

PURBANCHAL UNIVERSITY

2023

B.E. (Civil)/Sixth Semester/*Final*

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG362CI: Foundation Engineering (*New Course*)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question specified along its side. Assume suitable data if necessary.

Answer FIVE questions.

5×16=80

- 1(a) Discuss standard penetration test. What are the various correction. What is the importance of the test in geotechnical engineering? 4+2+2
- (b) A retaining wall has a vertical back and is 9m high. The back face of the wall is smooth and the upper surface of the fill is horizontal. Determine the active thrust on the wall per unit length. Take $c = 10 \text{ kN/m}^2$, $\gamma = 19 \text{ kN/m}^3$ and $\phi = 30^\circ$. Neglect tension. 8
- 2(a) What do you understand by disturbed and undisturbed samples? How do you obtain undisturbed samples. Describe general, local and punching shear failure. 2+2+4
- (b) A building owner has planned to construct his house with framed structure with square columns at a depth of 2m below the ground. If the column has to carry the load of 900 kN. Determine the size of the footing required to transfer the load to a soil strata with cohesion 15 kN/m^2 , angle of internal friction 30° and unit weight of 20 kN/m^3 . Use F.O.S. of 4. Take Terzaghi's bearing capacity factor $N_c = 37.2$, $N_q = 22.5$ and $N_\gamma = 19.7$ respectively. 8
- 3(a) Describe the general procedure for the design of a spread foundation. Write down the procedure for proportioning footing for equal settlement. 4+4
- (b) A raft ($20\text{m} \times 15\text{m}$) exerts a gross pressure of 300 kN/m^2 at foundation level. The depth of foundation is 2.5m. If the soil is clay ($\phi = 0$, $C_u = 80 \text{ kN/m}^2$ and $\gamma = 19 \text{ kN/m}^3$), determine the factor of safety. The raft is for the basement. Use Skempton's equation. 8

Contd. ...

(2)

- 4(a) A concrete pile of 50cm diameter and 16m long driven into a homogeneous mass of clay soil of medium consistency. The water table is also to the ground surface. The unit cohesion of soil under undrained condition is 55kN/m^2 and the adhesion factor is 0.75. Compute Q_u and Q_a with F.O.S. = 3. 8
- (b) What is negative skin friction? What is its effect on pile? How would you estimate load carrying capacity of drilled pier in sand and clay; 2+2+4
- 5(a) A sheet pile retains soil to a height of 7m. Find the depth of embedment if the soil has effective unit weight of 18 kN/m^3 and angle of internal friction of 30° . Use simplified method. 8
- (b) What are the types of caissons describe them? Describe three prominent methods of foundation soil stabilization. 4+4
6. Write short notes on any FOUR: 4×4=16
- (a) Requirements of foundation
 - (b) Earth pressure of elastic
 - (c) Active and Passive earth pressures
 - (d) Stresses on lower strata
 - (e) Group action of pile

≡

PURBANCHAL UNIVERSITY

2023

B.E. (Civil)/Sixth Semester/*Final*

Time: 03:00 hrs.

Full Marks: 80/Pass Marks: 32

BEG364CI: Sanitary Engineering (*New Course*)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

- 1(a) What are the sources of sanitary sewage? What factors affect the quantity of sanitary sewage. Illustrate the standard statement of quantity of sanitary sewage. 8
- (b) Prove with examples that: "The maximum runoff occurs when duration of storm is equal to the time of concentration (i.e. $t=t_c$)". 8
- 2(a) What is self-cleaning velocity and non-scouring velocity? Explain about self-purification of stream and the factors affecting it. 2+6
- (b) A 30 cm dia. Sewer having an invert slope of 1 in 150 was flowing full. What would be the velocity of flow and discharge when $n = 0.013$. What would be the velocity and the discharge when the same is flowing 0.2 and 0.8 of its full depth. 8
- 3(a) Define sewer appurtenances and list out them? Illustrate the man-hole with necessary sketches? 1+2+5
- (b) A city discharges sewage at the rate of 400 l/s. into a river whose minimum flow is 2200 l/s, the temperature of both being 20°C. The 5 day BOD at 20°C for sewage is 160 mg/l and that of river water is 2 mg/l. The DO content of sewage is zero while that of stream is 90% of the saturation DO. Find the degree of treatment required if the minimum DO to be maintained in the stream is 4 mg/l. Assume deoxygenation coefficient as 0.1 and reoxygenation coefficient as 0.3. Given saturation DO at 20°C as 9.17 mg/l. 8
- 4(a) What do you understand by physical treatment and biological treatment in waste water plant? Draw a complete flow chart of

Contd. ...

(2)

waste water treatment plant with a brief explanation of each component. 2+6

- (b) A sedimentation tank treats sewage @ $8000 \text{ m}^3/\text{day}$ containing 240 mg/l of suspended solids. The tank only removes 65% of the suspended solids. Compute the weight and volume of the sludge produced yearly if the moisture content of the sludge is (i) 97% and (ii) 94%. 8

- 5(a) Why do we need to treat sludge? What are the possible way out to manage sludge? Explain the method of sludge treatment. 2+2+4

- (b) Design a two stage high rate trickling filter for the following data: 8

organic loading for both filters = $15000 \text{ kg BOD/ha-m/day}$

Flow = 5.5 MLD

BOD of raw sewage before PST = 250 mg/l

BOD required in final effluent $\leq 35 \text{ mg/l}$

Recirculation ratio for both filters = 0.25

BOD removed in PST = 20%

Assume intermediate sedimentation tank with BOD removal efficiency of 15% .

6. Write short notes on:

$4 \times 4 = 16$

(a) Oxidation pond

(b) Methods of solid waste disposal

(c) Partial flow diagram

(d) Design of septic tank and sock pit

~

PURBANCHAL UNIVERSITY

2023

B.E. (Civil)/Sixth Semester/Final

Time: 03:00 hrs.

Full Marks: 80 / Pass Marks: 32

BEG365CI: Transportation Engineering-II (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side. Normal graph paper should be provided. Assume suitable data if necessary.

Answer FIVE questions.

5×16=80

- 1(a) What is the scope of traffic engineering? Discuss briefly the various factors which affect the road user characteristics and their effects in traffic performance. 8
- (b) On cross roads A and B the 12 minutes traffic volume during the design hour were 700 and 400 vehicles. The approach speeds were 50 and 30 kmph for roads A and B. the width of road A is 14m and that of B is 10m. Design the signal timing by trial method. Assume average time headway of 2.5 second during green phase. 8
- 2(a) Why is the origin and destination study carried out? How is origin and destination study data collected? 4+4
- (b) A van of weight 3T hits a parked car of weight 0.8 T and both the vehicles skid together through a distance of 4.2m before coming to stop. Calculate the initial speed of the van if, (i) it does not apply brakes before collision (ii) it applies brakes and skids through a distance of 2.8 m before collision. 8
- 3(a) Calculate the warping stress at interior, edge and corner of a concrete pavement of thickness 20cm with transverse joints at 4.5m spacing. The width of slab is 3.5m for concrete $E=3 \times 10^5$ kg/cm² and $\mu=0.15$, K value for sub grade = 5kg/cm². Temperature differential is 0.9 C per cm. assume thermal coefficient for concrete as 10×10^{-6} per°C 8

Contd. ...

(2)

- (b) Explain briefly the various aspect investigated during parking studies. What is the use of these studies? 8
- 4(a) Explain briefly the various design factors that are to be considered in rotary intersection design. 8
- (b) Explain ESWL and the concept in the determination of the equivalent wheel load. 8
- 5(a) What are the various causes of formation of waves and corrugations in flexible pavements? Give your suggestion to avoid or minimize the waves and corrugations. 8
- (b) What are the various types of bituminous construction in use? Discuss the advantage and limitation of each. 8
6. Write short notes on any FOUR: 4×4=16
- (a) Design of the lighting system
 - (b) Location of bridge site
 - (c) Survey for tunnel alignment
 - (d) Highway maintenance
 - (e) Difference between flexible and rigid pavement.

≡

PURBANCHAL UNIVERSITY

2023

B.E. (Civil)/Sixth Semester/*Final*

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG363CI: Irrigation Engineering (*New Course*)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question specified along its side.

Answer FIVE questions. Assume necessary data if necessary. 5×16=80

- 1(a) Briefly explain about the necessity of irrigation in the context of our country. Write down short notes on history of irrigation development and its present status in Nepal. 2+3+3
- (b) Find the amount of irrigation and number of days after which irrigation is to be applied to ensure sufficient irrigation for the crop at the following conditions (i) the soil moisture content is at FC, (ii) the FC of the soil is 40% (iii) PWP of the soil is 20%, (iv) density of soil 1.5 g/cc, (v) soil zone depth 90 cm, (vi) readily available moisture content is 85% of the available moisture content, (vii) average daily consumptive use of water by the crop is 5mm.. 4+4
- 2(a) What is the basic difference of the Drip and Sprinkler irrigation? Write down the advantages and disadvantages of Drip irrigation and Sprinkler irrigation. Also mention the conditions of their applicability. 2+4+2
- (b) Design a hydraulically efficient rectangular channel section using Kennedy's theorem to supply discharge of 15 m³/s at a slope of 1/1500. Take Kutter's $n = 0.0225$ and critical velocity ratio $m = 0.9$ show the designed section with necessary free board. 8
- 3(a) Differentiate between Delta and Duty of irrigation water for a crop? Derive the relationship between them. 4+4
- (b) Design a trapezoidal channel section with side slope of 0.5 V: 1H using Lacey's silt theorem to supply discharge of 5 m³/s. Take the mean diameter of the river bed materials of 0.40 mm. show the designed section with necessary free board. 8

Contd. ...

(2)

- 4(a) Why fish ladder is provided at the headwork? What are the considerations to be taken in to account for design of fish ladder? List out the functions of Divide wall and Scouring sluice? 2+4+2
- (b) Using Khosla's theory, find the maximum head difference (height of water column H) that can retain by a head work structures of length 50 m providing downstream cutoff wall of 3 m deep only in alluvial soil having the safe exit gradient G_E of 0.15. 8
- 5(a) What do you mean by water logging? What are their effects? What are the measures that can be applied to prevent and reclaim the water logged area. 1+3+4
- (b) Design a Sarda type of a fall with the following data: 8
- (i) Full Supply discharge = 10 cumecs
 - (ii) F.S.L. u/s/d/s = 101.50 m/ 100.50 m
 - (iii) Full supply depth = 1.65m
 - (iv) Bed level u/s/d/s= 98m/ 97m
 - (v) Bed width= 7m
- Assume Bligh's co-efficient = 7.
- 6(a) Design and sketch guide bund and launching apron for straight portion for following data: 8
- Maximum discharge: 4500 cumecs
- H.F.L: 102m
- River bed level: 100 m
- Average diameter of river bed material: 0.20mm.
- (b) Write down in detail about the common stages or irrigation system planning that needed to be followed. 8

≡

PURBANCHAL UNIVERSITY
2023

B.E. (Civil/Electronics & Comm./Computer)/Sixth Semester/Final

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG395MS: Engineering Economics (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Answer FIVE questions.

5×16=80

- 1(a) Suppose you make equal annual deposits of Rs 100000 into a fund that pays a nominal interest of 12% per year compounded semi annually. Find the balances at the end of year five. 8
- (b) What is engineering economics? Why is it important for project implementation? What are its principles? 8
- 2(a) The information given below show the records of a manufacturing company using standard costing system: 10

	Standards	Actual
Production (Units)	2,500	2,000
Direct Material (kg)	9,000	8,000
Direct Material Cost (Rs)	2,70,000	2,18,750
Direct labours (Hrs)	9,000	10,000
Direct labours cost (Rs)	1,80,000	2,50,000
Variable Overheads (Rs)	1,00,000	1,00,000

Calculate:

- Total material variance
- Total wage variance
- Variable overheads variance

Also indicate the adverse and favorable condition.

- (b) With an example, explain ERR method. 6
- 3(a) Find the both types of BC ratio using present worth formula where: 8

Contd. ...

Investment	Rs 2,50,000
Useful life	10 years
Interest	8%
Annual benefits	R 1,00,000
Annual total cost	Rs 44,000
Salvage value	Rs 40,000

(2)

- (b) Evaluate using FW formulation, whether the following project is feasible or not: 6

End of year	Net cash flow (in Rs.)
0	-4,00,000
1	95,000
2	95,000
3	95,000
4	95,000
5	1,40,000

Take MARR = 12% per year.

- 4(a) In the design of a special use structure, two mutually exclusive alternatives are under consideration. The economic estimates are as follows: 10

	A	B
Capital investment	55,000	1,20,000
Annual expenses	-9,000	-5,500
Useful life (Yrs)	20	50
Market value at the end of useful life	10,000	22,000

If perpetual service from the structure is assumed, which design alternative should be recommended? The MARR is 10% per year. Use coterminal method.

- (b) Why marketing research is needed? Explain. 6
- 5(a) Perform sensitivity analysis by investigating the annual worth of the following project over the range of $\pm 40\%$ in (i) Initial investment (ii) Annual net revenue (iii) Salvage value (iv) Useful life. 10

Contd. ...

Initial investment	5,00,000
Revenues per year	1,30,000
Expenses per year	1,00,000
Salvage value	5,000
Useful life	15 yrs
MARR	15%

(3)

Draw also the sensitivity diagram.

- (b) What do you understand by value added tax (VAT)? Explain. 6
6. Write short notes on any FOUR: 4×4=16
- Decision tree
 - Elements of cost
 - Break even analysis
 - Time value of money
 - Cash flow diagram
 - Payback period

~

PURBANCHAL UNIVERSITY

2023

B.E. (Civil)/Sixth Semester/Final

Time: 03:00 hrs.

Full Marks: 80 /Pass Marks: 32

BEG361CI: Design of Steel & Timber Structures (New Course)

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

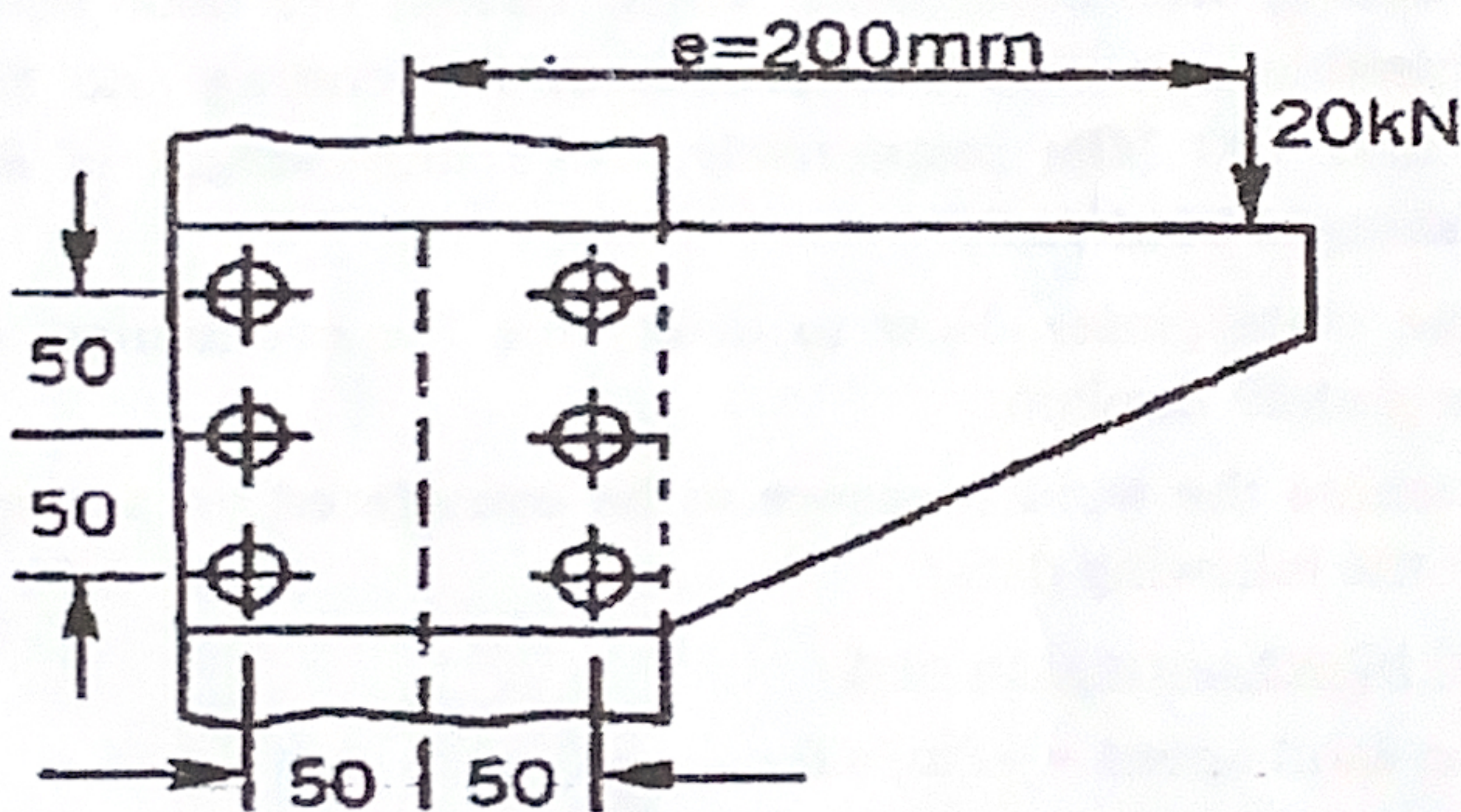
IS 800-1984, IS 883-1970 and structural steel sections table are allowed for use. Assume any missing data but use 250MPa Steel unless otherwise specified.

Answer FIVE questions.

5×16=80

1(a) Describe the strength and efficiency of the joints per pitch of the riveted joints. 6

(b) A vertical load of 20 kN is applied to a bracket plate at an eccentricity of 200 mm as shown in fig. find out the maximum stress offered by any rivet. 10

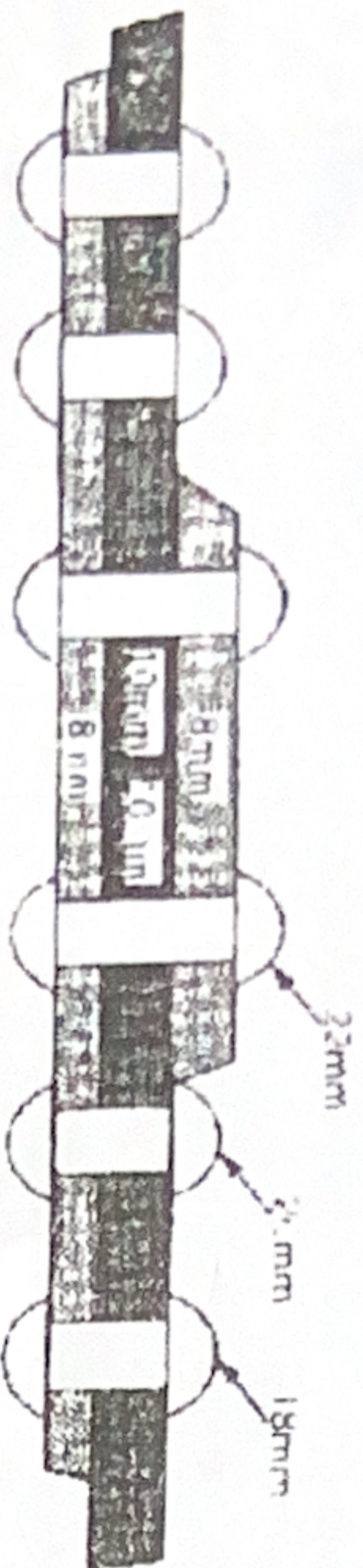
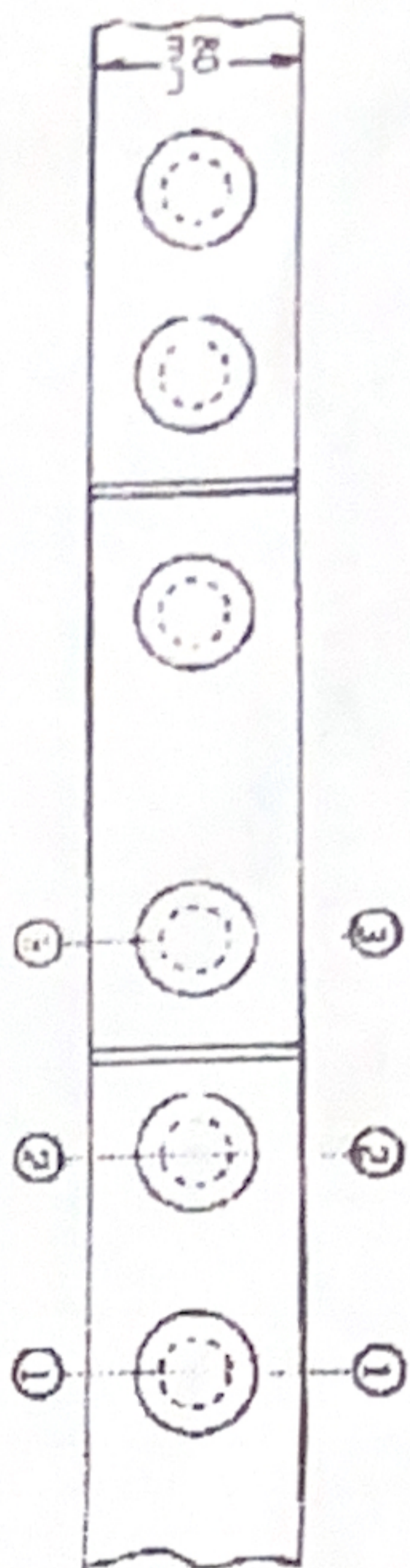


2(a) Calculate the strength of single angle ISA80*50*10mm thick section used as a tension member with long leg connected to gusset plate of 12 mm thick by 16 mm rivet. 8

(b) A triple riveted butt joint for connecting two plates 80mm×10mm with 8 mm cover plates is shown in fig. Find the strength and efficiency of the joints. Take pds rivet. 8

Contd. ...

(2)

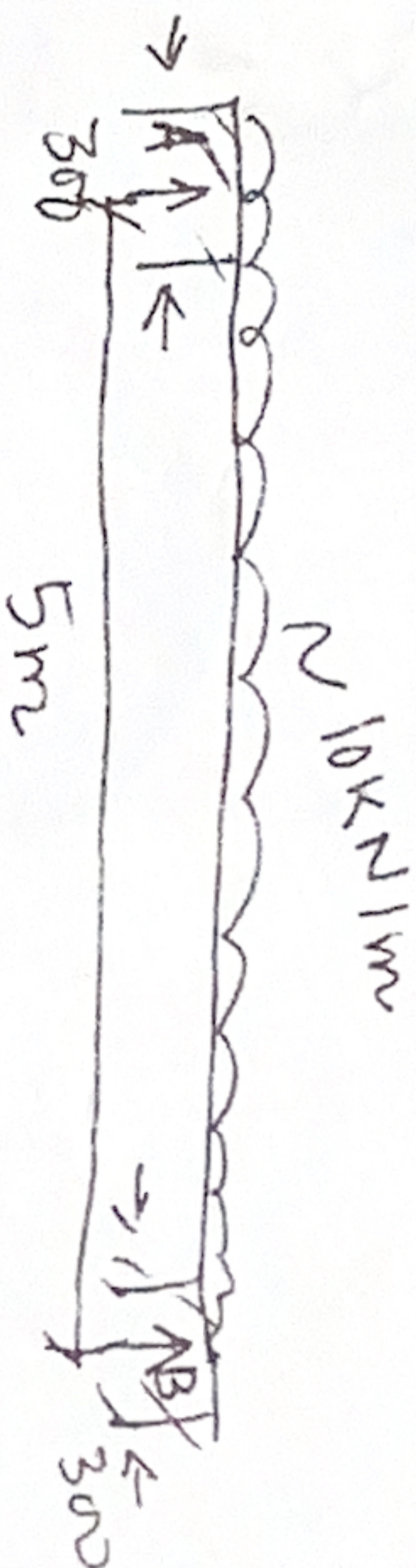


3. Design a Built-up column with lacing, carrying an axial load of 1000 kN. The column is built-up of two channel placed back to back. Its length is 5 m and effectively held in position at both ends.
4. A hall of clear dimensions 9m x 4m is to be covered by 10 cm thick RCC slab including floor finishing resting over RS joists spaced at an interval of 3m c/c. The live load on slab is 4 kN/m². The joists are resting over 20 cm thick walls. Design the floor joists if the permissible stress in bending stress in bending and shear are 165 and 100 MPa respectively. Take unit weight of RCC and Finishing is 25 kN/m³.
- 5(a) Define plate girder. How to determine the economical depth of plate girder? Explain.
- 8 (b) Determine the wind pressure to be considered on a sloping roof from the following data:
- Wind blows normal to roof
- Basic wind speed = 47 m/s²
- Span of the roof = 10 m
- Pitch = 1/4
- Height of eaves above ground = 5 m
- Risk coefficient, $k_1 = 1.0$, Terrain factor, $k_2 = 0.85$ and Topographic factor, $k_3 = 1.0$.

Contd. ...

(3)

- 6(a) A Sal wood timber beam is freely supported on supports (300 mm thick wall) 5.0 m (c/c) apart. It carries a UDL of 10 kN/m. Design a suitable section making the depth twice the width as shown in figure.
- 10



- 6 (b) Design a Sal wood solid rectangular column to carry an axial load of 200 kN. The effective length of column is 3.25 m.