



RENCANA PEMBELAJARAN SEMESTER (RPS)
PROGRAM STUDI S1 PENDIDIKAN TEKNIK BANGUNAN
JURUSAN TEKNIK SIPIL, FAKULTAS TEKNIK, 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			
<u>Information</u>	Dean of the Faculty of Engineering	Head of the Civil Engineering Department	Study Program Coordinator Building Engineering Education			
	<u>Dr. Fahmi Rizal, M.Pd., M.T</u> NIP. 195912041985031004	<u>Faisal Ashar, Ph.D.</u> NIP. 19750103 200312 1001	<u>Drs. Revian Body, MSA.</u> NIP. 19600103 198503 1003			
Graduate Learning Outcomes	Learning Achievement of Graduate Study Programs					
	<ol style="list-style-type: none"> 1. Able to apply basic science knowledge (mathematics, natural sciences) and other multidisciplinary disciplines which become the foundation for the field of Building Engineering Vocational Education in carrying out professional work in their respective fields (Knowledge and Understanding).. <ol style="list-style-type: none"> 1.1. Able to show good understanding and implement basic mathematical concepts to solve various problems in the field of building engineering. 1.2. Have a high understanding and can implement basic concepts of physics and chemistry (natural sciences) in the field of building engineering. 1.3. Have a high understanding and can implement the basic principles of basic engineering (mechanics, engineering drawings) in the field of building engineering. 2. Able to think critically and creatively in identifying, formulating, problem-solving, 					

evaluating various problems in the field of Building Engineering Vocational Education with the most appropriate and effective scientific method (Engineering analysis, investigations and assessment).

- 2.1. Able to identify various technical problems in the field of building engineering
 - 2.2. Able to analyze various technical problems in the field of building engineering
 - 2.3. Able to evaluate various technical problems in the building sector
 - 2.4. Able to communicate Engineering Analysis, Investigation and Assessment materials to students/training.
3. Have a reliable ability in designing, implementing and supervising engineering design works.
- 3.1. Able to realize work drawings in collaboration with various related parties.
 - 3.2. Able to manage building engineering work by paying attention to environmental, social, health and safety aspects.
 - 3.1. Able to supervise the implementation of building engineering work
 - 3.2. Able to communicate Engineering Design material to students.
4. Have reliable abilities in designing, implementing and evaluating the learning process in Building Engineering Vocational Education (Education design).).
- 4.1. Able to design curriculum and learning process in building engineering.
 - 4.2. Able to implement, control, evaluate and improve the quality of the learning process
 - 4.3. Able to develop effective, efficient, and attractive learning media.
5. Having the ability to adapt and innovate to the development of science and technology and implement it into the goals of education and professional work by considering possible non-technical risks (Engineering practice).
- 5.1. Able to innovate and develop technology in the field of building engineering by considering social, economic and environmental aspects.
 - 5.2. Able to analyze environmental conditions in the planning, implementation and supervision of buildings.
 - 5.3. Implement information technology and computers into the planning, implementation, and supervision processes of buildings.

6. Having social and managerial competence, working together, communicating effectively, having entrepreneurial character, having an environmental perspective and being aware of the importance of lifelong learning (transferable and soft skills)..
- 6.1. Able to work creatively, innovatively, collaboratively, be careful, responsible, responsive to environmental changes.
- 6.2. Have curiosity, think critically, are open-minded, and objective.
- 6.3. Able to communicate effectively and work together in teamwork..

Course Learning Outcomes

Learning Achievement 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, 5.2, 6.1, 6.2, 6.3
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, 5.2, 6.1,

		6.2, 6.3
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.	
References	Utama (RU) :	
	<ol style="list-style-type: none"> 1. Bambang Triatmodjo., 1996, “<i>Hidraulika I</i>”, Beta Offset, Yogyakarta. 2. Bambang Triatmodjo., 1996, “<i>Hidraulika II</i>”, Beta Offset, Yogyakarta 3. Anggrahini., 1996, “<i>Hidrolika saluran Terbuka</i>”, CV. Citra Media, Surabaya. 4. Chow, V.T., 1992, “<i>Hidrolika saluran Terbuka</i>”, Erlangga, Jakarta 5. Douglas. J.F., Gasiorek, J.M., Swaffield, J.A., 1986 “<i>Fluid Mechanics</i>”, Longman Group Ltd, Longman House, Burnt Mill, Marlow Essex CM 20 2JE, England 6. James F. Cruise., Mohsen M. Sherif., 2007., “<i>Elementary Hydraulics</i>”, Thomson Learning, Canada 7. Maryono, A., Muth, W., Eisenhauer, N., 2002, “<i>Hidrolika Terapan</i>“, PT. Pradnya Paramita, Jakarta 8. Nalluri, C., Featherstone, R.E., 1995, “<i>Civil Engineering Hydraulics</i>”, Blackwell Science, London. 9. Simon, A.L., 1981, “<i>Practical Hydraulics</i>”, Jhon Wiley & Sons New York. 10. Strum, T.W., 2001, “<i>Open Channel Hydraulics</i>”, Mc Graw Hill, USA 	
	Pendukung (RP)	
	1. Journal of Hydraulic Engineering, ASCE Journal, https://ascelibrary.org/journal/	
Learning Media	Software:	Hardware:
	Office Word dan Excell	Komputer, LCD Projector dan Papan tulis dan perangkatnya
Team Teaching	Totoh Andayono, S.T., M.T. , Dr. Fahmi Rizal, M.Pd, M.T.	
Assessment	UTS, UAS, Tugas Besar	
Requirements Subject	---	

LESSON MATERIAL

Weeks	Competence to be achieved	Study Materials	Learning Methods and Strategies	Assignments / task	Assessment Criteria / Indicators	Reference
(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 Understanding 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

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

(7)	4. Power line and pressure line 5. Piping system: <ul style="list-style-type: none"> • 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: <ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 1. Definition of the same 		Lectures and discussions	Quiz	<ol style="list-style-type: none"> 1. Attitude 2. Knowledge 3. Skill 	1,2,3,4,5,6,7,8,9

(11)	flow and the conditions for the same flow	Streams on Open Channels				
(12)	2. Similar flow equations 3. Use of the equation: <ul style="list-style-type: none"> • The Chezy equation • The Manning equation • The Strickler Equation 					
(13)	4. Determination of the cross-sectional dimensions of the channel 5. Economic channel planning					
(14)	6. Determination of standard depth and critical slope 7. Determination of flow types from standard and critical depths					
(15)	8. Depiction of the depth in the channel 9. Equation of momentum and energy in an open channel flow.					
(15)	10. Continuity in open channel flow					
(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	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%
<u>Kehadiran</u>	:	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
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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. ($\gamma_{\text{zat cair}} = 1000 \text{ kgf/m}^3$) **(20%)**
4. Untuk mengalirkan air dari kolam 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 $10^{-6} \text{ m}^2/\text{dtk}$, 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. ($z_1 = 2,5$ m, $z_2 = 1,85$ m) **(30%)**



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SOAL UJIAN AKHIR SEMESTER

Matakuliah	: Hidrolika
Kode/SKS	: SIP133
Sifat Ujian	: <i>Open Book</i>
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 $30 \text{ m}^3/\text{detik}$. Pada debit aliran separuh debit maksimum mempunyai kecepatan ($V_1 = 2,5 \text{ m/detik}$). 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 $15 \text{ m}^3/\text{dtk}$, 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 $\alpha = 45^\circ$ **(20%)**
3. Suatu monometer deferensial hasil pengujian diketahui: $S_1 = S_3 = 0,83$ $S_2 = 13,6$ $h_1 = 16 \text{ cm}$ $h_2 = 8 \text{ cm}$ $h_3 = 12 \text{ cm}$) 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 $7,2 \text{ m}^3/\text{dtk}$ 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%)**



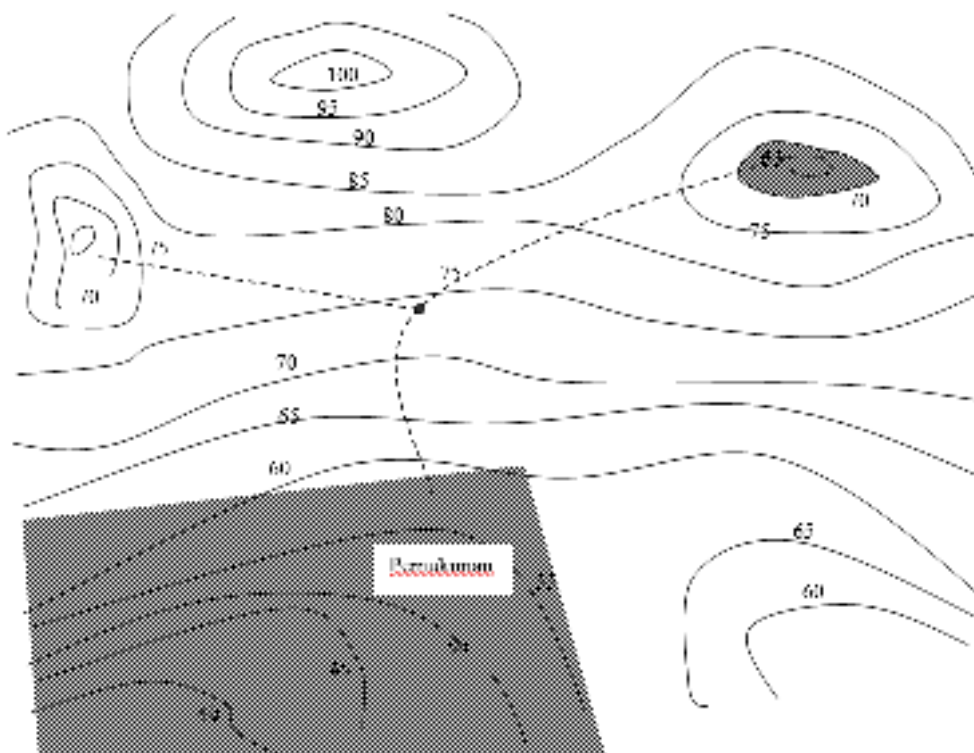
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**SOAL TUGAS MATA KULIAH
(Tugas Besar)**

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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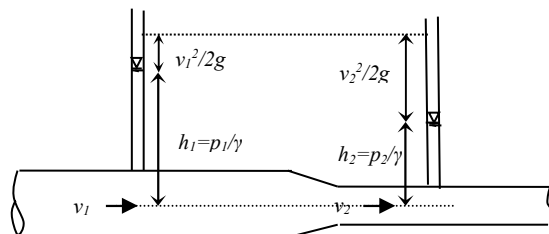
Alamat: Jl. Prof. Dr. Hamka, Kampus UNP Air Tawar, Padang 25131
Telp. (0751) 7055644, Fax (0751) 7055628, website: www.ft.unp.ac.id, e-mail: info@ft.unp.ac.id

**SOAL TUGAS MATA KULIAH
(QUIZ)**

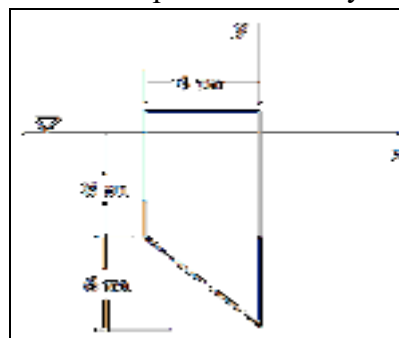
Matakuliah : Hidrolika
Kode/SKS : SIP133
Sifat Ujian : *Open Book*
Dosen : Totoh Andayono, S.T., M.T.
Waktu : 180 Menit
Bobot nilai maksimal : Evaluasi materi ($\pm 5\%$)

Catatan : 1 soal untuk setiap pokok bahasan

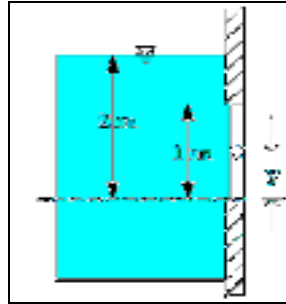
1. Sebuah tangki mempunyai lubang kecil dengan diameter 10 cm untuk mengalirkan fluida ideal. Jika tekanan pada sumbu aliran adalah sebesar $0,08 \text{ kgf/cm}^2$, maka hitunglah debit aliran saat $H = 1,5 \text{ m}$.
2. Suatu pipa dengan tampang mengecil, mempunyai diameter di titik A = 0,3 m dan 0,1 m di titik B. Jika diketahui debit aliran di titik A = $0,25 \text{ m}^3/\text{dt}$, tekanan di tampang A = 2 kgf/cm^2 dan 1 kgf/cm^2 di tampang B, maka hitunglah debit aliran dalam pipa. ($g = 9,81 \text{ m/dt}^2$)



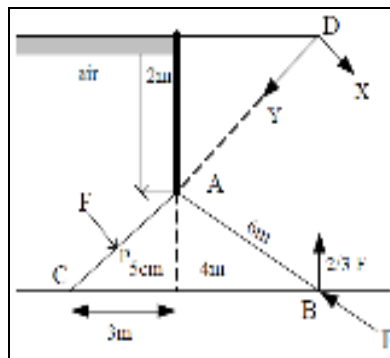
3. Tentukan gaya resultan dari air yang bekerja pada bidang vertikal seperti pada gambar. Tentukan pula titik pusat tekanan terhadap sumbu x dan y .



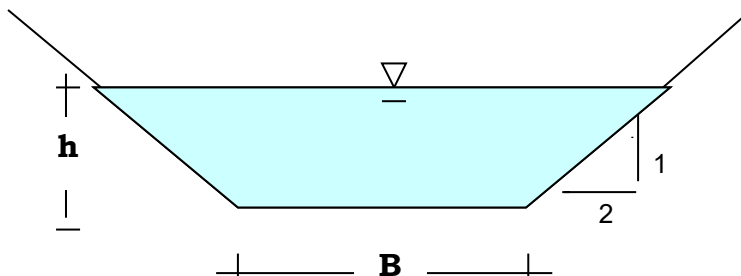
4. Tentukan letak dari sendi pada pintu berbetuk persegi empat (y) sehingga pintu akan terbuka bila tinggi muka air seperti pada gambar



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 :
- Garis gradien hidrolik selalu sejajar dengan garis gradien energi
 - Garis gradien energi berimpit dengan permukaan bebas
 - Garis-garis gradien energi dan hidrolik berimpit
 - Garis gradien hidrolik tidak pernah dapat naik
 - 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 $3,5 \text{ m}^3/\text{dtk}$ (nilai $C = 50$ dan $S_0 = 2 \times 10^{-4}$).