical widening required on a two lane road with a curve of 150m radius?

PART –B (16 Marks)

(AUC Nov/Dec 2010)

1. (i) Why is super elevation provided for pavement in curves? Explain the factors influencing it?
   (ii) Why are extra widening of pavements required in curve?

(AUC Nov/Dec 2010)

2. (i) Calculate the stopping sight distance for the design speed of 60 Kmph for a two way traffic road & an one way traffic road, take the reaction time of driver as 2.5 Seconds & coefficient of friction as 0.36.
   (ii) Under what circumstance summit curves are provided?

(AUC Nov/Dec 2011)

3. (i) Compute the stopping sight distance on a highway with a design speed of 80 Kph, if the highway is on an upgrade of 2%.

   (ii) Outline the design elements of hill roads

(AUC Nov/Dec 2011)

4. (i) Distinguish between overtaking sight distance & intermediate sight distance. How will you calculate these?

(ii) What is the super elevation to be provided on a horizontal curve on a national highway in plain terrain (HINT : Design speed = 100 kph), If the curve has a radius of 310 Metre?

5. (i) What is the need for transition curve? How its length determined?   **(AUC Apr/May 2011)**
(ii) Explain the procedure for calculating the length of valley curve?

6. (i) Explain the factors influencing the geometric design hill roads ?   **(AUC Apr/May 2011)**
   (ii) Calculate the SSD for design speed of 70 Kmph for two way traffic & one way traffic road. Take reaction time = 2.5 Seconds & co-efficient of friction = 0.35?

(AUC Apr/May 2012)

7. (i) Derive the formula for calculating super elevation on horizontal curve.**(AUC Apr/May 2012)**
   (ii) Explain the factors influencing overtaking sight distance?
   (iii)Calculate the stopping sight distance required to avoid head on collision of two cars approaching from opposite directions at a speed of 75 kmph and 85 kmph. Assume that the reaction time of divers be 2.5 Seconds & coefficient between road surface & tyres be 0.4.

8. A national highway passing through a flat terrain has a horizontal curve of radius equal to the ruling minimum radius. If the design speed is 100kmph, calculate absolute minimum sight distance, superelevation, extra widening and length of transition curve. Assume necessary data suitably.

9. An ascending gradient of 1 in 50 meets a descending gradient of 1 in 80. Determine the length of summit curve to provide (a) SSD (b) OSD, for design speed of 80kmph. Assume all other data.

10. Calculate the stopping sight distance required to avoid head on collision of two cars approaching from opposite directions at a speed of 75 kmph and 85 kmph. Assume that the reaction time of drivers is 2.5 sec and the co-efficient of friction between road surface and tyres are 0.4.

11. (i) State and explain the various types of kerbs.   **(AUC Nov/Dec 2010)**
   (ii) How rural roads are classified? Explain

10. (i)Draw a neat sketch & explain the cross section of an urban arterial.
   (ii)Briefly explain the IRC guidelines for the provision of different types of "kerbs" in urban roads, with a diagram.

12. Draw a neat labeled sketch of lane NH road with a central median and indicate all the cross
and co   ntrols.

UNIT – III: FLEXIBLE AND RIGID PAVEMENTS
PART -A (2 Marks)

1. What are the two types of stresses produced by temperature in a concrete pavement? **(AUC Nov/Dec 2010)**

2. State the function of wearing course? **(AUC Nov/Dec 2010)**

3. Define optimum moisture content? **(AUC Nov/Dec 2011)**

4. What are dowel bars? **(AUC Nov/Dec 2011)**

5. State the components of flexible pavements? **(AUC Apr/May 2011)**

6. How change in temperature produce frictional stresses in rigid pavements? **(AUC Apr/May 2011)**

7. What if rigidity factor in the design of highway pavements? **(AUC Apr/May 2012)**

8. Define 'ESWL' ? **(AUC Apr/May 2012)**

9. Write an expression for the radius of relative stiffness?

10. Write the assumption made by the Westergaurd in his analysis of rigid pavement.

11. Define pavement. What are the two types of pavements.

12. List out various types of joints in rigid pavements.

13. What are warping stresses?

14. Draw the cross section of rigid pavement.

15. Distinguish between "Tack coat and Prime Coat" in bituminous construction.

16. Draw the cross section of flexible pavement.

17. What are the Requirements of an ideal pavement?

18. What are the factors considered in a pavement design?

19. What is a flexible pavement? What is rigid pavement?

20. What are the Desirable properties of bituminous mix?

21. What are the critical load positions?

22. What is Modulus of sub-grade reaction?

23. Define Relative stiffness of slab to sub-grade.

24. What are the Failure criteria of rigid pavements?

25. What is a Bradbury's constant?

PART –B (16 Marks)

1. (i) Explain the factors to be considered in the design of pavements?   **(AUC Nov/Dec 2010)**
   (ii) State how variations in climatic conditions affect the design of pavements?

2. (i) Compare flexible and Rigid pavements.   **(AUC Nov/Dec 2010)**
   (ii) What is equivalent single wheel load? Explain briefly.

(AUC Nov/Dec 2011)

3. (i) List the different stresses induced in cement concrete pavements. Discuss the critical combination of these stresses.
   (ii) Explain the CBR method of design of flexible pavements.

(AUC Apr/May 2011) (AUC Nov/Dec 2011)

4. (i) How will you calculate the Equivalent single wheel load for a given combination of wheel loads?
   (ii) Explain the IRC method of design of rigid pavements ?

(AUC Apr/May 2011)

5. (i) Define ESWL and lane distribution factor and explain their significance?
   (ii) Describe the factors influencing the design of pavements?

6. (i) Differentiate between flexible and rigid pavements.   **(AUC Apr/May 2012)**
   (ii) Explain the design consideration for spacing of expansion and contraction joints? 8. Explain in detail about the IRC method of flexible pavement design . Discuss the limitation of this method.

7. (i)Define "ESWL" and "EWLF" and explain their significance.
   (ii) Explain temperature stresses that are developed in cement concrete pavement.
   (iii) State the drawbacks of CBR method.

8. With a neat sketch show various layers of flexible pavements? Explain the functions of each of them. Also discuss on the various materials used in each layer.

9. Explain briefly:
(i) Radius of relative stiffness

(ii) Interior loading

(iii) Edge loading

(iv) Equivalent radius of resisting stiffness.

10. Explain the concepts of ESWL based on stress and deflection. The loaded weight on the rear dual wheels truck is 5500 kg. The centre to centre spacing and clear space in the dual wheels are 30cm and 10cm respectively. Calculate the ESWL for the pavement thickness 20cm, 40cm, 70cm and 80cm.

UNIT – IV: HIGHWAY MATERIAL AND CONSTRUCTION PRACTISE

PART -A (2 Marks)

1. Define Elongation Index **(AUC Nov/Dec 2010)**

2. Define ' Softening point of bitumen'? **(AUC Apr/May 2012&Nov/Dec2010)**

3. Differentiate between Tar & Bitumen? **(AUC Nov/Dec 2011)**

4. Define 'Flakiness Index'? **(AUC Nov/Dec 2011)**

5. State any two techniques for protecting the sub-grade from moisture due to capillary rise ? **(AUC Apr/May 2011)**

6. Define ' Softening point of bitumen'? **(AUC Apr/May 2011)**

7. State the describe properties of road aggregate? **(AUC Apr/May 2012)**

8. Define Sub grade soil. What are the Desirable properties of Soil?

9. Write down the formula for CBR strength of soil.

10. What are Aggregates? Write down the properties of aggregates

11. Mention the name of the tests used to determine the properties of aggregate.

12. Write the expression for Group Index.

13. What do you meant by impact and abrasion?

14. What are bituminous materials?

15. What are the Desirable properties of bitumen?

16. What are the Different forms of bitumen?

17. What are the Requirements of Bitumen?

18. What do you mean ductility and viscosity of bitumen?

19. Mention the uses of polymer modified bitumen.

20. What is recycling of pavement?

21. Differentiate between cut-back bitumen and bitumen emulsions.

22. What is the purpose of applying tack coat in bituminous road construction?

23. Why penetration test carried out on bitumen?

24. What is the concept of WBM construction?

25. What is tack coat? What is prime coat? What is seal coat?

PART –B (16 Marks)

1.(i) What are the describe properties of road aggregates? Explain briefly. **(AUC Nov/Dec 2010)**
   (ii) Write a note on aggregate impact test ?

2. Write short notes on the followings: **(AUC Nov/Dec 2010)**
          i. Crushing test
          ii. Water absorption test
          iii. Ductility test
          iv. Viscosity test

                                            (AUC Nov/Dec 2011)
3. (i) Distinguish between impact and absorption values of aggregate. How are these values measured?
   (ii) What is WBM? Describe the construction procedure of a WBM road?
                                            (AUC Nov/Dec 2011)
4. (i) Distinguish between viscosity and softening point if road bitumen. Describe their test procedures ?
   (ii) Discuss the importance of surface and sub- surface drainage in highways ?

5. (i) Describe how impact value of aggregate is found in laboratory ?   **(AUC Apr/May 2011)**
   (ii) Explain the test procedure for assessing polishing value of aggregate.?

6. Briefly explain the penetration test and softening point test on Bitumen? **(AUC Apr/May 2011)**
                                            (AUC Apr/May 2012)
7. (i) Explain the construction procedure of dense Bituminous macadam road
(ii) Describe the procedure recommended by Bureau of Indian standards for carrying out the following tests..
i. Abrasion test.
ii. Flash and fire point test

                                            (AUC Apr/May 2012)
8. (i) Specify the design approach for the surface drainage system of highways.
   (ii) Explain the construction procedure for Bituminous concrete.

9. List few modern materials used in pavement construction with its impact on pavements.

10. What are quality control measures in pavement construction?

11. What is necessity of highway drainage for pavement construction?

12. What are the machineries used for the pavement construction?

UNIT – V: HIGHWAY MAINTENANCE
PART -A (2 Marks)

1. What is spalling of joint? **(AUC Nov/Dec 2010& Apr/May2012)**

2. What are the causes of Pot holes? **(AUC Nov/Dec 2010)**

3. Define pavement roughness index? **(AUC Nov/Dec 2011)**

4. What is serviceability of pavements? **(AUC Nov/Dec 2011)**

5. What is meant by mud pumping? **(AUC Apr/May 2011)**

6. Draw the figure for failure in sub-grade of flexible pavement? **(AUC Apr/May 2011)**

7. What are causes of scaling? **(AUC Apr/May 2012)**

8. What is mean by rutting?

9. What are called pot holes? How they are formed?

10. List the types of cracks formed in the cement concrete roads.

11. List any four types of flexible pavement failures.

12. What are the reasons for the development of edge cracks in flexible pavements?

13. What are Cracks? Mention its causes.

14. Define bituminous overlay.

15. What is construction joint?

16. Differentiate Crescent shaped, Shear crack and crocodile crack.

17. What is meant by streaking?

18. What is Polishing?

19. Define pumping (or) Upheaval.

20. Define raveling.

21. Define shoving.

22. Differentiate Spalling and traverse crack.

23. What is the Importance of drainage?

24. Define Bleeding.

25. What are the failures in subgrade soil, surface layer, sub-base and base course?

nt ev   aluation?

PART –B (16 Marks)

(AUC Nov/Dec 2010)

1. (i) Explain briefly the procedure of overlays design by Benkelman Beam Method.
   (ii) Discuss briefly the different types of failures of rigid pavemets?

(AUC Nov/Dec 2010)

2. (i) Explain the different types of evaluation of pavement surface condition.
   (ii) Explain the causes and remedial measures for surface rut.

(AUC Nov/Dec 2011)

3. (i) Distinguish between viscosity and softening point if road bitumen. Describe their test procedures ?
   (ii) Explain the procedure for structural evaluation of pavements?

(AUC Nov/Dec 2011)

4. (i) What are the different types of failure in cement concrete pavements?
   (ii) What are the flexible overlays? Explain how the Benkelman Beam is used to design the thickness of the overlay.

(AUC Apr/May 2011)

5. Describe the symptoms, causes and remedial measures for the different types of failures in flexible pavements?

(AUC Apr/May 2011)

6. (i) Briefly explain the procedure for overlay design by Benkelman Beam method ?
   (ii) Explain how resealing of crakes may be carried out in rigid pavements?

(AUC Apr/May 2012)

7. Explain any two commonly employed methods for structural evaluation of flexible pavements

8. (i) Explain briefly the maintenance of bituminous surface.   **(AUC Apr/May 2012)**
    (ii) What is meant by rutting? Explain the symptoms, causes and treatment.

9. What is the importance of highway maintenance? Write a note in Maintenance Management System.

10. Describe the typical failures in rigid pavements.

11. Explain the various methods of pavement evaluation for flexible pavement, rigid pavement.

12. What are the criteria that are followed during a project formulation?