

**II Year B.E/B.Tech**  
**CIVIL ENGINEERING**



**MODEL QUESTION PAPERS**

*(Effective from 2005 admitted batch)*

**SCHOOL OF DISTANCE EDUCATION**  
**ANDHRA UNIVERSITY**  
**VISAKHAPATNAM - 530 003**

**II Year B.E./B.Tech Degree Examination**  
**MATHEMATICS - III**

(Common to Civil, Mechanical, EEE & ECE Branches)

**Time : Three hours**

**Maximum : 75 Marks**

Question 1 is compulsory  
Answer any four from Questions 2 to 8  
All questions carry marks

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1. a) Define scalar and vector point functions.  
b) Write down the physical interpretation of curl.  
c) Explain briefly the wave equation with reference to transverse vibration of a string.  
d) Define Fourier transforms of the derivatives of a function.  
e) State Parseval's identity for F - transforms.
  
2. a) What is the directional derivative of  $\phi = xy^2 + yz^3$  at the point  $(2, -1, 1)$  in the direction of the normal to the surface  $x \log z - y^2 = -4$  at  $(-1, 2, 1)$ ?  
b) Verify Stoke's theorem for the vector field  $\vec{f} = (2x-y) \vec{i} - yz^2 \vec{j} - y^2z \vec{k}$  over the upper half surface of  $x^2 + y^2 + z^2 = 1$  bounded by its projection on the xy plane.
  
3. a) If  $r$  and  $\vec{R}$  have their usual meaning and  $\vec{A}$  is a constant

vector prove that 
$$\nabla_x \left\{ \frac{[\vec{A} \times \vec{R}]}{r^n} \right\} = \frac{2-n}{r^n} \vec{A} + \frac{n(\vec{A} \cdot \vec{R})}{r^{n+2}} \vec{R}.$$

- b) Prove that the spherical polar coordinate system is orthogonal.
-

4. a) If  $f(z)$  is a regular function of  $z$  prove that

$$\left[ \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right] |f(z)|^2 = 4|f'(z)|^2$$

b) Evaluate  $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2 + 1)(x^2 + 4)}$

5. a) Find the Fourier transform of  $e^{-x^2/2}$

b) Find the Fourier sine transform of  $f(x) = \begin{cases} 1, & 0 \leq x \leq a \\ 0, & x \geq a \end{cases}$

6. a) Find a solution of the equation  $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial y} + 2u$  in the form  $u = f(x)g(y)$ . Solve the equation subject to the conditions

$$u = 0 \text{ and } \frac{\partial^2 u}{\partial x^2} = 1 + e^3 y \text{ when } x = 0 \text{ for all values of } y.$$

b) A tightly stretched flexible string has its ends fixed at  $x = 0$  and  $x = l$ . At time  $t = 0$  the string is given a shape given by  $f(x) = \mu x(l - x)$  where  $\mu$  is a constant and then released. Find the displacement of any point  $x$  of the string at any time  $t > 0$ .

7. a) A continuous distribution of a variable  $x$  in the range  $(-3, 3)$  is defined as

$$f(x) = \frac{1}{16}(3+x)^2, \quad -3 \leq x \leq 3.$$

$$= \frac{1}{16}(2-6x)^2, -1 \leq x \leq 1.$$

$$= \frac{1}{16}(3-x)^2, 1 \leq x \leq 3.$$

Verify that the area under the curve is unity. Show that the mean is zero.

b) Fit a Poisson distribution to the following.

x	:	0	1	2	3	4
f	:	46	38	22	9	1

8. a) Find the correlation coefficient from the following data :

x	:	1	2	3	4	5
y	:	2	5	3	8	7

b) The following results were obtained in Applied Mechanics and Engineering Mathematics in an examination. Given  $r=0.95$ , Find both the regression equations.

	Applied Mech.	Engg. Maths
	(x)	(y)
Mean	47.5	10.5
Standard deviation	16.8	10.8

**II Year B.E./B.Tech Degree Examination**  
**STRENGTH OF MATERIALS AND THEORY OF**  
**STRUCTURES - II**  
(Civil Engineering)

**Time : Three hours**

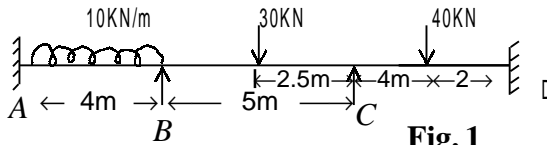
**Maximum : 75 Marks**

Question 1 is compulsory  
Answer any four from Questions 2 to 8  
All questions carry equal marks

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1. a) A beam having a span of 8m is fixed at both ends. Find the reactions at both ends if a non central load of 30 km. acts at a distance of 5 m. from left end support.
  - b) A slender column with both ends hinged and a length of 5m. has a symmetrical I section with flange width of 150mm and a total depth of 250 mm. The thickness of web or flange is 20mm. Find the Rankine's crippling load  $E = 2.1 \times 10^5 \text{ N/mm}^2$
  - c) Find the stress at failure according to Rankine's theory if the specimen is subjected to  $\sigma_x = 200 \text{ N/mm}^2$ ;  $\sigma_y = 150 \text{ N/mm}^2$ ,  $\sigma_{lxy} = 60 \text{ N/mm}^2$
  - d) Draw the influence lines for bending moment, shear force and left hand support reaction in a simply supported beam with span = 10m.
  - e) Define shear centre. What is the importance of it for the flexure loads on a beam.
2. a) Derive the fixed end moments when the right hand end of a fixed beam settles by  $\Delta$

- b) Draw the B.M.D and SFD for a continuous beam loaded as shown in Fig. 1.

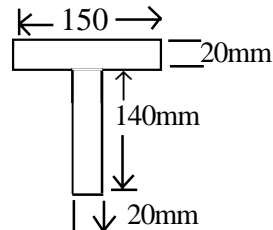


**Fig. 1**

3. a) Derive the equation for Rankine's crippling load for a column.
- b) A steel stanchion is made of an I section  $250 \times 150$  mm with  $I_x = 92 \times 10^6 \text{ mm}^4$ ;  $I_y = 415 \times 10^4 \text{ mm}^4$ ;  $A = 6500 \text{ mm}^2$  and two symmetrical flange plates of  $210 \times 20$  mm size. Both ends of the stanchion are fixed and its length is 15m. Find the Rankine's crippling load  $\sigma_4 = 250 \text{ N/mm}^2$  and  $\alpha = 1/7500$ .
4. a) Derive an equation for failure load for a long column subjected to eccentric load.
- b) The cross section of a long column 5.0m long is shown in Fig.2 One end of the column is fixed and the other end is hinged. Determine Euler's critical load.

$$E = 2.1 \times 10^5 \text{ N/mm}^2$$

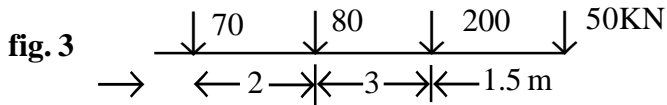
5. a) Explain Rankine's theory of failure for specimen subjected to  $\sigma_x, \sigma_y, \tau_{xy}$
- b) Determine the stress at failure according to principal strain theory for a rod subjected to



**Fig.2**

$$\sigma_x = 260; \sigma_y = 100; \tau_{xy} = 60 \text{ N/mm}^2$$

6. a) Derive the criterion for maximum bending moment to occur under a wheel load when two rolling load  $W_1, W_2$  are moving on a beam with  $W_1$  leading and separated by 'a' from  $W_2$
- b) A train of moving loads as shown in Fig. 3 is moving on a beam of span 20m. Find the position of loads when the B.M. is maximum at 9m. from left end.



7. a) Determine the condition required for B.M. at a section to become maximum when a set of loads is rolling the beam.
- b) Draw the influence lines for the forces in members a and c of the warren truss shown in Fig 4.

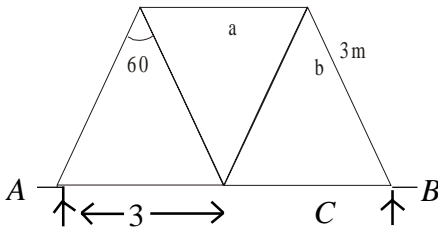
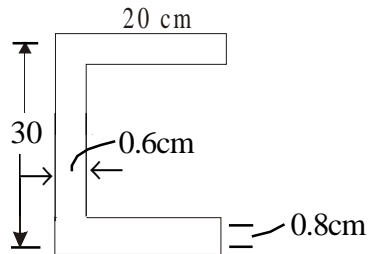


Fig.4



8. a) Give the procedure for calculating the maximum stress in a beam subjected to unsymmetrical bending.
- b) Determine the shear centre for a channel section shown in Fig5.

**II Year B.E./B.Tech Degree Examination**  
**FLUID MECHANICS - I**  
(Civil Engineering)

**Time : Three hours**

**Maximum : 75 Marks**

Question 1 is compulsory  
Answer any four from Questions 2 to 8.  
All questions carry equal marks

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1. Answer the following briefly, Each bit carries 3 marks.
- (a) What are the basic differences between the energy and momentum equations ?
  - (b) “The pressure under the nappie of a contracted sharp crested weir will be hydrostatic” Justify or contradict the statement through proper reasoning.
  - (c) Obtain the friction factor for laminar flow through a pipe in terms of Reynolds number.
  - (d) “A geometrically similar model is kinematically similar too”. Justify or contradict this statement with proper reason.
  - (e) “It is not possible to simultaneously satisfy both Reynolds law and Froude law” Justify or contradict the statement through proper reasoning.
2. (a) Plot the variation of deformation in terms of the velocity gradient for various types of fluids as a function of the shear stress. Clearly identify the types of fluids giving the type of equation for each category of fluid. (5 marks)
- (b) A circular disc of radius ‘**R**’ rotates at an angular velocity ‘**( $\omega$ )**’, maintaining a small distance ‘**h**’ above a fixed bed under the support of a fluid layer of viscosity is ‘ **$\mu$** ’. Obtain the expression for the torque on the disc. (6 marks)

- (c) Distinguish between Surface forces and body forces  
(4 marks)
3. (a) Arrive at the condition for irrotationality of an ideal fluid in terms of the velocity gradients. (5 Marks)
- (b) What is the significance of energy correction factor in Bernoullis equation? Arrive at the expression for the same. (6 Marks)
- (c) Explain the importance of flow net in engineering applications. (4 Marks)
4. (a) An oil of sp. gr. 0.90 flows through a vertical pipe of diameter 20cm. The flow is measured by a 20cmx10cm venturimeter. The throat is 10cm above the inlet. A differential U-tube mercury manometer is connected to the Venturimeter. If  $C_d = 0.99$ , what is (a) the flow for a manometer reading of 9 cm and (b) the manometer reading for a flow of 50 lps ? (8 Marks)
- (b) Derive the expression for emptying a hemispherical tank of radius 'R' through an orifice of area 'a' whose coefficient of discharge is  $C_d$ .
5. (a) State the laws of friction for turbulent flow in a pipe. (4Marks)
- (b) A concrete pipe 90 cm in diameter and 20 m long is used as a culvert. The pipe is laid on a slope of 1 in 60 and has square entrance. During a heavy flow of  $1.50\text{m}^3/\text{s}$ , if the culvert is submerged and the depth of flow over the invert at the downstream end is 1.25 m, estimate the depth of water above the pipe invert at the upstream end. [Assume  $f=0.025$ ] (7 Marks)
- (c) Derive the expression for loss of head due to sudden contraction in a pipe. (4 Marks)
6. (a) Water from a reservoir flows through a pipe line of length  $L$

and diameter  $d$  and discharges through a nozzle of diameter  $d_n$ . If the loss of head in the nozzle is  $K [V_n^2 / 2g]$  where  $K = \text{constant}$  and  $V_n = \text{velocity in the nozzle}$ . Show that for maximum power transmission through the pipeline is

$$\frac{d_n}{d} = \left[ \frac{(1+k)d}{2fL} \right]^{1/4}$$

where  $f$  is the friction coefficient for the pipe.

- (b) Water is discharged from a reservoir into the atmosphere through a pipe 39 m long. There is a sharp entrance to the pipe and the diameter is 50 mm for 15 m from the entrance. The pipe then enlarges suddenly to 75 mm in diameter for the remainder of its length. Taking into account the loss of head at entry, enlargement, calculate the difference of level between the water surface of the reservoir and the pipe exit which will maintain a flow of 2.8 lts/sec. Take  $f = 0.02$  for 50 mm pipe and 0.025 for 75 mm pipe. Draw also HGL and total energy gradient lines.

7. (a) Explain the Weber law of similarity. (4 Marks)
- (b) Show that the total resistance  $R$  of a floating ship is given by

the expression 
$$R = \frac{1}{l_r^3} \left[ r + r_f \left( \frac{C_{fs}}{C_{fm}} - 1 \right) \right]$$
 where  $l_r$  is the

scale ratio,  $r$  is the total resistance on the model,  $r_f$  is the frictional resistance on the model and  $C_{fs}$  and  $C_{fm}$  are the frictional coefficients for the ship and its model respectively. It may be assumed that the ship and the model are towed in the same water. (6 Marks)

- (c) A spillway model is to be built to a geometrically similar scale of 1/50 across a flume of 60 cm width. The prototype

is **15m** high and the maximum head on it is expected to be **1.5m**. (i) What height of model and what head off the model should be used? (ii) If the flow over the model at a particular head is **12 lps**, what flow per meter width of the prototype is expected? (iii) If the negative pressure in the model is **20 cm**, what is the negative pressure in the prototype? Is it practical? (5 Marks)

**8.** Write short notes on any Three (3x5 = 15 Marks)

- (a) Flow net            (b) Pipes in parallel            (c) Syphon  
(d) Reynolds experiment (e) Distorted models    (f) Lock gates

**II Year B.E./B.Tech Degree Examination**  
**BUILDING PLANNING AND DESIGN**  
(Civil Engineering)

**Time : Four hours**

**Maximum : 75 Marks**

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**Part - A**

1. a) Give the sizes of plots for the different income groups in India 5 x 3 = 15
  - b) What is the significance of the principle of flexibility in a building ?
  - c) What comfortable conditions are to be created in a building of humid tropics ?
  - d) Explain Anthropometrics with two sketches.
  - e) Draw Conventional Symbols for the following
    - i) Plaster ii) Glass iii) Stone
2. a) Explain the factors to be considered in the selection of site for a Residential Building. (8)
  - b) Distinguish between detached and semi detached houses.(7)
3. a) Define Orientation. What are the important points for good orientation of the buildings in a tropical climate ? (8)
  - b) Define Ventilation ? What are the types of Ventilation ? (7)
4. Write a brief note on
  - i) Aspect ii) Grouping iii) Circulation in buildings. (15)
5. a) How are buildings classified according to building bye-laws ? (8)
  - b) Explain with neat sketches the purpose and requirements of the following rooms i) Kitchen ii) Dining (7)

## Part - B

Answer the question given below.

6. Design a house for a moderate family. Site particulars :  
Size 20 x 25 (interior plot). Road parallel to width of site and facing North, Location : Kakinada. Wind direction : S, SW - W; climate Zone : Hot and humid : Space requirements :
- a) Front Verndah ; b) Living room, c) Dining room for six persons d) Kitchen and suitable utility verandah; e) Master bedroom with attached W.C f) Guest bed room; g) Separate bathroom with WC with in the building with an easy access to guest bed room and other users ; h) Staircase room leading to terrace.

The plinth area should be between 200 to 240sqm. Front open space 6m. Minimum side open space 2m on either side, rear open space 3m minimum.

### Marks distribution for Question No. 6

Design and draw plan	10 marks
Section	5 marks
Elevation	5 marks
Site plan	5 marks
Schedule of doors and windows	5 marks

**II Year B.E./B.Tech Degree Examination**  
**REINFORCED CONCRETE STRUCTURES - I**

Civil Engineering

**Time : Three hours**

**Maximum : 75 Marks**

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1. a) What is the advantage of limit state design over working stress method ?  
b) Under what conditions doubly reinforced beams are adopted?  
c) Reinforced concrete slabs are generally safe in shear. Comment ?  
d) List the functions of transverse reinforcement in a reinforced concrete beam.  
e) What do you understand by development length ?
2. A reinforced concrete beam of rectangular section has to carry a uniformly distributed load of 8 kN/m over an effective span of 10 m. Design the section using M20 and Fe415 grade steel, when i) there is no restriction on the size beam section ii) the size of the section is restricted to 250 mm x 500 mm effective. Use working stress method.
3. Determine the area of tensile reinforcement required for singly reinforced beam section of size 300 x 550 mm effective to carry a factored moment of 180 kNm. The concrete is M20 and steel is Fe415 grade.
4. A series of beams placed at 2.5 m centres are supported on masonry walls and the effective span of the beam is 5m. the slab thickness is 100mm and ribs below the slab are 200mm wide and 250 deep. If the slab and beams are so cast to act together, determine the reinforcement at mid span for the T beam to carry an imposed load of 5 kN/m<sup>2</sup> of the slab. Use concrete M20 and steel Fe415 grade.

5. A reinforced concrete rectangular beam section of 230mm width and 450 mm overall depth is reinforced with 4 bars of 16 mm of Fe415 grade, placed at an effective cover of 228 mm. Design the shear reinforcement if the beam is subject to a uniformly distributed load of 50 kN/m over a simply supported clear span of 6 m. Concrete is M20.
6. Design a reinforced concrete slab 4.5x 3.2 simply supported on all four sides. It has to carry a characteristic live load of 4 kN/m<sup>2</sup> in addition to its dead weight. Assume M20 and Fe415 steel. Also assume that exposure condition is mild.
7. A reinforced concrete column of unsupported length 3 m is to be designed for a factored load of 1200 kN. Determine the cross sectional dimensions of the column and the reinforcement required for the two cases.
  - i) There is no restriction on the column size.
  - ii) One side of the column is restricted to 230 mm.

The grade of concrete is M20 and steel is Fe415.
8. A solid footing has to transfer a total load of 800 kN. Assuming Fe 415 and  $f_{ck} = 20$  MPa, and safe bearing capacity to be 200 kN/m<sup>2</sup>, design the footing.

**II Year B.E./B.Tech Degree Examination**  
**STEEL STRUCTURES - I**

Civil Engineering

**Time : Three hours**

**Maximum : 75 Marks**

Question 1 is compulsory

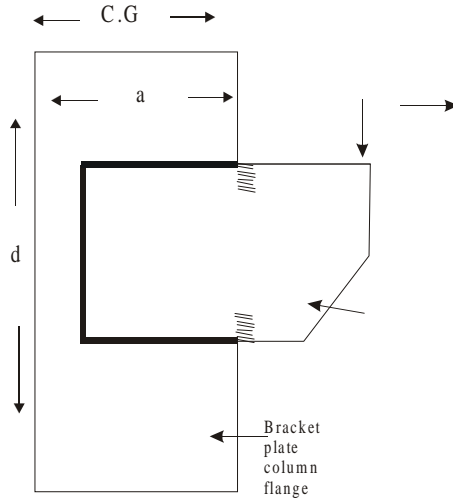
Answer any four from Questions 2 to 8

All questions carry equal marks

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- 1.** Answer the following.  $5 \times 3 = 15 \text{ M}$
- a) Compute the value of rivet, 22mm in diameter, used to connect two plates 12mm thick in the following cases :  
(i) Power driven rivets and (ii) Hand driven rivets.
  - b) Two plates 12mm thick are jointed by (i) a single V-butt weld and (ii) a double V-butt weld. Determine the strength of the welded joint. Effective length of the weld is 220mm.
  - c) Differentiate between laterally supported and unsupported beams with examples.
  - d) The main tie of a roof truss consists of ISA 150 X 115 X 8 mm and is connected to a gusset plate by 18mm diameter rivets. Find out the maximum load it can carry ?
  - e) Discuss the various mechanical properties of structural steel.
- 2.** (a) Discuss in detail the advantages and disadvantages of steel as a structural material.
- (b) What are the different Rolled Steel Sections ? How are they designated ?
- 3.** A bracket plate is used to transfer the reaction of a beam to a column flange as shown in figure. The bracket plate is connected to the column flange by a 6 mm fillet weld. Compute the maximum load that can be placed over the bracket

plate at a distance of 100mm from the flange of the column section and  $a = 250\text{mm}$  and  $d = 250\text{ mm}$ .



4. Design a built-up column 10m long to carry an axial of 750 kN. The column is restrained in position but not in direction at both the ends. Design the column with two channels back-to-back with single lacing system.
5. Design a beam of 5 m effective span. carrying a udl of 20 kN/m if the compression flange is laterally unsupported.
6. Design an I-section purlin, for an industrial building to support a galvanized corrugated iron sheet for the following data.

Spacing of the trusses  $c/c = 6\text{m}$

Span of truss = 12 m

Spacing of purlins  $c/c = 1.5\text{m}$

Intensity of wind pressure = 2 kN/m<sup>2</sup>

Weight of galvanized corrugated iron sheet = 130 N/m<sup>2</sup>

Yield stress of steel = 250 MPa.

7. A plate girder is composed of the following elements :
- (i) Web plate : 900mm depth x 10mm thickness
  - (ii) Two angles : ISA 200 mm x 100mm x 12.0mm @ 27.2 kg/m, in each flange
  - (iii) Two flange plates : 500 mm x 16 mm in each flange.

The girder is simply supported over an effective span of 15m. The diameter of rivets used for connecting flange angles to the web and flange plates to flange angles is 20 mm.

Determine the safe uniformly distributed load which the girder can carry, inclusive of its own weight. Assume that the compression flange is not restrained against lateral bending, but the ends are restrained against torsion. Take  $f_y = 250 \text{ N/mm}^2$ .

8. A column section I.S.H.B. 350 @ 674 N/m carries an axial load of 1100 kN. Design a suitable gusset base. Allowable bearing pressure on concrete is 4000 kN/m<sup>2</sup>.

## II Year B.E./B.Tech Degree Examination

### SOIL MECHANICS

Civil Engineering

Time : Three hours

Maximum : 75 Marks

Question 1 is compulsory

Answer any four from Questions 2 to 8.

All questions carry equal marks

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1. a) Derive relationship between Void Ratio and Porosity.  
b) State Darcy's Law. What are its limitations ?  
c) How the shear tests are classified based on drainage ?  
d) When does Quick Sand Condition occur in soils ?  
e) mention different types of failures that occur in finite slopes  
(5x3 = 15)
2. a) Establish relationship between 'Bulk Density', 'Dry Density' and 'Water Content'. (5)  
b) In a liquid limit test, specimens of certain sample of clay at water contents of 31.9, 27.6, 25.5 & 23.3% required 5, 16, 23 and 42 blows respectively to close the standard groove. The plastic limit of the clay is 13%. Find the liquid limit, plasticity Index, Flow Index & Toughness Index. (10)
3. a) Explain the various factors that affect compaction of soils. (8)  
b) Classify the soil with the following properties as per Indian Standard Soil Classification system (7)  
i) soil fraction retained on 0.075mm sieve : 28%  
ii) Soil Fraction retained on 4.75mm sieve : 12%  
iii) Liquid Limit : 45%  
iv) Plastic Limit : 23%
4. a) Define the Terms : Total, Neutral and Effective Stresses. What is 'Effective Stress Principle' and Explain its significance in soil Engineering? (7)

- b) In a falling head permeability test on a sample 12.2cm high and 44.4Cm<sup>2</sup> in cross sectional area, the water level in a standpipe of 6.25mm internal diameter dropped from a height of 75cm to 25cm in 20 minutes. Find the coefficient of permeability. (8)
5. a) State the assumptions made in Boussinesq's theory of stress distribution in soils. (5)
- b) Derive Terzaghi's differential equation of one dimensional consolidation theory. Explain various assumptions made in the theory. (10)
6. a) Discuss Merits and Demerits of Direct Shear Test. (6)
- b) The results of Triaxial test (UU) performed on a clay sample are as follows.

Cell Pressure (kN/m <sup>2</sup> )	100	300	500
Deviator Stress at failure (kN/m <sup>2</sup> )	130	485	645

- Plot failure envelope and determine the shear parameters (9)
7. a) Explain the procedure for stability analysis of finite slopes using method of slices. (8)
- b) In a laboratory consolidation test on a 20mm thick sample of saturated clay taken from a site, 50 percent consolidation took 10 minutes under double drainage. Estimate the time required for the clay layer of 5m thickness at the site to reach 30 percent consolidation if there is drainage only towards top. (7)
8. Write short notes on any **Three** of the following
- Vane Shear Test
  - Failures of Finite and Infite slopes.
  - Newmark's Influence Chart
  - Corrections to Hydromete Readings.

## II Year B.E./B.Tech Degree Examination

### ENGINEERING GEOLOGY

Civil Engineering

Time : Three hours

Maximum : 75 Marks

Question 1 is compulsory

Answer any four from Questions 2 to 8.

All questions carry equal marks

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1. Answer the following
  - a. What is a mineral and what is a rock 3
  - b. Define fold and a fault with examples 3
  - c. What are the different types of ground water aquifers 3
  - d. Define apparent resistivity and its units ? 3
  - e. What is gravity dam ? What are geological features required for its strong foundations 3
2. Define land form ? Explain the land forms given below.
  - a. Sand dunes b. Ventifacts c. Spits and Bars d. Sea Cliff
3.
  - a. What are the different types of rocks ? Give two examples each ?
  - b. Write about the important rocks and their utility Engineering projects
4. Give a note on the following faults with illustrations.
  - a. Normal Fault b. Step Fault c. Strike Fault
5. Explain the following
  - a. Electromagnetic Spectrum
  - b. Types of aerial photographs c. IRS satellites and sensors
6. Describe the methods of disaster prevention and management techniques
7. What are the important geological investigations for bridge sites
8. Write short notes on **three** of the following
  - a. Bulk heads b. Groins c. Tsunami d. Earthquake