TEACHING PLAN

BACHELOR OF EDUCATION IN BUILDING ENGINEERING (BE-BE) STUDY PROGRAM

DEPARTMENT OF CIVIL ENGINEERING, FACULTY OF ENGINEERING, UNIVERSITAS NEGERI PADANG

COURSES	CODE	GROUP OF COURSES	SCU		SEM	VERSION
			Teori	Prakt		
HIDROLIKA	**SIP133**	**Study Program Compulsory Courses**	**2**		**1**	**1**
Responsible Lecturer	**Totoh Andayono, S.T., M.T.**		**the signature of the responsible lecturer**			
Information	**Dean of the Faculty of Engineering**	**Head of the Civil Engineering Department**	**Study Program Coordinator Building Engineering Education**			
	Dr. Fahmi Rizal, M.Pd., M.T NIP. 195912041985031004	Faisal Ashar, Ph.D. NIP. 19750103 200312 1001	Drs. Revian Body, MSA. NIP. 19600103 198503 1003			

Graduate Learning Outcomes	Learning Achievement of Graduate Study Programs
	1. Master *basic knowledge of science* (mathematics, natural sciences) and other scientific disciplines that form the basis of building engineering vocational education field for carrying out professional work *(Knowledge and Understanding).* 1.1. Able to implement basic concepts of mathematics and physics to master subjects matter in the field of building engineering vocational education. 1.2. Mastering Statics, Mechanics, Statistics, Technology Materials, and Engineering Drawings as the basic knowledge in the field of building engineering vocational education. 2. Able to identify, formulate, solve, and evaluate various technical problems of buildings as the basic ability for teaching in the field of building engineering vocational education *(Engineering analysis, investigation and*

assessment) .

2.1. Able to identify, formulate, solve, and evaluate technical problems in the field of geotechnical and transportation as the basic ability for teaching in the field of building engineering vocational education.

2.2. Able to identify, formulate, solve, and evaluate technical problems in the field of structure and construction management as the basic ability for teaching in the field of building engineering vocational education.

2.3. Able to identify, formulate, solve, and evaluate technical problems in the field of hydrology as the basic ability for teaching in the field of building engineering vocational education.

3. Possess the ability to design building by taking into account environmental, social, health and work safety issues as the basis for teaching in the field of building engineering vocational education *(Engineering design).*

3.1. Able to make design programming by taking into account environmental, social, health and work safety issues, in cooperation with various party related.

3.2. Able to analyze the design by taking into account environmental, social, health and work safety aspects.

3.3. Able to produce design by taking into account environmental, social, health and work safety aspects.

4. Possess social, managerial, team work, and effective communication competencies, entrepreneurial character, environmental insight and life-long learning habits. *(Transferable and soft skills).*

4.1. Possess religious character implemented in personal and professional activities.

4.2. Possess the spirit of nationalism, social sensitivity and environmental insight

4.3. Able to communicate effectively and work in a team.

4.4. Able to transfer science and technology to the community to improve the quality of life

4.5. Possess entrepreneurial character

5. Possess the ability to innovate and adapt to the development of science and technology, and implement it into the learning process of building engineering vocational education field by taking into account non-technical risks that may occur (ethical, ecological, commercial, and industrial impact) *(Engineering practice).*

5.1. Able to innovate and use information technology (software) in the field of building engineering vocational education by taking into account the ethical, ecological, commercial and industrial impact.

5.2. Able to use information technology-based equipment (hardware) in field of building engineering vocational education.

6. Possess a good ability to design, implement and evaluate the learning process in the field of building engineering vocational education *(Educational design).*
   6.1. Able to design curriculum and learning process of building engineering vocational education.
   6.2. Able to implement, control, evaluate and improve the quality of learning process through research in the field of building engineering vocational education.
   6.3. Able to develop an effective, efficient, and attractive learning media in the field of building engineering vocational education.

Course Learning Outcomes

Learning Achievment of Course

CPMK	CPL
1. Knowing and understanding the properties and behaviour of fluids	1.3, 2.4
2. Understand and be able to apply ideal liquid flow	1.1, 1.2, 1.3, 2.1, 2.2, 2.4
3. Understand and be able to apply real liquid flow	1.1, 1.2, 1.3, 2.1, 2.2, 2.4
4. Understand and can calculate hydrostatics	1.1, 1.2, 1.3, 2.1, 2.2, 2.4
5. Understand the concept and can calculate the flow in the pipe (closed channel) and can plan the piping system	1.1, 1.2, 1.3, 2.1, 2,2 2.4, 3.1, 3.4, 4.1, 4.2, 4.3 5.2
6. Knowing and understanding the concept of water flow characteristics and types and open channel cross-sectional characteristics	1.1, 1.2, 1.3, 2.4
7. Understand the concept and can calculate the flow on open channels	1.1, 1.2, 1.3, 2.1, 2,2 2.4, 3.1, 3.4, 4.1, 4.2, 4.3, 5.2,

Short descriptions of course

This course provides an understanding of the theory and concepts of hydraulics and can analyze to solve engineering problems and apply hydraulic equations in water construction planning.

<table>
<tr><td rowspan="4">References</td><td colspan="2">Utama (RU) :</td></tr>
<tr><td colspan="2">1. Bambang Triatmodjo., 1996, “Hidraulika I”, Beta Offset, Yogyakarta.
2. Bambang Triatmodjo., 1996, “Hidraulika II”, Beta Offset, Yogyakarta
3. Anggrahini., 1996, “Hidrolika saluran Terbuka”, CV. Citra Media, Surabaya.
4. Chow, V.T., 1992, “Hidrolika saluran Terbuka”,Erlangga, Jakarta
5. Douglas. J.F., Gasiorek, J.M., Swaffield, J.A., 1986 “Fluid Mechanics”, Longman Group Ltd, Longman House, Burnt Mill, Marlow Essex CM 20 2JE, England
6. James F. Cruise., Mohsen M. Sherif., 2007., “Ëlementary Hydraulics”, Thomson Learning, Canada
7. Maryono, A., Muth, W., Eisenhauer, N., 2002, “Hidrolika Terapan“, PT. Pradnya Paramita, Jakarta
8. Nalluri, C., Featherrstone, R.E., 1995, “Civil Engineering Hydraulics”, Blackwell Science, London.
9. Simon, A.L., 1981, “Practical Hydraulics”, Jhon Wiley & Sons New York.
10. Strum, T.W., 2001, “Open Channel Hydraulics”, Mc Graw Hill, USA</td></tr>
<tr><td colspan="2">Pendukung (RP)</td></tr>
<tr><td colspan="2">1. Journal of Hydraulic Engineering, ASCE Journal, https://ascelibrary.org/journal/</td></tr>
<tr><td rowspan="2">Learning Media</td><td>Software:</td><td>Hardware:</td></tr>
<tr><td>Office Word dan Excell</td><td>Komputer, LCD Projector dan Papan tulis dan perangkatnya</td></tr>
<tr><td>Team Teaching</td><td colspan="2">Totoh Andayono, S.T., M.T. , Dr. Fahmi Rizal, M.Pd, M.T.</td></tr>
<tr><td>Assessment</td><td colspan="2">UTS, UAS, Tugas Besar</td></tr>
<tr><td>Requirements Subject</td><td colspan="2">---</td></tr>
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LESSON MATERIAL

Weeks	Competence to be achieved	Study Materials	Learning Methods and Strategies	Assignments / task	Assessment Criteria / Indicators	Rreference
(1)	CPMK-1 Understanding and mastering the concept of theory about 1. Scope of Hydraulics 2. Dimensions and Units 3. Properties of Liquid Substances 1. 4. Liquid Flow Type	**Properties and Behavior of Fluid**	Lectures and discussions	Quiz	1. Attitude/behavior 2. Knowledge	**1,5,6**
(2)	CPMK-2 Understanding and mastering the theory of: 1. The concept of ideal liquid flow 2. Discharge flow 3. Bernoulli's equation for ideal liquid flow	**Ideal Liquid Flow**	Lectures and discussions	Quiz	**1.** Attitude **2.** Knowledge	**1,5,6,8**
(3)	CPMK-3 nderstanding and mastery of: 1. The concept of real liquid flow 2. The Osborne Reynolds experiment 3. Bernoulli's equation for real liquids	**Real Liquid Flow**	Lectures and discussions	Quiz	**1.** Attitude 2. Knowledge	**1,5,6,8**

(4) **(5)**	CPMK-4 Calculate and analyze: 1. The pressure at a point 2. Manometer 3. Hydrostatic forces acting on the horizontal plane 4. Hydrostatic forces acting on a flat plane that lies obliquely in the liquid 5. Hydrostatic forces acting on a flat plane that is located vertically in the liquid 6. Hydrostatic pressure in the curved plane	**Hydrostatics**	Lectures and discussions	Quiz	**1.** Attitude 2. Knowledge 3. Skill	**1,5,6,7**
(6)	CPMK-5 Calculate and analyze:: 1. Surface Roughness 2. Coarse Pipe 3. Steady Flow Through Pipe		Lectures and discussions	Quiz	**1.** Attitude 2. Knowledge 3. Skill	**1,2,6,7,8**

(7)	4. Power line and pressure line 5. Piping system: • Serial Link • Parallel connection pipes • Combined pipe • Branch Pipe • Pipe network	**Flow in Closed Channels (Pipes)**				
(8)	**Mid-Semester Evaluation through Mid-Semester Examination**					
(9)	CPMK-6 Knowing and Understanding the concepts: 1. Characteristics of water flow in open channels 2. Types of water flow according to space and time 3. The general equation for flow in an open channel 4. Cross-sectional characteristics of the channel	**The characteristics and types of water flow and the cross-sectional characteristics of the open channel**	Lectures and discussions	Quiz	**1.** Attitude 2. Knowledge 3. Skill	**1,2,3,4,5,6, 7,8,9**
(10)	CPMK-7 Understands concepts and can calculate and analyze: 1. Definition of the same		Lectures and discussions	Quiz	**1.** Attitude 2. Knowledge 3. Skill	**1,2,3,4,5,6, 7,8,9**

(11) **(12)** **(13)** **(14)** **(15)**	flow and the conditions for the same flow 2. Similar flow equations 3. Use of the equation: • The Chezy equation • The Manning equation • The Strickler Equation 4. Determination of the cross-sectional dimensions of the channel 5. Economic channel planning 6. Determination of standard depth and critical slope 7. Determination of flow types from standard and critical depths 8. Depiction of the depth in the channel 9. Equation of momentum and energy in an open channel flow. 10. Continuity in open channel flow	**Streams on Open Channels**				
(16)	**Final Semester Evaluation (Evaluation which is intended to determine the final achievement of student learning outcomes)**					

Keterkaitan CPMK dengan CPL dan Metode Assesment

	Assesment	Bobot (%)	CPL-1			CPL-2				CPL-3				CPL-4					CPL-5			CPL-6		
			1	2	3	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	3	1	2	3
CPMK-1	UTS (soal 1)	**3**			■				■															
CPMK-2	UTS (soal 2)	**6**	■	■	■	■	■		■															
CPMK-3	UTS (soal 3)	**6**	■	■	■	■	■		■															
CPMK-4	UAS (soal 3)	**4**	■	■	■	■	■		■															
CPMK-5	UTS (soal 4 dan 5) UAS (soal 6)	**23**	■	■	■	■	■		■	■			■	■	■	■				■				
CPMK-6	UAS (soal 4)	**4**	■	■	■	■	■		■	■			■	■	■	■				■				
CPMK-7	UAS (soal 1,2 dan 5)	**24**	■	■	■	■	■		■	■			■	■	■	■				■				
CPMK-5	Tugas Besar	**25**	■	■	■	■	■		■	■			■	■	■	■				■				
CPMK-6			■	■	■	■	■		■	■			■	■	■	■				■				
CPMK-7			■	■	■	■	■		■	■			■	■	■	■				■				
Kehadiran		**5**																						
TOTAL		**100**																						

Komponen Penilaian

Ujian Tengah Semester	:	30%
Ujian Akhir Semester	:	40%
Tugas Besar	:	25%
Kehadiran	:	5%
Total	**:**	**100%**

Deskripsi Tingkat Penilaian

	Excellent	**Good**	**Satisfy**	**Fail**
Deskripsi	90-100	70-89	51-69	<50
Formulasi	-	-	-	-
Menghitung	90-100	70-89	51-69	<50
Analisis	90-100	70-89	51-69	<50

Sistem Penilaian

Nilai Angka	**Nilai Mutu**	**Angka Mutu**	**Sebutan Mutu**	**Nilai Angka**	**Nilai Mutu**	**Angka Mutu**	**Sebutan Mutu**
85 – 100	A	4.0	Dengan pujian	55 – 59	C	2.0	Cukup
80 – 84	A-	3.6	Sangat baik sekali	50 – 54	C-	1.6	Kurang cukup
75 – 79	B+	3.3	Baik sekali	40 – 49	D	1.0	Kurang
70 – 74	B	3.0	Baik	≤ 39	E	0.0	Gagal
65 – 69	B-	2.6	Cukup Baik	-	T	-	Tertunda
60 – 64	C+	2.3	Lebih dari cukup				

KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN
UNIVERSITAS NEGERI PADANG
JURUSAN TEKNIK SIPIL
Alamat: Jl. Prof. Dr. Hamka, Kampus UNP Air Tawar, Padang 25131
Telp. (0751) 7055644, Fax (0751) 7055628, website: www.ft.unp.ac.id, e-mail: info@ft.unp.ac.id

SOAL UJIAN TENGAH SEMESTER (MID TERM)

Matakuliah	:	Hidrolika
Kode/SKS	:	SIP133
Sifat Ujian	:	*Open Book*
Dosen	:	Totoh Andayono, S.T., M.T.
Waktu	:	180 Menit
Bobot nilai maksimal	:	30%

1. Suatu pelat terletak sejauh 0,5 mm dari pelat yang lain tetap. Pelat tersebut bergerak dengan kecepatan 0,25 m/det dan memerlukan suatu gaya tiap satuan luas sebesar 2 Pa (N/m^2) untuk menjaga kecepatan yang tetap. Tentukan viskositas cairan yang terletak di antara dua pelat tersebut **(10%)**
2. Pipa dengan diameter membesar mengalirkan air dengan kecepatan aliran di titik1 sebesar 2,5 *m/dt*. Jika D_1 = 0,1 m dan D_2 = 0,25 m tinggi tekanan di titik 1 = 1,5 m, maka hitunglah tekanan pada titik 2.(z_1 = 1,5 m, z_2 = 0,8 m) **(20%)**
3. Sebuah pipa mengalirkan zat cair dengan z_1 = 1,5 m, z_2 = 0,8 m. Jika diameter pada titik A = 20 cm dan titik B = 12,5 cm dan tekanan pada titik A 100 kPa, tekanan di titik B 80 kPa serta besarnya kehilangan energi 0,5 m, hitung debit yang melalui pipa tersebut.(γzat cair = 1000 kgf/m^3) **(20%)**
4. Untuk mengalirkan air dari kalom penampungan A ke kolam B direncanakan menggunakan pipa dari baja berdiameter 0,75 meter. Jika kehilangan energi direncanakan hanya sebesar 0,5X m/km dan kekentalan kinematik air 10^{-6} m^2/dtk, hitung besarnya air yang dapat dilewatkan melalui pipa tersebut. **(20%)**
5. Sebuah pipa air minum mempunyai diameter 5 cm, pada daerah tertentu harus dilakukan sambungan dengan cara memperbesar diameternya menjadi 2 kali diameter sebelumnya. Hitung tinggi tekanan pada diameter setelah pembesaran pipa jika diketahui tinggi tekanan di diameter awal sebesar 200 cm. (z_1 = 2,X5 m, z_2 = 1,85 m) **(30%)**

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SOAL UJIAN AKHIR SEMESTER

Matakuliah	:	Hidrolika
Kode/SKS	:	SIP133
Sifat Ujian	:	*Open Book*
Dosen	:	Totoh Andayono, S.T., M.T.
Waktu	:	180 Menit
Bobot nilai maksimal	:	40%

SOAL:

1. Suatu saluran terbuka berpenampang trapezium dengan kemiringan tebing 1:2 mempunyai lebar 5,5 meter, angka kekasaran 20 mm. kedalaman untuk debit maksimum adalah H, dengan debit maksimumnya adalah 30 m^3/detik. Pada debit aliran separuh debit maksimum mempunyai kecepatan (V1 = 2,5 m/detik). Tentukan kemiringan saluran terbuka tersebut dan kedalaman maksimumnya. **(20%)**
2. Bangunan sipon saluran irigasi mengalirkan air dari kolam A ke kolam B. Debit air di kolam A adalah 15 m^3/dtk, dengan luas penampang 15 m^2. Sipon terdiri dari pipa yang terbuat dari beton yang mempunyai diameter 1,7 meter dengan panjang 250 meter. Hitung kehilangan tinggi tekanan total jika tikungan sipon mempunyai sudut $\alpha = 45°$ **(20%)**
3. Suatu monometer deferensial hasil pengujian diketahui: S1= S3= 0,83 S2= 13,6 h1= 16 cm h2= 8 cm h3= 12 cma) Tentukan PA apabila PB= 10 psib) Tentukan PB dalam m air apabila PA= 20 psi dan tekanan barometer adalah 720 mmHg. **(10%)**
4. Jelaskan perbedaan Open Channel dan Close Conduit/Pipe flow? Kemudian jelaskan jenis aliran berdasarkan waktu pemantauan, dan berdasarkan ruang pemantauan **(10%)**
5. Gorong-gorong jalan raya berbentuk lingkaran, untuk mengalirkan air sebesar 7,2 m^3/dtk hanya terisi 0,85D saja. Hitung diameter gorong-gorong tersebut jika kemiringan dasar saluran 0,0005 dan koefisien Manning 0,015. **(20%)**
6. Instalasi distribusi air direncanakan menggunakan pipa baja berdiameter 300 mm, hitung debit air yang dapat dialirkan apabila kehilangan energi yang diizinkan hanya 3,6 meter/km **(20%)**

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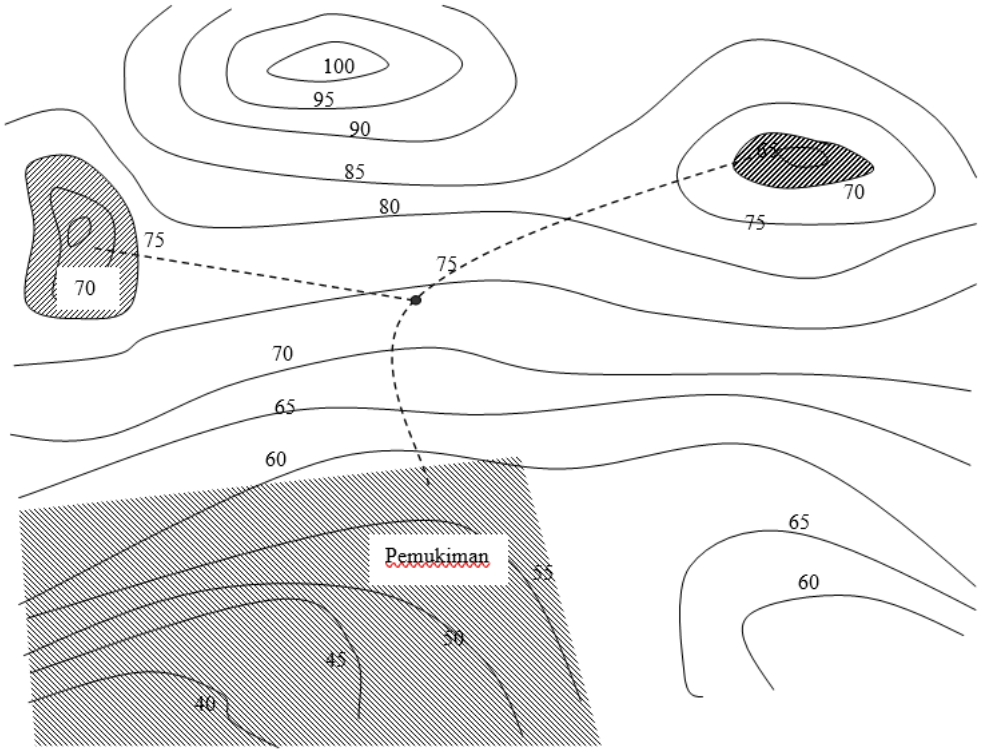
SOAL TUGAS MATA KULIAH
(Tugas Besar)

Matakuliah	:	Hidrolika
Kode/SKS	:	SIP133
Sifat Ujian	:	*Open Book*
Dosen	:	Totoh Andayono, S.T., M.T.
Waktu	:	30 Hari
Bobot nilai maksimal	:	30%

Soal:



Rencanakan jaringan pipa pada pemukiman tersebut

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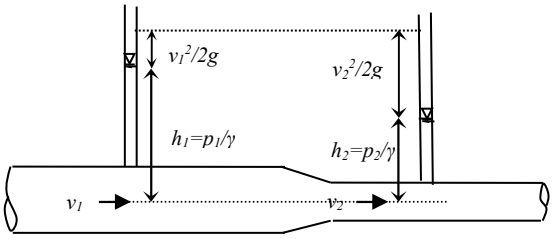
SOAL TUGAS MATA KULIAH
(QUIZ)

Matakuliah	:	Hidrolika
Kode/SKS	:	SIP133
Sifat Ujian	:	*Open Book*
Dosen	:	Totoh Andayono, S.T., M.T.
Waktu	:	180 Menit
Bobot nilai maksimal	:	Evaluasi materi (±5%)

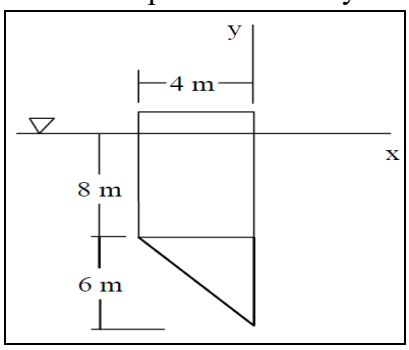
Catatan : 1 soal untuk setiap pokok bahasan

1. Sebuah tangki mempunyai lubang kecil dengan diameter 10 cm untuk mengalirkan fluida ideal. Jika tekanan pada sumbu aliran adalah sebesar 0,08 kgf/cm^2, maka hitunglah debit aliran saat H = 1,5 m.

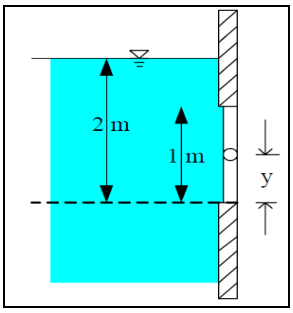
2. Suatu pipa dengan tampang mengecil, mempunyai diameter di titik A = 0,3 m dan 0,1 m di titik B. Jika diketahui debit aliran di titik A = 0,25 m^3/dt, tekanan di tampang A = 2 kgf/cm^2 dan 1 kgf/cm^2 di tampang B, maka hitunglah debit aliran dalam pipa.(g = 9,81 m/dt^2)



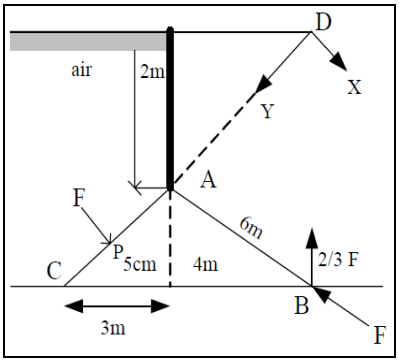
3. Tentukan gaya resultan dari air yang bekerja pada bidang vertikal seperti pada gambar. Tentukan pula titik pusat tekanan terhadap sumbu *x* dan y.



4. Tentukan letak dari sendi pada pintu berbetuk persegi empat (y) sehingga pintu akan terbuka bila tinggi muka air seperti pada gambar



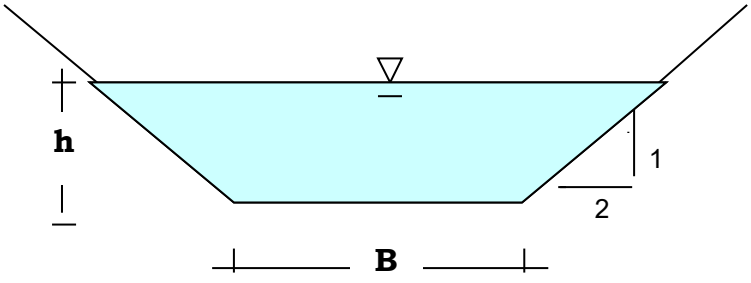
5. Suatu bendung dari pelat baja seperti pada gambar mempunyai penyangga AB tiap 5m. Tentukan besarnya gaya pada penyangga tersebut bila berat bendung diabaikan.



6. Jelaskan karakteristik dalam saluran terbuka dan gambarkan :
   a. Garis gradien hidrolik selalu sejajar dengan garis gradien energi
   b. Garis gradien energi berimpit dengan permukaan bebas
   c. Garis-garis gradien energi dan hidrolik berimpit
   d. Garis gradien hidrolik tidak pernah dapat naik
   e. Garis gradien hidrolik dan permukaan bebas berimpit

7. Jelaskan jenis aliran berdasarkan waktu pemantauan, dan berdasarkan ruang pemantauan

8. Saluran terbuka aliran seragam mempunyai bentuk seperti gambar berikut :



Hitung kedalaman aliran (h) dan lebar saluran (B) yang paling ekonomis jika saluran tersebut dapat mengalirkan air sebesar 3,5 m^3/dtk (nilai C = 50 dan $S_0 = 2 \times 10^{-4}$).