Vidya Jyothi Institute of Technology

(An Autonomous Institution)
(Accredited by NAAC & NBA, Approved by AICTE New Delhi & Permanently Affiliated to JNTUH)
Aziznagar Gate, C.B. Post, Hyderabad-500 075

DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION: R18

BATCH: 2019-2023

ACADEMIC YEAR: 2020 - 2021

PROGRAM: B.TECH (MECHANICAL ENGINEERING)

YEAR/SEM: II /II

COURSE NAME: MECHANICS OF FLUIDS & HYDRAULIC MACHINERY

COURSE CODE: A24311

NAME OF THE FACULTY: K.RAJESH KUMAR

DESIGNATION: Associate Professor

HOD

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Aziznagar Gate, C.B. Post, Hyderabad-500 075

DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION: R18

BATCH: 2018-2022

ACADEMIC YEAR: 2019 - 2020

PROGRAM: B.TECH (MECHANICAL ENGINEERING)

YEAR/SEM: II /II

COURSE NAME: MECHANICS OF FLUIDS & HYDRAULIC MACHINERY

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NAME OF THE FACULTY: K.RAJESH KUMAR

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DEPARTMENT OF MECHANICAL ENGINEERING

REGULATION: R15

BATCH: 2017-2021

ACADEMIC YEAR: 2018 - 2019

PROGRAM: B.TECH (MECHANICAL ENGINEERING)

YEAR/SEM: II /II

COURSE NAME: MECHANICS OF FLUIDS & HYDRAULIC MACHINERY

COURSE CODE: A14315

NAME OF THE FACULTY: K.RAJESH KUMAR

DESIGNATION: Associate Professor

HOD

COURSE FILE INDEX

PO's	STATEMENT
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO'S	STATEMENT
PSO1	Analyze and solve problems of thermal and manufacturing in thecomprehensive design of mechanical engineering components.
PSO2	An ability to design, develop and implement sustainable mechanical engineering solutions in view of environmental issues with social responsibility.

1. SYLLABUS

UNIT	TOPICS(R18)	Total No. of Hours
I	**FLUID PROPERTIES AND FLUID STATICS**: Density, Specific weight,specific gravity, viscosity, vapour pressure, Compressibility surface tension-Pressure at a point, Pascal's Law, Pressure variation with temperature,density and altitude, Hydrostatic law- Piezometer, Simple and differential manometers.	10
II	**FLUID KINEMATICS:** Stream line, path line and streak lines, stream tube, classification of flows, steady,unsteady, uniform, non uniform, laminar, turbulent, rotational, irrotational flows, one, two and three dimensional flow. **FLUID DYNAMICS:** Surface and body forces,Euler's and Bernoulli's equations derivations Applications of Bernoulli's equations: Venturimeter, Orifice meter, Pitot tube Navier stoke's Equations(Explanation only), momentum equation and its application	8
III	**CLOSED CONDUIT FLOW:** Reynolds's experiment, Darcy equation, Minor losses in pipes - pipes in series and pipes in parallel, total energy line and hydraulic gradient line, numerical Problems **BOUNDARY LAYER CONCEPTS:** Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (no derivation) boundary layer in transition and separation of boundary layer, submerged objects – drag and lift.	14
IV	**IMPACT OF WATER JETS:** Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and a tip, velocity triangles at inlet and outlet expressions for work done and efficiency, Series vanes, Radial flow vanes. **HYDRAULIC TURBINES:** Overshot and undershot water wheels, Classification of water turbines, Pelton wheel, work done and working proportions. Francis turbine and Kaplan turbine, draft tubes, types & its efficiency. **PERFORMANCE OF HYDRAULIC TURBINES:** Performance under unit head, unit quantities, Performance under specific conditions, specific speed, performance characteristic curves, model testing turbines, Cavitation, Governing of turbines, surge tank, water hammer.	20
V	**CENTRIFUGAL PUMPS:** Types of component parts and working, work done by the impeller, manometric head losses and efficiencies, minimum starting speed, loss of head due to reduced or increased flow, diameters of impeller and pipes, specific speed, Model testing of pumps, Multistage pumps, Pumps in parallel, Performance of pumps, characteristic curves, NPSH, cavitation, priming devices, pump troubles and remedies	12

	RECIPROCATING PUMPS: Main components and working of a reciprocating pump, types of reciprocating pumps, power required driving the pump, coefficient of discharge and slipping indicator diagram	
	Total Hours	64

COURSE PRE-REQUISITES: Mathematics, Engineering Mechanics, Strength of Materials, Workshop Processes and Engineering Drawing.

UNIT	TOPICS(R15)	Total No. of Hours
I	**FLUID STATICS**: Dimensions and units: physical properties of fluids-specific gravity, viscosity surface tension- vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure –measurement of pressure- Piezometer, U-tube and differential manometers.	10
II	**FLUID KINEMATICS:** Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow & three dimensional flow. **FLUID DYNAMICS:** Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.	8
III	**CLOSED CONDUIT FLOW:** Reynolds's experiment - Darcy Weisbach equation- Minor losses in pipes - pipes in series and pipes in parallel - total energy line- hydraulic gradient line. Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle. **BOUNDARY LAYER CONCEPTS:** Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (no derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.	14
IV	**BASICS OF TURBO MACHINERY:** Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes. **HYDRAULIC TURBINES:** Classification of turbines, heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design –draft tube theory- functions and efficiency. **PERFORMANCE OF HYDRAULIC TURBINES:** Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, Cavitation, surge tank, water hammer.	20
V	**CENTRIFUGAL PUMPS:** Classification, working, work done – baromertic head- losses and efficiencies- specific speed -performance characteristic curves, NPSH. **RECIPROCATING PUMPS:** Working, Discharge, slip, indicator diagrams	12
	Total Hours	64

COURSE PRE-REQUISITES: Mathematics, Engineering Mechanics, Strength of Materials, Workshop Processes and Engineering Drawing.

2.TEXT BOOKS & OTHER REFERENCES

S. NO.	TITLES(R18)
TEXT BOOKS:	
1	Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH, Rajsons Publications
2	Fluid Mechanics, John F.Douglas, Jansuz M.Gasiorek, John A. Swaffield, Lynne B.Jack,Pearson
3	Fluid Mechanics F.M.White, Mc Graw Hill.
REFERENCE BOOKS:	
1	Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2	Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3	Hydraulic Machines by Banga & Sharma, Khanna Publishers.
	Web References: http://nptel.ac.in/courses/112105125/28 https://ocw.mit.edu/courses

3. TIME TABLE

DEPARTMENT OF MECHANICAL ENGINEERING				
TIME TABLE FOR ONLINE COURSES				
ACADEMIC YEAR 2020-21 SECTION - A				
DAY	**9:30-10:30**	**10:40-11:40**	**11:50-12:50**	**02:00-03:00**
MON	KOM	BEE	PS	MFHM
TUE	TE	KOM	BEE	PS
WED	MFHM	TE	KOM	MD
THU	BEE	MFHM	TE	GS
FRI	PS	BEE	MD	KOM
SAT	MD	PS	MFHM	TE

SL.NO	SUBJECT	FACULTY
1	THERMAL ENGINEERING	Mr. K.NARENDRA REDDY
2	KINEMATICS OF MACHINES	Mrs G.SRAVYA
3	MECHANICS OF FLUIDS AND HYDRAULIC	Mr. HASAN
4	MACHINE DRAWING AND DRAFTING	Mr. T.PAVAN
5	BASIC ELECTICAL ENGINEERING	Mr.M.VIJAY KUMAR
6	PROBABILITY AND STATISTICS	Dr. R.RAMAKRISHNA
7	GENDER SENSITIZATION	Mrs. J.SRIDEVI
	MFHM LAB	Mr. HASAN
	BEE LAB	Mr.M.VIJAY KUMAR

H.O.D

DEPARTMENT OF MECHANICAL ENGINEERING				
TIME TABLE FOR ONLINE COURSES				
ACADEMIC YEAR 2020-21 SECTION - B				
DAY	**9:30-10:30**	**10:40-11:40**	**11:50-12:50**	**02:00-03:00**
MON	KOM	PS	MD	MFHM
TUE	TE	KOM	PS	BEE
WED	MFHM	TE	KOM	GS
THU	BEE	MFHM	TE	MD
FRI	MD	PS	BEE	KOM
SAT	PS	BEE	MFHM	TE

SL.NO	**SUBJECT**	**FACULTY**
1	THERMAL ENGINEERING	Mr.K.ASHOKACHARY
2	KINEMATICS OF MACHINES	Mr. S.VENKATESH
3	MECHANICS OF FLUIDS AND HYDRAULIC M	Mr.K. RAJESH KUMAR
4	MACHINE DRAWING AND DRAFTING	Mr. T.PAVAN
5	BASIC ELECTICAL ENGINEERING	MrS.A.SRILATHA
6	PROBABILITY AND STATISTICS	Dr. R.RAMAKRISHNA
7	GENDER SENSITIZATION	Mrs. J.SRIDEVI
	MFHM LAB	Dr.Dileep Kumar Sahu
	BEE LAB	MrS.A.SRILATHA

H.O.D

DEPARTMENT OF MECHANICAL ENGINEERING				
TIME TABLE FOR ONLINE COURSES				
ACADEMIC YEAR 2020-21 SECTION - C				
DAY	**9:30-10:30**	**10:40-11:40**	**11:50-12:50**	**02:00-03:00**
MON	KOM	PS	BEE	MFHM
TUE	TE	KOM	GS	BEE
WED	MFHM	TE	KOM	PS
THU	PS	MFHM	TE	MD
FRI	BEE	PS	MD	KOM
SAT	MD	BEE	MFHM	TE
SL.NO	**SUBJECT**			**FACULTY**
1	THERMAL ENGINEERING			Mr.K. RAVI KUMAR
2	KINEMATICS OF MACHINES			Mr. C.NAVEEN RAJ
3	MECHANICS OF FLUIDS AND HYDRAULIC M			Mr.CH.RAKESH
4	MACHINE DRAWING AND DRAFTING			Mr.N. PRAVEEN KUMAR
5	BASIC ELECTICAL ENGINEERING			Mr.M.VIJAY KUMAR
6	PROBABILITY AND STATISTICS			Mrs. FOUZIA TABASSUM
7	GENDER SENSITIZATION			Miss. J.SRIDEVI
		MFHM LAB		Mr.CH.RAKESH
		BEE LAB		Mr.M.VIJAY KUMAR

H.O.D

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

ACADEMIC YEAR 2020-21 B.TECH III-II SEM

TIME TABLE FOR ONLINE CLASSES--SECTION A

DAY	TIMINGS	COURSE NAME	FACULTY NAME
MON	9:30-10:30AM	Design of Machine Members-II	Dr.VV Satyanarayana
	10:45-11:45 AM	Heat Trasfer	Mr.Chirra Ravi
	12:00-1:00 PM	Finite Element Method	Dr.G. Sreeram Reddy
	2.00-3.00 PM	Refrigeration And Air Conditioning	Mr.Ismael
TUE	9:30-10:30AM	Metrology & Machine Tools	Dr.V.Phanindra
	10:45-11:45 AM	Finite Element Method	Dr.G. Sreeram Reddy
	12:00-1:00 PM	**** OPEN ELECTIVE ****	
	2.00-3.00 PM	Personality Development And Behavioral skills	Dr.Padma venkat
WED	9:30-10:30AM	Production Planning & Control	Mr.S.Ramakrishna
	10:45-11:45 AM	Refrigeration And Air Conditioning	Mr.Ismael
	12:00-1:00 PM	**** OPEN ELECTIVE ****	
	2.00-3.00 PM	Metrology & Machine Tools	Dr.V.Phanindra
THU	9:30-10:30AM	Design of Machine Members-II	Dr.VV Satyanarayana
	10:45-11:45 AM	Heat Trasfer	Mr.Chirra Ravi
	12:00-1:00 PM	**** OPEN ELECTIVE ****	
	2.00-3.00 PM	Finite Element Method	Dr.G. Sreeram Reddy
FRI	9:30-10:30AM	Production Planning & Control	Mr.S.Ramakrishna
	10:45-11:45 AM	Metrology & Machine Tools	Dr.V.Phanindra
	12:00-1:00 PM	Heat Trasfer	Mr.Chirra Ravi
	2.00-3.00 PM	Design of Machine Members-II	Dr.VV Satyanarayana
SAT	9:30-10:30AM	Refrigeration And Air Conditioning	Mr.Ismael
	10:45-11:45 AM	Heat Trasfer	Mr.Chirra Ravi
	12:00-1:00 PM	Personality Development And Behavioral skills	Dr.Padma venkat
	2.00-3.00 PM	Production Planning & Control	Mr.S.Ramakrishna
		HT LAB	C.L.Sindhuja/Dr. Dareddy Ramana Reddy
		MMT LAB	Dr.V.Phanindra/Mr.Ismael

HOD

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MECHANICAL ENGINEERING DEPARTMENT

TIMETABLE 2019-20 w.e.f. 09-12-2019

II B.Tech II Sem

SECTION-A

TIME/ DAY	9.00- 9.55	9.55- 10.50	10.50- 11.45	11.45- 12.30	12.30- 01.25	01.25- 02.20	02.20- 03.15	03.15- 04.05
MON	BEE	PS	KOM		TE	MFHM	GS	SAE
TUE	MFHM	BEE	TE		KOM	PS	VAC/GUEST LEC	
WED	KOM	TE	BEE		MFHM	MD&D		
THU	PS	KOM	MFHM		BEE	MFHM/BEE LAB		
FRI	MFHM/BEE LAB				TE	KOM	PS	BEE
SAT	TE	MFHM	PS		GS	MD&D		

SL.NO	SUBJECT	FACULTY
1	THERMAL ENGINEERING	Mr.K. RAVI KUMAR
2	KINEMATICS OF MACHINES	Mr.S. VENKATESH
3	MECHANICS OF FLUIDS AND HYDRAULIC MACHINES	Mr.C. NAVEEN RAJ
4	MACHINE DRAWING AND DRAFTING	Mr.T. PAVAN KUMAR/ Mr.RAMAKANTH
5	BASIC ELECTICAL ENGINEERING	S.CHAITANYA
6	PROBABILITY AND STATISTICS	ANURADHA
7	MECHANICS OF FLUIDS AND HYDRAULIC MACHINES-LAB	S.Prasad/ Mr.J.PRADEEPKUMAR
8	BASIC ELECTICAL ENGINEERING-LAB	S.CHAITANYA
9	GENDER SENSITIZATION	SUNEETHA
10	VALUE ADDED COURSE - II (VAC-II)	Mr.S. VENKATESH
11	SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)	Mr.C. NAVEEN RAJ

H.O.D

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MECHANICAL ENGINEERING DEPARTMENT

TIMETABLE 2019-20 w.e.f. 09-12-2019

II B.Tech II Sem

SECTION-B

TIME/DAY	9.00- 9.55	9.55- 10.50	10.50-11.45	11.45-12.30	12.30-01.25	01.25-02.20	02.20-03.15	03.15-04.05
MON	TE	KOM	KOM		BEE	PS	MFHM	SAE
TUE	PS	TE	BEE		MFHM	KOM	VAC/GUEST LEC	
WED	MFHM	TE	BEE		GS	MFHM/BEE LAB		
THU	MD&D				TE	BEE	GS	PS
FRI	KOM	PS	MFHM		TE	MD&D		
SAT	MFHM/BEE LAB				PS	MFHM	BEE	KOM

SL.NO	SUBJECT	FACULTY
1	THERMAL ENGINEERING	Mr.K.ASHOKACHARY
2	KINEMATICS OF MACHINES	Ms.P. PAVANI
3	MECHANICS OF FLUIDS AND HYDRAULIC MACHINES	Mr.K. RAJESH KUMAR
4	MACHINE DRAWING AND DRAFTING	S.Prasad/ Mr.J.PRADEEPKUMAR
5	BASIC ELECTICAL ENGINEERING	Mr.L.RAJU
6	PROBABILITY AND STATISTICS	Mrs. FOUSIA
7	MECHANICS OF FLUIDS AND HYDRAULIC MACHINES-LAB	Mr.K.RAJESH KUMAR/Dr.B.PHANINDRA
8	BASIC ELECTICAL ENGINEERING-LAB	Mr.L.RAJU
9	GENDER SENSITIZATION	SUNEETHA
10	VALUE ADDED COURSE - II (VAC-II)	Mr.S. VENKATESH
11	SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)	Mr.C. NAVEEN RAJ

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MECHANICAL ENGINEERING DEPARTMENT

TIMETABLE 2019-20 **w.e.f. 09-12-2019**

II B.Tech II Sem **SECTION-C**

TIME/ DAY	9.00- 9.55	9.55- 10.50	10.50- 11.45	11.45- 12.30	12.30- 01.25	01.25- 02.20	02.20- 03.15	03.15- 04.05
MON	MFHM	TE	KOM		PS	MD&D		
TUE	KOM	PS	TE		MFHM	BEE	VAC/GUEST LEC	
WED	MFHM/BEE LAB				BEE	MFHM	KOM	GS
THU	TE	BEE	MFHM		GS	KOM	PS	SAE
FRI	PS	KOM	BEE		TE	MFHM/BEE LAB		
SAT	MD&D				BEE	PS	MFHM	TE

SL.NO	SUBJECT	FACULTY
1	THERMAL ENGINEERING	Mr.K. NARENDRA REDDY
2	KINEMATICS OF MACHINES	Mr.M. MALLESH
3	MECHANICS OF FLUIDS AND HYDRAULIC MACHINES	Mr.CH.RAKESH
4	MACHINE DRAWING AND DRAFTING	Mr.N. PRAVEEN KUMAR/ Mr.S.VENKATESH
5	BASIC ELECTICAL ENGINEERING	K.SWAPNA
6	PROBABILITY AND STATISTICS	Mrs. FOUSIA
7	MECHANICS OF FLUIDS AND HYDRAULIC MACHINES-LAB	Mr.CH.RAKESH/ Mr.M.MALLESH
8	BASIC ELECTICAL ENGINEERING-LAB	K.SWAPNA
9	GENDER SENSITIZATION	MOUNIKA
10	VALUE ADDED COURSE - II (VAC-II)	Mr.S. VENKATESH
11	SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)	Mr.C. NAVEEN RAJ

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MECHANICAL ENGINEERING DEPARTMENT

TIMETABLE 2019-20 **w.e.f. 09-12-2019**

II B.Tech II Sem

SECTION-D

TIME/ DAY	9.00- 9.55	9.55- 10.50	10.50- 11.45	11.45- 12.30	12.30- 01.25	01.25- 02.20	02.20- 03.15	03.15- 04.05
MON	KOM	PS	BEE		TE	MFHM/BEE LAB		
TUE	MD&D				MFHM	KOM	VAC/GUEST LEC	
WED	GS	MFHM	TE		BEE	PS	KOM	SAE
THU	TE	MFHM	PS		BEE	MD&D		
FRI	MFHM	MFHM	KOM		PS	TE	BEE	GS
SAT	PS	KOM	BEE		TE	MFHM/BEE LAB		

SL.NO	SUBJECT	FACULTY
1	THERMAL ENGINEERING	Mrs.C.L.SINDUJA
2	KINEMATICS OF MACHINES	Ms.G. SRAVYA
3	MECHANICS OF FLUIDS AND HYDRAULIC MACHINES	Mr.HASAN
4	MACHINE DRAWING AND DRAFTING	Dr.G. SREERAM REDDY/ Mr.T.PAVAN KUMAR
5	BASIC ELECTICAL ENGINEERING	Mr.B.RAJESH
6	PROBABILITY AND STATISTICS	Mr.SADANANDAM
7	MECHANICS OF FLUIDS AND HYDRAULIC MACHINES-LAB	Mr.HASAN/S.Ramakrishna
8	BASIC ELECTICAL ENGINEERING-LAB	Mr.B.RAJESH
9	GENDER SENSITIZATION	MOUNIKA
10	VALUE ADDED COURSE - II (VAC-II)	Mr.S. VENKATESH
11	SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)	Mr.C. NAVEEN RAJ

H.O.D

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY
MECHANICAL ENGINEERING DEPARTMENT
TIME TABLE 2018 - 19

II B.Tech II Sem

SECTION-A

TIME/ DAY	9.00- 10.00	10.00- 11.00	11.00- 12.00	12.00- 01.00	01.00- 01.45	01.45- 02.45	02.45- 03.45
MON	IPR	PT	FMHM	KOM	BREAK		
TUE	TE-I	P&S	FMHM	PT	BREAK	TE-I	P&S
WED	P&S	KOM	TE-I	PT	BREAK	MD	MD
THU	FMHM	TE-I	PT/FMHM LAB	PT/FMHM LAB	BREAK	MD	MD
FRI	PT	IPR	PT/FMHM LAB	PT/FMHM LAB	BREAK	P&S / KOM	KOM / FMHM

SL.NO	SUBJECT	FACULTY
1	PRODUCTION TECHNOLOGY	Dr V.V. SATYANARANA/Mr.A.Subba Rao
2	THERMAL ENGINEERING-I	Mr.K NARENDRA REDDY
3	KINEMATICS OF MACHINERY	Mr. NAVEEN RAJ
4	FLUID MECHANICS & HYDRAULIC MACHINERY	Mr. HASAN
5	MACHINE DRAWING	Syeda Saniya Fatima
6	PROBABILITY & STATISTICS	Ms. ANURADHA
7	IPR CYBER LAWS	Dr KVR SATYAKUMAR
8	PRODUCTION TECHNOLOGY LAB	Dr Dileep Kumar Sahu/Mr. NAVEEN RAJ
9	FMHM LAB	Dr.B. Ramesh Babu/Mr. HASAN

H.O.D

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY
MECHANICAL ENGINEERING DEPARTMENT
TIMETABLE 2018 - 19
SECTION-B

II B.Tech II Sem

TIME/ DAY	9.00- 10.00	10.00- 11.00	11.00- 12.00	12.00- 01.00	01.00- 01.45	01.45- 02.45	02.45- 03.45
MON	FMHM	P&S	PT/FMHM LAB		BREAK		
TUE	TE-I	FMHM	KOM	IPR		MD	
WED	P&S	KOM	TE-I	PT		PT	P&S
THU	KOM	FMHM	MD			PT/FMHM LAB	
FRI	IPR	TE-I	FMHM	PT		PT	TE-I
						P&S	KOM

SL.NO	SUBJECT	FACULTY
1	PRODUCTION TECHNOLOGY	Dr PHANENDRA/Mr.A.Subba Rao
2	THERMAL ENGINEERING-I	Ms. SINDHUJA
3	KINEMATICS OF MACHINERY	Ms. PAVANI
4	FLUID MECHANICS & HYDRAULIC MACHINERY	Mr. K RAJESH
5	MACHINE DRAWING	Mr. NAVEEN RAJ /Mr. S VENKATESH
6	PROBABILITY & STATISTICS	Ms. SRIDEVI
7	IPR CYBER LAWS	Dr KVR SATYAKUMAR
8	PRODUCTION TECHNOLOGY LAB	Dr Dileep Kumar Sahu/Mr. PAVAN KUMAR
9	FMHM LAB	Dr.B. Ramesh Babu/Mr. K RAJESH

H.O.D

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY
MECHANICAL ENGINEERING DEPARTMENT
TIMETABLE 2018 - 19
SECTION-C

II B.Tech II Sem

TIME/ DAY	9.00- 10.00	10.00- 11.00	11.00- 12.00	12.00- 01.00	01.00- 01.45	01.45- 02.45	02.45- 03.45
MON	IPR	KOM	P&S	PT			
TUE	FMHM	TE-I	PT/FMHM LAB		BREAK	TE-I	FMHM
WED	TE-I	FMHM	MD		LUNCH	PT	KOM
THU	P&S	PT	KOM	FMHM		KOM	P&S
FRI	PT	IPR	TE-I	P&S		PT/FMHM LAB	
						MD	

SL.NO	SUBJECT	FACULTY
1	PRODUCTION TECHNOLOGY	Mr. SAMPATH KUMAR/Mr.A.Subba Rao
2	THERMAL ENGINEERING-I	Mr. K ASHOKACHARY
3	KINEMATICS OF MACHINERY	Mr. VIRAJEE
4	FLUID MECHANICS & HYDRAULIC MACHINERY	Mr. K RAJESH
5	MACHINE DRAWING	Mr. PRAVEEN / Syeda Saniya Fatima
6	PROBABILITY & STATISTICS	Ms. FAUZIA TABASSUM
7	IPR CYBER LAWS	Mr. P SUMAN
8	PRODUCTION TECHNOLOGY LAB	Dr. Dareddy Ramana Reddy/Mr. SAMPATH KUMAR
9	FMHM LAB	G.Ambika/Mr.J.PRADEEP KUMAR

H.O.D

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY
MECHANICAL ENGINEERING DEPARTMENT
TIMETABLE 2018-19
SECTION-D

II B.Tech II Sem

TIME/ DAY	9.00- 10.00	10.00- 11.00	11.00- 12.00	12.00- 01.00	01.00- 01.45	01.45- 02.45	02.45- 03.45
MON	TE-I	KOM	FMHM	PT	BREAK		
TUE	P&S	FMHM	TE-I	KOM	LUNCH	PT/FMHM LAB	
WED	PT	P&S	KOM	IPR		PT/FMHM LAB	
THU	KOM	TE-I	PT	P&S		TE-I	FMHM
FRI	IPR	FMHM	MD			MD	
						P&S	PT

SL.NO	SUBJECT	FACULTY
1	PRODUCTION TECHNOLOGY	Mr.RAGHU RAMI REDDY/Mr.A.Subba Rao
2	THERMAL ENGINEERING-I	Mr. RAVI KUMAR
3	KINEMATICS OF MACHINERY	Mr. VENKATESH
4	FLUID MECHANICS & HYDRAULIC MACHINERY	Mr. NAVEEN RAJ
5	MACHINE DRAWING	Mr. PAVAN / Mr. PRAVEEN
6	PROBABILITY & STATISTICS	Ms. FAUZIA TABASSUM
7	IPR CYBER LAWS	Mr. P SUMAN
8	PRODUCTION TECHNOLOGY LAB	Dr. Dareddy Ramana Reddy/Ms. P.PAVANI
9	FMHM LAB	G.Ambika/Mr. RAVI KUMAR

H.O.D

4.PROGRAM OUTCOMES(PO'S) & PROGRAM SPECIFIC OUTCOMES (PSO'S)

PO's	STATEMENT
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO'S	STATEMENT
PSO1	Analyze and solve problems of thermal and manufacturing in thecomprehensive design of mechanical engineering components.
PSO2	An ability to design, develop and implement sustainable mechanical engineering solutions in view of environmental issues with social responsibility.

PO's	STATEMENT
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
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PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
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PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO'S	STATEMENT
PSO1	An ability to analyze and solve manufacturing engineering problems and employing reverse engineering techniques for the design of mechanical engineering components.
PSO2	An ability to design, develop and implement sustainable mechanical engineering solutions in view of environmental issues with social responsibility.

5. COURSE OBJECTIVES & COURSE OUTCOMES (CO'S)

R18

Course Outcomes:

At the end of the course, the students should be able to:

CO1	Understand fluid properties and fluid statics.
CO2	Understand the principles of flow and energy momentum equations.
CO3	Analyze the losses in pipe flow, boundary layer, separation of flows, forces on different vanes. Able to quantify the flow of fluid in flow measurement instruments.
CO4	Understand the working of hydraulic machinery and analyze their characteristic curves.
CO5	Appreciate the working principles of pumps and their applications.

R15

Course Outcomes:

At the end of the course, the students should be able to:

CO1	Model the real life situations with mathematical models. Understand the concept of linear programming.
CO2	Solve transportation and assignment problems.
CO3	Formulate the sequencing of jobs on machines. Understand the various replacement concepts.
CO4	Identify and apply various inventory models.
CO5	Apply queuing and dynamic programming models.

6. MAPPING OF COURSE OUTCOMES (CO'S) WITH PROGRAM OUTCOMES (PO'S) & PROGRAM SPECIFIC OUTCOMES (PSO'S)

R18

Co's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1		1	1	1		1	1	1
CO2	3	3	3	2	2	1		1	1	1	1	1	1	2
CO3	3	3	3	2	1	1		1	1	1	1	2	1	1
CO4	3	3	3	2	2	1		1	1	1	1	1	1	2
CO5	3	3	3	2	2	1		1	2	1	1	1	1	2
Avg.	**3**	**2.8**	**2.8**	**1.5**	**1.6**	**1**		**1**	**1.2**	**1**	**0.8**	**1.2**	**1**	**1.6**

Note: Low-1, Medium-2, High-3

R15

CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	1	1	1	1	1	1	1		1	1	1
CO2	3	3	2	1	2	1	1	1	1	1		1	1	2
CO3	2	3	2	1	1	1	1	1	1	1		2	1	1
CO4	2	3	2	1	2	1	2	1	1	1		1	1	2
CO5	3	3	2	1	2	1		1	2	1		1	1	2
	2.6	**2.8**	**2.2**	**1**	**1.6**	**1**	**1**	**1**	**1.2**	**1**		**1.2**	**1**	**1.6**

Note: Low-1, Medium-2, High-3

7. ACADEMIC CALENDAR

Vidya Jyothi Institute of Technology (Autonomous)

(Accredited by NAAC & NBA, Approved By A.I.C.T.E., New Delhi, Permanently Affiliated to JNTU, Hyderabad)
(Aziz Nagar, C.B.Post, Hyderabad -500075)

II, III & IV B. Tech I Semester Academic Calendar for the Academic year 2020-21

Department of Mechanical Engineering

II/III/IV YEAR I SEMESTER		Commencement of Class Work 13.07.2020	
I Spell of Instruction	13-07-2020	19-09-2020	10 Weeks
Mini Projects	Aug 2020 (I Review),Sep 2020(I Review)		
I Mid Examinations	21-09-2020	26-09-2020	1 Week
II Spell of Instruction	28-09-2020	16-10-2020	3 Weeks
Dussehra Holidays	17-10-2020	25-10-2020	9 Days
II Spell of Instruction Continuation	26-10-2020	14-11-2020	3 Weeks
Events organized(STTP)	Jan 2021		
Internships	Jan 2021 Mar 2021		
II Mid Examinations	16-11-2020	21-11-2020	1 Week
Preparation & Practical Examination	23-11-2020	28-11-2020	1 Week
III Mid Examinations	01-12-2020	03-12-2020	3 days
End Semesiter Examinations	04-12-2020	19-12-2020	2 Weeks
II/III/IV YEAR II SEMESTER		Commencement of Class Work 30-03-2021	
I Spell of Instruction	30-03-2021	12-06-2021	11 Weeks
Major Projects	April-2021 (I Review) May- 2021(II Review) June- 2021(III Review) July -2021 (Final Review)		
I Mid Examinations	14-06-2021	22-06-2021	8 Days
II Spell of Instruction	23-06-2021	14-08-2021	8 Weeks
II Mid Examinations	16-08-2021	19-08-2021	4 Days
Preparation & Practical Examination	20-08-2021	24-08-2021	4 Days
Betterment Examinations	25-08-2021	28-08-2021	4 Days
End Semester Examinations	30-08-2021	18-09-2021	3Weeks

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(Aziz Nagar, C.B.Post, Hyderabad -500075)

II/III/IV B.Tech I & II Semester Academic Calendar for the Academic Year 2019-20

II/III/IV YEAR I SEMESTER		**Commencement of Class Work 17.06.2019**	
	From	**To**	**Duration**
I Spell of Instruction	17.06.2019	10.08.2019	8 WEEKS
I Mid Examinations	13.08.2019	17.08.2019	4 DAYS
II Spell of Instruction	19.08.2019	05.10.2019	7 WEEKS
Dussehra Holidays	07.10.2019	12.10.2019	1 WEEK
II Spell of Instruction Continuation	14.10.2019	19.10.2019	1 WEEK
II Mid Examinations	21.10.2019	24.10.2019	4 DAYS
Practical Examinations	25.10.2019	29.10.2019	4 DAYS
Betterment Examinations	30.10.2019	01.11.2019	3 DAYS
End Semester Examinations	02.11.2019	18.11.2019	2 WEEKS
Supplementary Examinations	19.11.2019	04.12.2019	2 WEEKS
II/III/IV YEAR II SEMESTER		**Commencement of Class Work 02.12.2019**	
I Spell of Instruction	02.12.2019	10.01.2020	6 WEEKS
Pongal Holidays	11.01.2020	15.01.2020	5 DAYS
Technical/Sports fest	16.01.2020	18.01.2020	3 DAYS
I Spell of Instruction Continuation	20.01.2020	01.02.2020	2 WEEKS
I Mid Examinations	03.02.2020	08.02.2020	1 WEEK
II Spell of Instruction	10.02.2020	04.04.2020	8 WEEKS
II Mid Examinations	06.04.2020	09.04.2020	4 DAYS
Practical Examinations	13.04.2020	17.04.2020	4 DAYS
Betterment Examinations	18.04.2020	22.04.2020	4 DAYS
End Semester Examinations	23.04.2020	08.05.2020	2 WEEKS
Supplementary Examinations	11.05.2020	23.05.2020	2 WEEKS
Commencement of classes will be from			

DIRECTOR

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Revised Academic Calendar for II, III & IV B.Tech II Semester for the Year 2018-19

SECOND SEMESTER	Commencement of Class work : 17-12-2018		
	FROM	TO	DURATION
I Spell of Instruction	17-12-2018	11-01-2019	3 Weeks 5 Days
Sankranthi Holidays	12-01-2019	16-01-2019	5 Days
I Spell of Instruction Continuation	17-01-2019	16-02-2019	4 Weeks 3 Days
I Mid Examinations	18-02-2019	23-02-2019	6 Days
II Spell of Instruction	25-02-2019	20-04-2019	8 Weeks
II Mid Examinations	22-04-2019	25-04-2019	4 Days
Practical Examinations	26-04-2019	30-04-2019	4 Days
Betterment Examination	01-05-2019	03-05-2019	3 Days
End Semester Examinations	04-05-2019	18-05-2019	2 Weeks
Supplementary Exams/ Summer Vacation	20-05-2019	29-06-2019	6 Weeks
Commencement of class work for II/III/IV Year I Semester will begin on 01-07-2019			

DIRECTOR

8. TEACHING SCHEDULE

Lecture No. as per period	Topic(R18)
UNIT-I	**FLUID PROPERTIES AND FLUID STATICS**
LH1	Introduction
LH2	Properties of fluids &Viscosity
LH3	Properties of surface tension & capillarity
LH4	Vacuum Pressure, Gauge pressure & Atmospheric pressure
LH5	Measurement of Pressure
LH6	Pascal Law
LH7	Pressure measuring Instruments
LH8	Peizometer & Manometer and Inclined Manometer
LH9	U-tube Manometer & Inverted U-tube Manometer
LH10	Tutorial
UNIT-II	**FLUID KINEMATICS & FLUID DYNAMICS**
LH11	Introduction to fluid kinematics
LH12	Types of fluid flow
LH13	Continuity equation
LH14	Introduction to surface force & Body force
LH15	Euler's Equation of fluid flow
LH16	Bernoulli's Equation of fluid flow
LH17	Force exerted by a pipe bend
LH18	Tutorial
UNIT-III	**CLOSED CONDUIT FLOW**
LH19	Reynold's experiment and Major losses and Minor Losses in Pipe flow
LH20	Total energy Line & Hydraulic gradient Line
LH21	Pipes in Series and parallel & compound Pipes
LH22	Measurement of flow velocity, discharge by using the Venturimeter
LH23	Measurement of flow velocity, discharge by using the Orifice meter
LH24	Measurement of flow velocity by using Pitot static tube

UNIT-III	**BOUNDARY LAYER CONCEPTS**
LH25	Introduction to Boundary Layer
LH26	Characteristics along thin plate of Laminar flow
LH27	Thickness of boundary layers for Displacement thickness
LH28	Thickness of boundary layers for Energy thickness & Momentum thickness
LH29	Characteristics along thin plate of Turbulent boundary layers
LH30	Separation of boundary layer
LH31	Force of layers through Drag & Lift
LH32	Tutorial
UNIT-IV	**IMPACT OF WATER JETS**
LH33	Force of jets on vertical stationary vanes
LH34	Force of jets on inclined stationary vanes
LH35	Force of jets on curved stationary vanes
LH36	Force of jets on moving vertical vanes
LH37	Force of jets on moving Inclined vanes and curved vanes
LH38	Force of jets striking at the tips of the curved vane, Velocity Diagram with work done
LH39	Force of jet striking series of vanes & Efficiency of series vanes
LH40	Force of jet striking Radial curved vanes
LH41	Efficiency of Radial curved vanes
LH42	Tutorial
UNIT-IV	**HYDRAULIC TURBINES**
LH43	Introduction to Hydraulic turbines
LH44	Types of heads available
LH45	Types of efficiencies of Hydraulic turbines
LH46	Classifications of turbines
LH47	Velocity diagrams ,work done & efficiency of Pelton wheel turbine
LH48	Velocity diagrams ,work done & efficiency of Inward flow reaction turbine
LH49	Velocity diagrams ,work done & efficiency of Outward flow reaction turbine

LH50	Velocity diagrams ,work done & efficiency of Francis turbine
LH51	Velocity diagrams ,work done & efficiency of Kaplan turbine ,Work done & Efficiency of Draft tube
LH52	Tutorial
UNIT-IV	**PERFORMANCE OF TURBINES**
LH53	Performance under Unit head
LH54	Unit quantities
LH55	Performance under specific condition
LH55	Performance characteristic curves & Model Testing of turbines
LH56	Governing of turbines & Surge tank,
LH57	Cavitation & Water Hammer
LH58	Tutorial
UNIT-V	**CENTRIFUGAL PUMP & RECIPROCATING PUMP**
LH59	Introduction to Centrifugal Pump with working & work done by the Impeller
LH60	Barometric Head Losses & Manometric Efficiency of Centrifugal Pump
LH61	Multistage centrifugal pump & Characteristic curves of Centrifugal pumps& NPSH
LH62	Working & Efficiency of reciprocating pump
LH63	Theoretical & Actual Indicator diagram and Discharge & Slip
LH64	Tutorial

Lecture No. as per period	Topic(R15)
UNIT-I	**FLUID STATICS**
LH1	Introduction
LH2	Properties of fluids &Viscosity
LH3	Properties of surface tension & capillarity
LH4	Vacuum Pressure, Gauge pressure & Atmospheric pressure
LH5	Measurement of Pressure
LH6	Pascal Law
LH7	Pressure measuring Instruments
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LH29	Characteristics along thin plate of Turbulent boundary layers
LH30	Separation of boundary layer
LH31	Force of layers through Drag & Lift
LH32	Tutorial
UNIT-IV	**BASICS OF TURBO MACHINERY**
LH33	Force of jets on vertical stationary vanes
LH34	Force of jets on inclined stationary vanes
LH35	Force of jets on curved stationary vanes
LH36	Force of jets on moving vertical vanes
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LH49	Velocity diagrams ,work done & efficiency of Outward flow reaction turbine

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LH51	Velocity diagrams ,work done & efficiency of Kaplan turbine ,Work done & Efficiency of Draft tube
LH52	Tutorial
UNIT-IV	**PERFORMANCE OF TURBINES**
LH53	Geometric similarity, Unit
LH54	specific quantities
LH55	Characteristic curves of Turbines & selection of turbine
LH55	Governing of turbines
LH56	Surge tank,
LH57	Cavitation & Water Hammer
LH58	Tutorial
UNIT-V	**CENTRIFUGAL PUMP & RECIPROCATING PUMP**
LH59	Introduction to Centrifugal Pump with working & work done by the Impeller
LH60	Barometric Head Losses & Efficiency of Centrifugal Pump
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LH62	Working & Efficiency of reciprocating pump
LH63	Theoretical & Actual Indicator diagram and Discharge & Slip
LH64	Tutorial

9. ASSIGNMENT QUESTIONS

A.Y.2020-21

ASSIGNMENT I

Q.No	Questions	Bloom's Taxonomy Level	Course Outcomes
Q.1	Define surface tension. Describe the relation ship between surface tension and pressure inside a droplet of liquid in excess of outside pressure is given by $P=4\sigma/d$.	L3	CO1
Q.2	Differentiate between simple manometers and differential manometers.	L2	CO1
Q.3	Explain Euler's equation of motion. Describe Bernoulli's equation from Euler's equation	L2	CO2
Q.4	Identify the expression for the force exerted by the fluid flow in a pipe bend.	L3	CO2
Q.5	Show the expression for the velocity of flow by using pitot static tube.		

A.Y.2020-21

ASSIGNMENT II

Q.No	Questions	Bloom's Taxonomy Level	Course Outcomes
Q.1	Explain the term Boundary Layer? Describe the characteristics along thin plate for laminar & turbulent boundary layers.	L2	CO3
Q.2	Express the work done per second per unit weight of water in a reaction turbine is given as: $1/g\{Vw_1u_1+Vw_2u_2\}$	L4	CO4
Q.3	A Kaplan turbine working under a head of 20 m, develops 11772 Kw shaft power. The outer dia. of runner is 3.5m and Hub dia. is1.75m. The guide blade angle at the extreme edge of runner is 35°. The hydraulic & overall efficiency of turbine are 88% and 84%. If the velocity of the whirl is zero, find i)Runner vane angle at inlet & outlet ii)Speed of turbine.	L2	CO4
Q.4	Define specific speed of a turbine. Explain its expression and compare it with unit speed. Describe its applications.	L3	CO4
Q.5	A centrifugal pump with 1.2m diameter runs at 200rpm and pumps 1880 lits/sec & the average lift being 6m.The angle which the vanes makes at exit with the tangent to the impeller is 26° & the radial velocity of flow is 2.5 m/s. Determine η_{mano} and the least speed to start pumping against ahead of 6m. The inner dia of the impeller is 0.6m	L4	CO5

A.Y.2019-20

ASSIGNMENT I

Q.No	Questions	Bloom's Taxonomy Level	Course Outcomes
Q.1	A piston 99.5 mm diameters works in a cylinder 100mm diameter, 120mm long. The space between the two is filled with lubricating oil of viscosity 0.05 poise. Calculate the speed of the piston through the cylinder under the action of an axial force of 5N.	**L3**	CO1
Q.2	Explain the working principle of simple U-tube manometer. Discuss the advantages of this manometer over a Piezometer.	**L2**	CO2
Q.3	A pipe of 20cm dia. is carrying water with a mean velocity of 3 m/sec. calculate the discharges, if the pipe bifurcates into two pipes of 10cm each. Find the velocity of water in the 10cm dia. pipe.	**L2**	CO2
Q.4	Derive the Darcy- weisbach equation & Chezy's formula by using loss of head due to friction.	**L2**	CO3
Q.5	Explain the boundary layer of flow. Describe its formation along a long thin plate with neat sketch.	**L2**	CO3

ASSIGNMENT II

Q.No	Questions	Bloom's Taxonomy Level	Course Outcomes
Q.1	Derive the expression for the loss of head due to sudden enlargement in case of minor loss.	**L2**	CO3
Q.2	Prove that the work done per second on a series of moving curved vanes by a jet of water strikes on one of the tips of the vane is given by, work done /sec $=\rho a V_1(V_{w1}\pm V_{w2})u$	**L3**	CO4
Q.3	A Francis turbine with an overall efficiency of 75% is required to produce 148.25 KW power. It is working under a head of 7.62m. The peripheral velocity=0.26 X $(2gH)^{1/2}$ and the radial velocity of flow at the inlet is 0.96 X $(2gH)^{1/2}$. The wheel runs at 150 rpm and the hydraulic losses to the turbine are 22% of the available energy. Assuming radial discharge, calculate: (i) guide blade angle (ii) Wheel vane angle (iii) Dia. Of the wheel at the inlet (iv) width of the wheel at inlet	**L3**	CO4

A.Y.2018-19

ASSIGNMENT I

Q.No	Questions	Bloom's Taxonomy Level	Course Outcomes
Q.1	A glass tube 20mm in diameter contains a mercury column with water above the mercury. The surface tension of mercury in contact with water is 0.36 N/m. Determine the capillary depression of the mercury. Take Θ=130°.	**L2**	CO1 Unit-1
Q.2	Differentiate between simple manometers and differential manometers.	**L2**	CO2 Unit-1
Q.3	A 300mm diameter pipe conveying water branches into two pipes of diameter 250mm and 200 mm respectively. If the average velocity in the 300mm and 200mm pipes are 2.5m/sec & 1 m/sec. calculate the velocity in 250mm pipe.	**L2**	CO2 Unit-2
Q.4	Derive the expression for the force exerted by the fluid flow in a Pipe bend.	**L2**	CO3 Unit-2
Q.5	Examine whether or not the following velocity profiles satisfy the essential boundary conditions for velocity distribution in the laminar boundary layer on a flat plate.	**L3**	CO3 Unit-3

A.Y.2018-19

ASSIGNMENT II

Q.No	Questions	Bloom's Taxonomy Level	Course Outcomes
Q.1	Derive the Darcy- weisbach equation & Chezy's formula by using loss of head due to friction.	L2	CO3 Unit-3
Q.2	A Pelton wheel is working under a head of 45m and the discharge is 0.8m3/sec.The mean bucket speed is 14m/sec. Find the power produced if the jet is deflected by the blades through an angle of 165°. The coefficient of velocity is 0.985.	L3	CO4 Unit-4
Q.3	A Kaplan turbine develops 1471kW under a head of 6m. The turbine is set 2.5m above the tailrace level. A vacuum gauge inserted at the turbine outlet records a suction head of 3.1m. If the hydraulic efficiency is 85%, what would be the efficiency of draft tube having inlet diameter of 3m. What will be the reading of suction gauge if power developed is reduced to half the head and speed remaining constant?	L3	CO4 Unit-4
Q.4	Define specific speed of a turbine. Explain its expression and compare it with unit speed. Describe its applications ?	L2	CO5 Unit-5
Q.5	A double acting reciprocating pump, running at 50 rpm is discharging 900 liters of water per minute. The pump has a stroke of 400 mm. the diameter of piston is 250 mm. The delivery and suction heads are 25 m and 4 m respectively. Find the slip of the pump and power required to drive the pump.	L3	CO5 Unit-5

10. MID QUESTION PAPERS I & II

Vidya Jyothi Institute of Technology (Autonomous)

(Accredited by NAAC & NBA, Approved By A.I.C.T.E., New Delhi, Permanently Affiliated to JNTU, Hyderabad)
(Aziz Nagar, C.B.Post, Hyderabad -500075)

II Year B.Tech II Semester 1st Mid Exam

Branch: MECHANICAL ENGINEERING	Duration: 90Min
Sub:MECHANICS OF FLUIDS & HYDRAULIC MACHINERY	Marks: 20
Date:	Session: AN

Course Outcomes:

1. Understanding the basic static, Kinematic and dynamic principles of fluid flow.
2. Compute drag and lift coefficient using the theory of boundary layer flows

Bloom Levels:

Remember	I
Understand	II
Apply	III
Analyze	IV
Evaluate	V
Create	VI

PART-A (3Q×2M = Marks)		**Course Outcomes**		**Bloom Levels**	**Marks**
ANSWER ALL THE QUESTIONS		**CO**	**PO**		
1	Explain Dynamic viscosity in fluid flow.	CO1	PO1,PO2,	V	2
2	Write the difference between: a) Uniform Flow & Non uniform Flow b) Laminar Flow & Turbulent flow.	CO1	PO1,PO3	II	2
3	Derive Dercy-wiesbach equation in case of Loss of head due to friction.	CO2	PO2,PO4	IV	2

PART-B (5+5+4= 14 Marks)		**Course Outcomes**		**Bloom Levels**	**Marks**
ANSWER ALL THE QUESTIONS		**CO**	**PO**		
4.a)	Write short notes on pressure measurement using U-tube manometer	CO1	PO2,PO4, PO6	II	5

4.b)	A simple manometer containing mercury is connected to a pipe in which an oil of sp gr 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the manometer is open to the atmosphere. Find the vacuum pressure in pipe if the difference of mercury level in the two limbs is 20cm and height of oil in the left limb from the center of the pipe id 15cm below?.	CO1	PO3,PO5, PO6	V	5
	[OR]				
5.a)	State and Explain Pascal Law.	CO1	PO2,PO4, PO6	III	5
5.b)	Explain the types fluid flow through a pipe.	CO1	PO3,PO4, PO6	V	5
6.a)	Derive Bernoulli's equation by using Euler's equation of fluid flow.	CO2	PO3,PO4, PO8	VI	5
6.b)	A pipe of diameter 400mm carries water at a velocity of 25 m/s. The pressures at points A and B are 29.43 N/cm2 and 22.563 N/cm2 respectively. While the datum head at A and B are 28m and 30m. Find Loss of Head between A and B.	CO2	PO2,PO4, PO8	V	5
	[OR]				
7.a)	Derive the force exerted by water on Pipe bend.	CO2	PO3,PO4,PO8	III	5
7.b)	An orifice meter with orifice diameter10cm is inserted in a pipe of 20cm diameter. The pressure gauges fitted upstream and down stream of the orifice meter gives readings of 19.62 N/cm2 and 9.81 N/cm2 respectively. Coefficient of discharge for the orifice meter is given as 0.6. Find the discharge of water through pipe.	CO2	PO1,PO4, PO6	V	5
8.a)	Derive Darcy weis-bach equation in case of Major Losses in Pipe flow.	CO3	PO3,PO4, PO6	III	4
	[OR]				
8.b)	A horizontal pipe of diameter500mm is suddenly contracted to a diameter of 250mm. The pressure intensity in the larger and smaller pipe is given as 13.734 N/cm2 and 11.722 N/cm2 respectively. Find the loss due to sudden contraction if Cc=0.62. Also determine the rate flow of water.	CO3	PO3,PO5, PO6	V	4

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(Aziz Nagar, C.B.Post, Hyderabad -500075)

II Year B.Tech II Semester 2nd Mid Exam	
Branch: MECHANICAL ENGINEERING	Duration: 90Min
Sub:MECHANICS OF FLUIDS & HYDRAULIC MACHINERY	Marks: 20
Date:	Session: AN

Course Outcomes:

3. Develop the performance equations of hydraulic machines under different input parameters
4. Evaluate the performance of hydraulic machines for various engineering applications

Bloom Levels:

Remember	I
Understand	II
Apply	III
Analyze	IV
Evaluate	V
Create	VI

PART-A (3Q×2M = Marks)		Course Outcomes		Bloom Levels	Marks
ANSWER ALL THE QUESTIONS		CO	PO		
1	What is Boundry layer Thickness?	CO3	PO1,PO2,	V	2
2	Explain the function of Draft tube.	CO3	PO1,PO3	II	2
3	What is mean by cavitation?	CO4	PO2,PO4	IV	2

PART-B (4+5+5= 14 Marks)		Course Outcomes		Bloom Levels	Marks
ANSWER ALL THE QUESTIONS		CO	PO		
4.a)	Explain the separation of boundary layer.	CO3	PO2,PO4, PO6	II	4
4.b)	Explain different types of thickness of a boundary layer and give their corresponding expressions	CO3	PO3,PO5, PO6	V	4
[OR]					
5.a)	Derive an expression for the force exerted by a jet striking the moving curved plate at one end tangentially when the plate is Unsymmetrical.	CO3	PO2,PO4, PO6	III	2.5
5.b)	A jet of water 120 mm in diameter and moving with a velocity of 25m/sec strikes normally on a flat plate. Determine the power developed and the efficiency of the system when i.) the plate is stationary ii.) the plate is moving with a velocity of 8m/sec in the direction of the jet.	CO3	PO3,PO4, PO6	V	2.5

6.a)	Derive an expression for the force exerted by a jet striking the series of moving curved vanes	CO2	PO3,PO4, PO8	VI	2.5
6.b)	A kaplan turbine working under a head of 20m develops 11772kw shaft power. The outer diameter of the runner is 3.5m and hub diameter is 1.75m. The guide blade angles at the extreme edge of the runner is 35° . The hydraulic and overall efficiencies of the turbines are 88% and 84% respectively. If the velocity of the wheel at the outlet is Zero. Determine the : i) the runner vane angles at inlet & outlet ii) speed of the turbine	CO2	PO2,PO4, PO8	V	2.5
[OR]					
7.a)	A pelton wheel is to be designed for the following specifications:Shaft Power=11,772kw; Head =380m; Speed=750rpm; overall efficiency=86%. jet diameter is not to exceed one-sixth of the wheel diameter. Determine:i) wheel diameter ii) the no.of jets requirediii) diameter of the jet Take Cv=0.98, ϕ=0.45.	CO4	PO3,PO4,PO8	III	2.5
7.b)	Explain the use of Draft tube in case of turbines.	CO4	PO1,PO4, PO6	V	2.5
8.a)	Explain the working of single stage centrifugal pump with neat sketch.	CO4	PO3,PO4, PO6	III	5
[OR]					
8.b)	Write the difference between Single acting reciprocating pump & Double acting reciprocating pump.	CO4	PO3,PO5, PO6	V	5

Vidya Jyothi Institute of Technology (Autonomous)

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II B.Tech II Semester I Mid Examination, Feb,2020

Subject: Mechanics of Fluids & Hydraulic Machinery

Time: 1 Hr. **Branch:Mechanical**

Max.Marks:20

Note: This paper contains two parts ***Part-A & Part-B***

Part-A is compulsory which carries 6 marks

Part-B consist of 4 questions. Answer any two questions.

Bloom's Level:

Remember	L1
Understand	L2
apply	L3
Analyze	L4
Evaluate	L5
Create	L6

PART-A

	COMPULSORY QUESTION	Bloom's Level	Marks
1.a)	Define the term "Absolute pressure gauge & Gauge pressure".	L2	6M
	OR		
b)	State the assumptions made in derivation of Bernoulli's Equation.	L3	6M

PART-B

	ANSWER ANY TWO QUESTIONS	Bloom's Level	Marks
2)	Explain the working principle of simple U-tube manometer. What are the advantages of this manometer over a Piezometer.	L3	7M
	OR		
3)	A glass tube 20mm in diameter contains a mercury column with water above the mercury. The surface tension of mercury in contact with water is 0.36 N/m. Determine the capillary depression of the mercury. Take ϴ=130°.	L4	7M
4)	A 300mm diameter pipe conveying water branches into two pipes of diameter 250mm and 200 mm respectively. If the average velocity in the 300mm and 200mm pipes are 2.5m/sec & 1 m/sec. calculate the velocity in 250mm pipe.	L3	7M
	OR		
5)	What is Major Loss? Prove that in a pipe flow of water $f=4flv^2/2gd$	L2	7M

Vidya Jyothi Institute of Technology (Autonomous)

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II B.Tech II Semester II Mid Examination, April 2020

Subject: Mechanics of Fluids & Hydraulic Machinery

Branch:Mechanical

Time: 1 Hr.

Max.Marks:20

Note: This paper contains two parts ***Part-A & Part-B***

Part-A is compulsory which carries 6 marks

Part-B consist of 4 questions. Answer any two questions.

Bloom's Level:

Remember	L1
Understand	L2
apply	L3
Analyze	L4
Evaluate	L5
Create	L6

PART-A			
COMPULSORY QUESTION		**Bloom's Level**	**Marks**
1.a)	What is Boundry Layer theory? Explain the terms displacement thickness, momentum thickness and energy thickness.	L2	6M
	OR		
b)	What is Lift & Drag force? Derive the expression for Lift and Drag Force.	L3	6M
PART-B			
ANSWER ANY TWO QUESTIONS		**Bloom's Level**	**Marks**
2)	Obtain an expression for the force exerted by a jet of water on a moving vertical plate in the direction of the jet.	L3	7M
	OR		
3)	The penstock supplies water from a reservoir to the Pelton wheel with a gross head of 500m. One third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of the penstock is 2 m3/s.The angle of deflection of the jet is 165°. Determine the power given by the water to the runner and also hydraulic efficiency of the Pelton wheel. Take speed ratio=0.45 and Cv=1.0	L4	7M
4)	What is a reciprocating pump ? Explain its working with a neat sketch	L3	7M
	OR		

I MID EXAMINATIONS (SUBJECTIVE TEST)

Course: II B.Tech II- Sem
Name of the Subject: MOFHM
Date of Exam:
Maximum Marks: 20

Branch: MECH
A.Y: 2018-19
Time of Exam: 1 1/2hr

PART-A
Answer all the Questions.

Q.No	Question	Bloom's Taxonomy Level	CO's
Q.1.	Explain the term "Viscosity" with examples **[2M]**	**L3**	CO1 Unit-1
Q.2.	What are the assumption of Bernouli's Equation. **[2M]**	**L2**	CO2 Unit-2
Q.3.	What do you mean by Equivalent pipes? **[2M]**	**L3**	CO3 Unit-3

PART-B
Answer all the Questions.

Q.No	Question	Bloom's Taxonomy Level	CO's
Q.4(i)	A glass tube 20mm in diameter contains a mercury column with water above the mercury. The surface tension of mercury in contact with water is 0.36 N/m. Describe the capillary depression of the mercury. Take ϴ=130°. **[5M]**	**L2**	CO1 Unit-1
	OR		
Q.4(ii)	Differentiate between: i) Simple manometer & Differential Manometer ii) Absolute pressure & Gauge pressure **[5M]**	**L3**	CO1 Unit-1
Q.5(i)	Explain Euler's equation of motion. Describe Bernoulli's equation from Euler's equation. **[5M]**	**L3**	CO2 Unit-2
	OR		
Q.5(ii)	Describe the expression for the force exerted by the fluid flow in a Pipe bend. **[5M]**	**L2**	CO2 Unit-2
Q.6(i)	Illustrate the Reynold's Experiment. Relate the Darcy- weisbach equation & Chezy's formula by using loss of head due to friction. **[4M]**	**L3**	CO3 Unit-3

	OR		
Q.6(ii)	Explain the hydraulic grade line and total energy line. Explain the same with an example. **[4M]**	**L3**	CO3 Unit-3

II MID EXAMINATIONS (SUBJECTIVE TEST)

Course: II B.Tech II- Sem
Name of the Subject: MOFHM
Date of Exam:
Maximum Marks: 20

Branch: MECH
A.Y: 2018-19
Time of Exam: 1 1/2hr

PART-A

Answer all the Questions.

Q.No	Question	Bloom's Taxonomy Level	CO's
Q.1.	Explain the following terms: a. Displacement Thickness b. Momentum Thickness **[2M]**	L3	CO3 Unit-3
Q.2.	Define the following terms: a. Reaction turbine c. Hydraulic efficiency b. Impulse turbine d. Overall efiiciency **[2M]**	L2	CO4 Unit-4
Q.3.	Explain the term Slip in centrifugal pump. **[2M]**	L3	CO5 Unit-5

PART-B

Answer all the Questions.

Q.No	Question	Bloom's Taxonomy Level	CO's
Q.4(i)	Describe the expression for Displacement thickness of a Laminar boundary layer. **[4M]**	L2	CO3 Unit-3
	OR		
Q.4(ii)	Explain the separation of boundary layer and its preventive methods. **[4M]**	L3	CO3 Unit-3
Q.5(i)	Prove that in case of series Radial vanes efficiency(η)=$\{1-v_2^2/v_1^2\}$ **[5M]**	L3	CO4 Unit-4
	OR		
Q.5(ii)	A Francis turbine with an overall efficiency of 75% is required to produce 148.25 KW power. It is working under a head of 7.62m. The peripheral velocity=0.26 X $(2gH)^{1/2}$ and the radial velocity of flow at the inlet is 0.96 X $(2gH)^{1/2}$. The wheel runs at 150 rpm and the hydraulic losses to the turbine are 22% of the available energy. Assuming radial discharge, determine: (i) guide blade angle (ii) Wheel vane angle (iii) Dia. Of the wheel at the inlet (iv) width of the wheel at inlet. **[5M]**	L2	CO4 Unit-4

Q.6(i)	Explain the priming of a centrifugal pump. Discuss the different priming arrangements employed for small and big pumping units. **[5M]**	**L3**	CO5 Unit-5
	OR		
Q.6(ii)	A centrifugal pump while running at 800 rpm discharges 100 Lit./s against a net head of 14m. The manometric efficiency of the pump is 78%. If the vane angle at the outlet is 35 degrees and the velocity of flow is 2m/sec, determine the outer diameter of the impeller. **[5M]**	**L3**	CO5 Unit-5

11. RUBRICS FOR MID EVALUATION

RUBRICS FOR MID EXAMINATION EVALUATION

Criteria of Evaluation	Poor (1)	Satisfactory (2)	Good (3)	Very Good (4)	Excellent (5)
Interpretation	Answer reflects that the question was not understood at all.	Answer reflects that the question was somewhat understood	Answer reflects that the Question was understood to a reasonable level	Answer reflects that the Question was understood to an appreciable level	Answer reflects that the Question was completely understood
Presentation	No proper presentation	Presentation was marginal with issues in legibility and grammar	Presentation was clear but with grammatical errors	Presentation was explicitly good and clear with minor grammatical errors	Presentation was excellent and clear with no grammatical errors
Solution	Solution has more errors	Solution has moderate amount of errors	Solution was complete but with minor errors	Solution was complete but with no clear mention of entire procedure	Solution was accurate/ complete with clear mention of the entire procedure.

12. LECTURE NOTES

Fluid Mechanics is that branch of science which deals with the behaviour of the fluids (liquids or gases) at rest as well as in motion.

* Study of fluid at rest is called fluid statics.
* Study of fluid at motion is called fluid dynamics.
* Study of fluid where pressure forces are not considered is called fluid Kinematics.

Properties of fluids.:

* Density (Mass Density) : defined as the ratio of the mass of a fluid to its volume.
  Mass per unit volume is called density.
  - Mass per unit volume
  - It is denoted by "ρ"
  - Unit of density Kg/m^3 (S.I unit)

Mathematically;

$$\rho = \frac{\text{Mass of fluid}}{\text{Volume of fluid}}$$

* Specific wt. (weight Density) : It is the ratio between the weight of a fluid to its volume.
  - It is denoted by w

Mathematically;

$$w = \frac{\text{Wt. of fluid}}{\text{Vol. of fluid}}$$

$$= \frac{\text{Mass of fluid} \times g}{\text{Vol. of fluid}}$$

$$\boxed{w = \rho \times g}$$

Sp. wt. of water $= 9.81 \times 1000 \ N/m^3$ (S.I.)

* sp. volume = defined as the volume of fluid occupied by a unit mass or volume per unit mass.

Mathematically;

$$\text{sp. volume} = \frac{\text{Vol. of fluid}}{\text{Mass of fluid}} = \frac{1}{\rho}.$$

✓ unit of sp. vol. = m^3/kg

* Sp. Gravity : Ratio of the weight density of a fluid to wt. density of a standard fluid.

Mathematically; $$s\,(\text{for liquids}) = \frac{\text{wt. density of liquid}}{\text{wt. density of water}}.$$

$$s\,(\text{for Gas}) = \frac{\text{wt. density of Gas}}{\text{wt. density of air}}.$$

Ex: sp. gr. of mercury = 13.6.

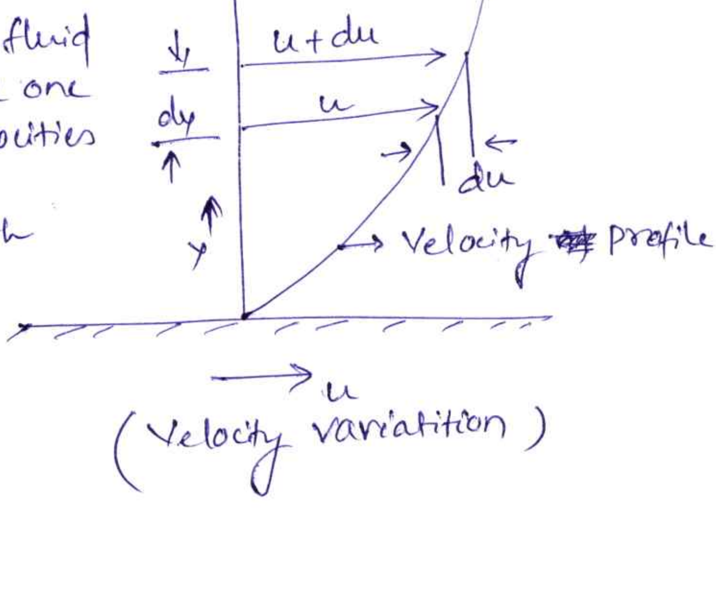
∴ wt. density of mercury = 13.6 × wt. density of water.

= 13600 Kg/m^3.

Viscosity: It is the property of a fluid which offers resistance to the movement of one layer of fluid over another adjacent layer of the fluid.

When two layers of a fluid at a distance "dy" apart, move one over another at different velocities as u and u + du.

The viscosity together with relative velocity causes a shear stress acting between the fluid layers.



(Velocity variatition)

Kinematic Viscosity : defined as the ratio between the dynamic viscosity and density of fluid. It is denoted by (ν)

$$\therefore \quad \nu = \frac{\text{viscosity}}{\text{Density}} = \frac{\mu}{\rho}$$

$$= m^2/s \quad (\text{S.I.})$$

$$1 \text{ stroke} = cm^2/s \quad (\text{C.G.S})$$

$$\therefore \; 1 \text{ stoke} = 1\,cm^2/s = \left(\frac{1}{100}\right)^2 m^2/s$$

$$\boxed{1 \text{ stoke} = 10^{-4}\, m^2/s}$$

$$\boxed{1 \text{ centistoke} = \frac{1}{100} \text{ stoke}}$$

Newton's law of Viscosity : It states that the shear stress (τ) on a fluid element layer is directly proportional to the rate of shear strain. The constant of propertinality is called the coefficient of viscosity.

Mathematically,

$$\boxed{\tau = \mu \cdot \frac{du}{dy}}$$

Variation of viscosity with Temprature : The viscosity of liquids decreases with the increase of temprature while the viscosity of gas increases with the increase of temprature.

1. for Liquids ; $\mu = \mu_0 \left[\dfrac{1}{1 + \alpha t + \beta t^2} \right]$

where μ = viscosity of liquid at $t^\circ c$. in poise

μ_0 = viscosity of liquid at $0^\circ c$ in poise.

α, β = constants for the liquid

for water; $\mu_0 = 1.79 \times 10^{-3}$ poise

$\alpha = 0.03368$

$\beta = 0.000221$

③

The stress is proportional to the rate of change of velocity with respect to 'y'. It is denoted by symbol (τ)

Mathematically;

$$\tau \propto \frac{du}{dy}$$

or, $$\boxed{\tau = \mu \cdot \frac{du}{dy}}$$

where μ = constant of proportionality.

= coefficient of dynamic viscosity

$\frac{du}{dy}$ = Rate of shear strain
= Rate of shear deformation
= velocity Gradiant

or, $$\boxed{\mu = \frac{\tau}{\frac{du}{dy}}}$$

"Viscosity can be defined as the shear stress required to produce unit rate of shear strain"

Unit $$\mu = \frac{\text{shear stress}}{\frac{\text{Ch. of vel.}}{\text{Ch. of dist}^n}} = N\text{-}s/m^2 \ (S.I.)$$

In C.G.S unit the viscosity is measured in poise.

$$1 \text{ poise} = 1 \frac{\text{dyne-s}}{cm^2} \quad (C.G.S)$$

* Conversion.

$$\boxed{1 N = 98.1 \text{ poise } (P)}$$

$$\boxed{1 \text{ poise } (P) = \frac{1}{10} \frac{N\text{-}s}{m^2}}$$

$$\boxed{1 \text{ Centipoise } (CP) = \frac{1}{100} \text{ poise } (P)}$$

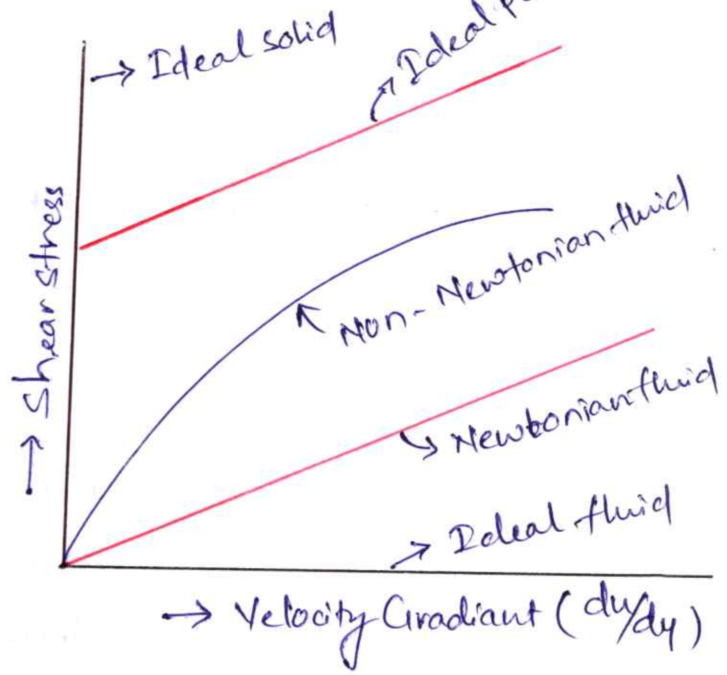
2. for Gas : $\mu = \mu_0 + \alpha t - \beta t^2$

for air; $\mu_0 = 0.000017$
$\alpha = 0.00000056$
$\beta = 0.1189 \times 10^{-9}$

Types of fluids :

Fluids may be classified into following five types:

1. Ideal fluid : fluid which is incompressible and is having no viscosity is called as ideal fluid



2. Real fluid : fluid which poceses viscosity is known as real fluid

3. Newtonian fluid : A real fluid in which the shear stress is directly proportional to the rate of shear strain is known as Newtonian fluid.

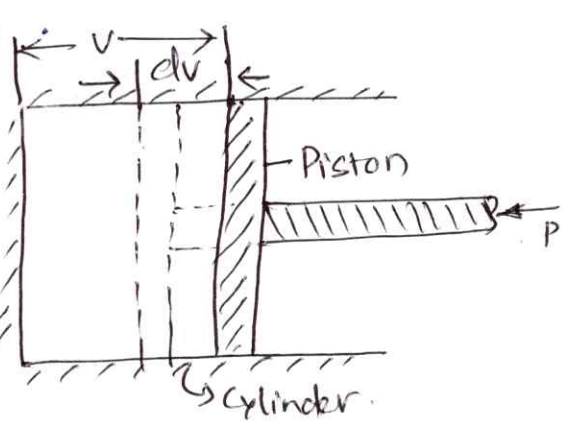
4. Non-Newtonian fluid : A real fluid in which the shear stress is not proportional to the rate of shear strain, is called as Non Newtonian fluid.

5. Ideal plastic fluid : A fluid in which shear stress is more than the yield value and shear stress is proportional to the rate of shear strain, is called as Ideal Plastic fluid

Compressibility : It is the reciprocal of bulk modulus (K) i.e., ratio of compressive stress to volumetric strain.

Bulk modulus (K) : It is the ratio of increases in pressure to the volumetric strain

Consider a cylinder fitted with a piston.



Let, V = Vol. of Gas cylinder
P = pr. of gas when vol. v.

Let the pressure increased to $p + dp$
volume decreased to $v - dv$

$\therefore$ Increase in pressure $= dp$
decrease in vol. $= dv$

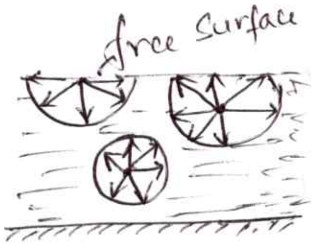
$\therefore$ vol. strain $= -\frac{dv}{v}$

$\therefore$ Bulk modulus $K = \frac{\text{Increase in press.}}{\text{vol. strain}}$

$$= \frac{dp}{-\frac{dv}{v}} = -\frac{dp \cdot v}{dv}$$

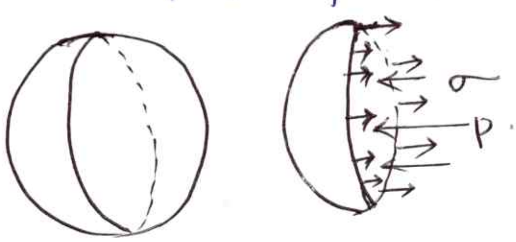
$\therefore$ compressibility $= 1/K$

Surface Tension : It is defined as the tensile force acting on the surface of a liquid in contact with a gas or on the surface between two immscible liquids such that the contact surface behaves like a membrane under tension. It is denoted by a Greek letter (σ) and measured in N/m.



Examples.

1. Liquid Droplet :



Consider a small spherical droplet of liquid of radius 'r'.

Tensile force on the entire surface due to surface tension will be acting on the circumference.

Let σ = surface tension.
p = intensity of pressure
d = dia. of droplet

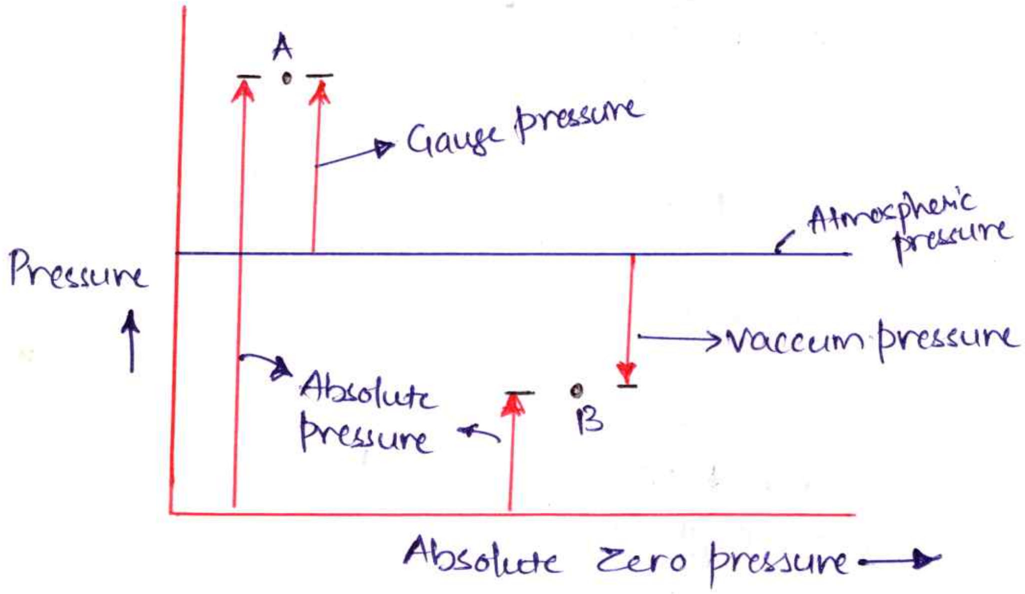
Let the droplet cut into two halves.

Tensile force due to surface tension acting around the Circumference $= \sigma \times$ Circumference
$= \sigma \times \pi d$

Measurement of pressure :

The pressure on a fluid is measured in two different systems.

1. It is measured above the absolute zero or complete vaccum which is called as atmospheric pressure.
2. pressure is measured above the atmospheric pressure which is called as gauge pressure.
3. Pressure measured below the atmosphesic pressure is called as vaccum pressure.



Mathematically;

(i) Absolute pressure = Atmospheric pressure + Gauge pressure

$$P_{abs} = P_{atm} + P_{gauge}$$

(ii) Vaccum pressure = Atmospheric pressure − Absolute press.

$$P_{vacc.} = P_{atm} - P_{abs}.$$

The pressure of the fluid is measured by the following devices :

1. Manometers
2. Mechanical Gauges.

Resolving the forces in x-direction

$$p_x \times dy \times 1 - p_z (ds \times 1) \sin(90^\circ - \theta) = 0$$

or, $p_x dy - p_z ds \cos\theta = 0$

But from fig. $ds \cos\theta = AB = dy$

$$\therefore \quad p_x \cdot dy - p_z \cdot dy = 0$$

$$\Rightarrow p_x \cdot \cancel{dy} = p_z \cdot \cancel{dy}$$

$$\Rightarrow \boxed{p_x = p_z} \quad \text{——— (1)}$$

Similarly, the resolution of forces in y-direction;

$$p_y \times dx \times 1 - p_z \times ds \times 1 \times \cos(90^\circ - \theta) - \frac{dx \times dy}{2} \times 1 \times \rho \times g = 0$$

$$\Rightarrow p_y \cdot dx - p_z \, ds \sin\theta - \frac{dx dy}{2} \rho g = 0$$

from fig: $ds \sin\theta = dx$

As, the element is very small, the weight is considered as negligible.

$$\therefore \quad p_y \cdot dx - p_z dx = 0$$

$$\Rightarrow p_y \cdot \cancel{dx} = p_z \cdot \cancel{dx}$$

$$\Rightarrow \boxed{p_y = p_z} \quad \text{—— (2)}$$

from eqn (1) & (2)

$$\boxed{p_x = p_y = p_z}$$

Hydrostatic law : It states that rate of increase of pressure in a vertical direction is equal to weight density of the fluid at that point.

Mathematically;

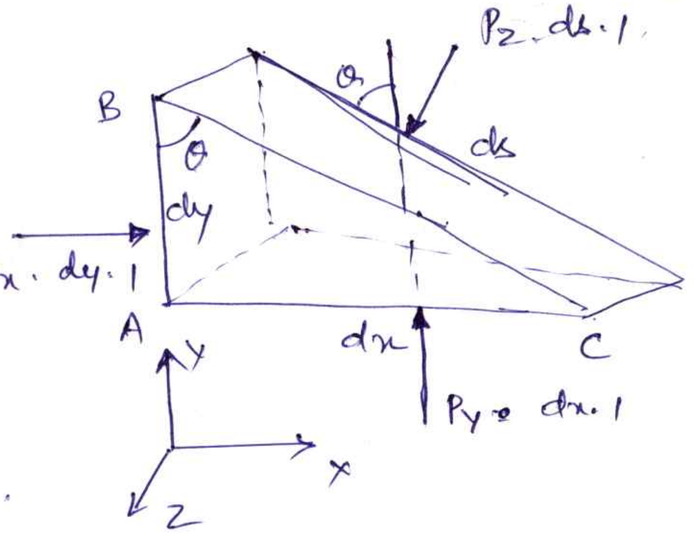
$$p = \rho g Z.$$

$$\text{or, } \boxed{Z = p/\rho g}$$

where Z = pr. head

Pascal's law.

It states that the intensity of pressure at a point in a static fluid is equal in all directions.



Consider a fluid element of dimensions dx, dy and ds.

Let the fluid element be wedge shaped with a fluid mass at rest.

Let, the width of the element perpendicular to the plane is unity.

Let, p_x, p_y and p_z are the pressure acting on the face AB, AC and BC respectively.

let $\angle ABC = \theta$

∴ Forces acting on the element are

1. pressure force normal to the surface
2. weight of the element in vertical direction.

Force on face AB $= p_x \times$ Area of face AB
$= p_x \times dy \times 1$

similarly, force on face AC $= p_y \times dx \times 1$

force on face BC $= p_z \times dz \times 1$

weight of the element = Mass of the element × g

= Volume × ρ × g

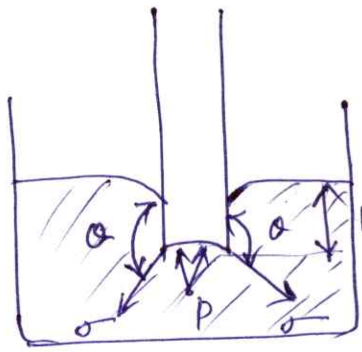
$= \left[\frac{AB \times AC}{2} \times 1\right] \times \rho \times g$

where ρ = density of liquid

Capillary fall

Let, the glass tube is dipped in mercury.

Let h = height of depression of liquid in the tube.



Surface tension acting in downward direction = $\sigma \times \pi d \times \cos\theta$ —— (3)

Hydrostatic force acting upward = Intensity of pressure at a depth 'h' = $p \times \frac{\pi}{4} d^2$

$= \rho g h \times \frac{\pi}{4} d^2$ { pressure = $\rho \times g \times h$ } —— (4)

Unequilibrium condⁿ;

Equⁿ (3) & (4)

$$\sigma \times \pi d \times \cos\theta = \frac{\pi}{4} d^2 \times \rho g h$$

$$h = \frac{4\sigma \cos\theta}{\rho g d}$$

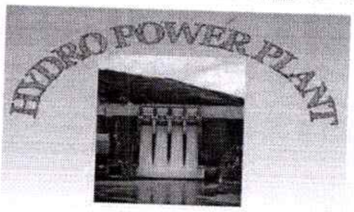
Value of $\theta = 128°$ (for mercury & glass tube)

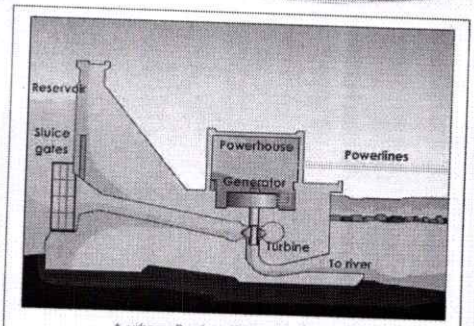
Vaporization: A change from the liquid state to the gaseous sate is called as vapourization.

Vapour pressure: The pressure at which liquid is converted into vapour, it is called as vapour pressure.

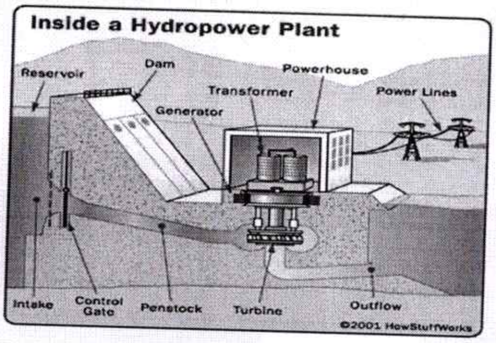
Cavitation: It is the phenomenon of formation of vapour bubbles of a flowing liquid in a region where the pressure of the liquid falls below the vapour pressure and sudden collapsing of these vapour bubbles in a region of high pressure.

13. PPT'S MATERIAL





A schematic view of a hydro power plant



Reservoir

- Used to store water from catchment area.

<u>Two types</u>:

1. <u>Natural reservoir</u>:

- ✓ Formed in high and huge hills & mountains
- ✓ Water is taken through tunnels to power house.

2. <u>Artificial reservoir</u>:

Dam

- Reinforced concrete structure retaining wall to store large amount of water.
- Helps to develop head of water.

Classification:

➢ Based on functions

1. Storage dam
2. Diversion dam
3. Detention dam

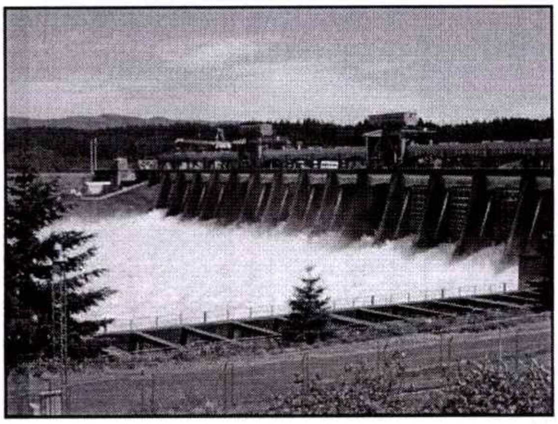
Dam

➢ Based on the shape

I. Multiple Arch dam
II. Trapezoidal dam

➢ Based on construction Materials

A. Earth, rock pieces and fragments
B. Stone masonry, concrete or R.C.C. structure



Penstock

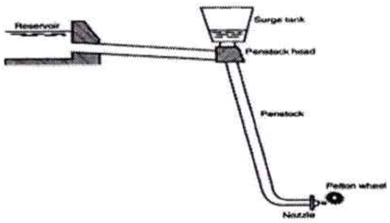
- Pipe used to carry water from reservoir to the power house.
- Made up of steel, reinforced concrete structure.
- As per topography of dam these are either buried/exposed above the ground.
- Laid in the shortest route to reach power house

Surge Tank

- A reservoir fitted on the penstock near the turbine.
- Receives the excess water when the pen stock is suddenly closed by the valve.

Main functions:

- Acts as relief valve when load on water turbine fluctuates.
- Acts as a temporary reservoir
- Maintain a smooth and continuous discharge



Power House

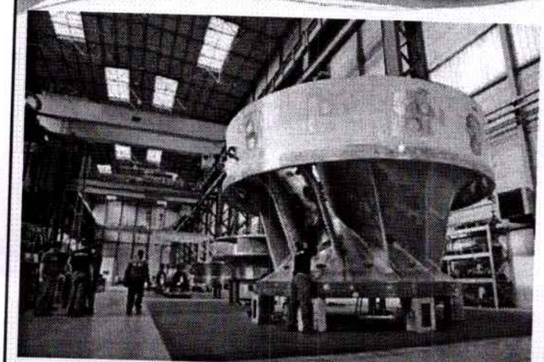
- Building or plant in which control valves of water turbines which are connected to electric generator, transformers & other allied components are kept.
- Power generation is depend on the supply of water to the turbines.

Turbine

- Hydraulic device used to convert hydraulic energy to mechanical energy.

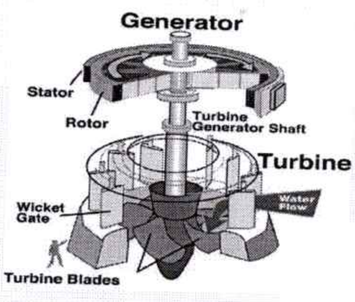
Two types:

- Impulse turbine(Pelton Wheel Turbine)



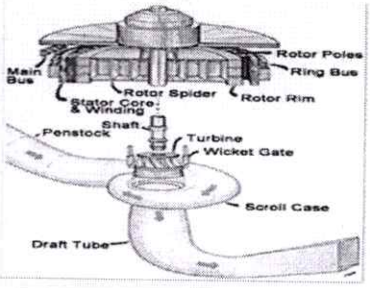
Generator

- Device used to convert mechanical energy to electrical energy.
- Coupled to the turbine shaft.



Draft tube

- Used to located at the outlet of the tube.
- Has gradually increasing diameter tube which decrease the pressure of the flow at the outlet.



Terms used in Hydro power plant

- Firm power
- Secondary power
- Load factor
- Turbine Flow meter

Firm Power

- Minimum amount of power that can be generated with little or no interruption throughout the year
- Complete dependable power as it is available all the times
- Can be increased considerably by providing storage
- Also called as "Primary power"

Secondary power

- Power generated by utilizing the water other than that used for firm power
- Surplus or non-firm power available for a shorter period of time in a year
- Used in interconnected grid systems where it relives the load on power plants
- Part of this power converted to firm power when the hydroelectric generation is low
- Generation of this power can be achieved by utilizing

Load factor

- Ratio of average load over a given time interval to the peak load during the same time interval

Turbine flow meter

- Flow measurement & controlling device

Construction:

- Has small propeller inside along the centre line of the tube
- Propeller of axial turbine is freely suspended & rotates whenever liquid pass through the device
- Rotational speed of the propeller is directly proportional to the velocity of fluid flow

Turbine flow meter

- Turbine & housings are connected by means of bearings are connected to the magnetic coil
- Complete assembly is kept inside the flow meter

Working:

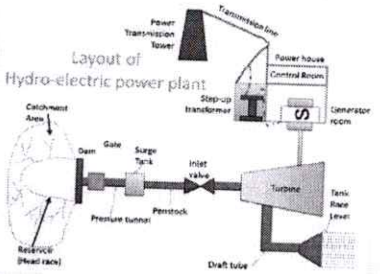
- Magnetic coil inside the flow meter senses the motion of blades of the propeller
- Output of the magnetic coil are in the form of voltage pulses
- These pulses are feed into the processing systems kept near to the flow meter

Turbine flow meter

- Processing systems are amplified the signals and are measured with the help of microprocessors

Usages:

- Have wide range accuracy, durability and reliability
- Temperature ranges from -257°c to400°c
- Accuracy ranges from +0.05% in liquids & gases
- Flow rate ranges from 0.03to 20,000gal/min.



Advantages of hydro power plant

- No fuel charges
- Highly reliable
- Low running cost
- No stand by loss
- Operation & maintain ace charges are low
- Efficiency doesn't change with age
- Less supervising staff
- No fuel transportation problems & air pollution
- Long life of plant

Disadvantages of Hydro power plant

- Initial cost is very high
- Long time for erection requires
- Located in hilly areas
- Power generation depend on water
- As it is far away from load centers it requires long transmission lines
- Due to long transmission lines losses will be more

Types of Hydro power plants

The type of Hydro power plants are identified by the following terms:

- Purpose
- Hydraulic principle
- Operation
- Location
- Plant capacity

CC

14. END SEMESTER EXAMINATION QUESTION PAPERS

Vidya Jyothi Institute of Technology (Autonomous)

Approved by NAAC & NBA, Approved By A.I.C.T.E., New Delhi, Permanently Affiliated to JNTU, Hyderabad)
(Aziz Nagar, C.B.Post, Hyderabad -500075)

Subject Code:A24311

R18

B.Tech. II Year II Semester Regular Examination, OCTOBER/NOVEMBER-2020

SUBJECT : Mechanics of Fluids & Hydraulic Machinery **BRANCH :** MECH

Time: 2 Hours **Max. Marks:**75

Note: This question paper contains EIGHT questions and answer any FIVE questions. Each question carries 15 marks.

Bloom's Level:

Remember	L1
Understand	L2
Apply	L3
Analyze	L4
Evaluate	L5
Create	L6

ANSWER ANY FIVE QUESTIONS	5QX15M = 75 M	Bloom's Level	Marks
1	State and explain Pascal's Law.	L4	15M
2	Derive the discharge equation for Venturimeter equation with neat sketch.	L3	15M
3	Write the applications of Bernoulis Equation.	L1	15M
4	An orifice meter with orifice diameter 15cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the rate of flow of oil of sp.gr. 0.9, when the co-efficient of discharge of the orifice meter=0.64.	L4	15M
5	List out minor loss in pipes and explain in detail.	L2	15M
6	What is Boundry Layer theory? Explain the terms displacement thickness,momentum thickness and energy thickness.	L3	15M
7	Obtain an expression for the force exerted by a jet of water on a moving unsymmetrical curved vane striking tangentially at one end of the tips of the vane. Find the work done & efficiency of the jet.	L1	15M
8	Explain the types of Multi-stage centrifugal pumps with neat sketches.	L4	15M

VJIT(A)

Vidya Jyothi Institute of Technology (Autonomous) (Accredited by NAAC & NBA, Approved By A.I.C.T.E., New Delhi, Permanently Affiliated to JNTU, Hyderabad) (Aziz Nagar, C.B.Post, Hyderabad -500075) **Subject Code:A14315**	R15

B.Tech. II Year II Semester Regular Examinations, MAY-2019

SUBJECT NAME:Mechanics of Fluids and Hydraulic Machines **BRANCH : MECH**

Time: 3 Hours **Max. Marks:75**

Note: This question paper contains two Parts A and B.
Part A is compulsory which carries 25 Marks. Answer all the questions.
Part B consists of 5 questions. Answer all the questions.

Bloom`s Level:

Remember	L1	Analyze	L4
Understand	L2	Evaluate	L5
Apply	L3	Create	L6

PART - A ANSWER ALL THE QUESTIONS		B.L	25M
1	Define the terms mass density, specific weight, specific volume and specific gravity of liquid?	L2	2M
2	Define Pascal`s law.	L2	3M
3	What are the types of fluid flows?	L1	2M
4	Draw a neat sketch of pitot tube?	L3	3M
5	What are the types of major and minor losses?	L1	2M
6	Briefly explain boundary layer separation.	L1	3M
7	What is the basic difference between turbine and pump?	L6	2M
8	Find the force acting on the inclined flat plate moving in the direction of the jet.	L5	3M
9	What is priming of pumps?	L2	2M
10	What is cavitation?	L2	3M

PART - B ANSWER ALL THE QUESTIONS		B.L	50M
11. i. a)	Define viscosity. What do you understand by types of viscosity? Do viscosity changes with temperature for liquid and gasses? If so, justify your statement.	L2	5M
b)	What is surface tension? Derive equation of pressure for A) bubble B) liquid jet	L4	5M
	[OR]		
ii.	A) What is the difference between absolute, gauge and vacuum pressure? B) What is manometer? How are they classified? C) What is pressure head? Explain the principle of micromanometer.	L5,L2, L2	(3+3+ 4)M
12.i.a)	Differentiate between stream line, streak line and path line?	L5	5M
b)	Derive Euler's equation of motion?	L3	5M
	[OR]		
ii. a)	Derive an expression for discharge through the venturimeter.	L3	5M
b)	Derive an expression for momentum equation?	L3	5M
13.i. a)	Obtain an expression for Darcy-Weisbach friction factor f for laminar flow in pipe.	L4	5M
b)	The rate of flow of water through a horizontal pipe is 0.25 m^3/sec. the diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm . The pressure intensity in the smaller pipe is 11.772 N/ cm^2. Find: A) loss of head due to sudden enlargement B) pressure intensity in the large pipe C) power lost due to enlargement.	L5	5M
	[OR]		
ii. a)	What is drag? Explain different types of drag on an immersed body in detail.	L2	5M
b)	Differentiate between laminar and turbulent flow?	L5	5M
14.i.	A water jet moving with a velocity of 40 m/sec impinges on a series of vanes, which are moving at 20 m/sec. The jet makes an angle of 30^0 when entering. The relative velocity at outlet is 0.95 times of that at inlet and the water jet leaves in a direction perpendicular to the vane motion. Find (A) vane angles at entrance and exit (B) the hydraulic efficiency	L3	10M
	[OR]		
ii. a)	In a Pelton wheel, 0.1 m^3 / sec of water strikes the blade with a velocity of 25 m/sec, while the blade velocity is 10 m/sec. If the blade deflects the jet through an angle of 120^0 , Calculate the power developed by the turbine	L5	5M
b)	Draw velocity triangles and explain the expression for maximum efficiency of a Pelton turbine with usual notations.	L4	5M
15.i.	The impeller vanes of a centrifugal pump 0.3 m diameter and 0.5 m width at outer periphery and have a vane angle of 60^0 at outlet. The pump delivers 17 m^3/sec of water and the impeller rotates at 1000 rpm. Assuming that the pump is designed to admit water radially. Calculate the shaft power required to deliver water	L5	10M
	[OR]		
ii.a)	Sketch the features of a single acting reciprocating pump.	L6	3M
b)	A single acting reciprocating pump running at 30 rpm, delivers 0.012 m/s of water. The diameter of the piston is 25 cm and stroke length 50 cm. Determine the theoretical discharge of the pump, coefficient of the discharge, slip and percentage slip of the pump.	L5	7M

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(Aziz Nagar, C.B.Post, Hyderabad -500075) **Subject code: A14315**

II B. Tech II SEM REGULAR EXAMINATION - MAY 2018

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

(FOR MECH)

Time: 3hrs **Max.Marks:75**

Note: This question paper contains two PARTs A and B.

PART A is compulsory which carries 25 marks. Answer all questions.

PART B consists of 5 Units. Answer all the questions.

PART - A

ANSWER ALL THE QUESTIONS **25 M**

1. Define the term viscosity .write briefly the effect of temperature on viscosity of liquids and gases.(3M)
2. What is surface tension? Give some examples of phenomenon of surface tension. (2M)
3. State the Bernoulli's equation. (2M)
4. Define Laminar and Turbulent flows.How they are characterized on the basis of Reynolds number. (3M)
5. State the reasons(causes) for minor energy losses. (2M)
6. Write a short notes on Boundary layer concept. (3M)
7. What is the force exerted by fluid jet on stationery flat plate? (2M)
8. Write short notes on selection of turbines. (3M)
9. What do you know about priming of a centrifugal pump? (2M)
10. Sketch the main parts of a reciprocating pump. (3M)

PART-B

ANSWER ALL THE QUESTIONS **5QX10M=50M**

11.i.(a) Write short notes on liquids and their properties. (4M)

(b) If the surface tension at the soap-air interface is 0.09N/m, calculate the internal pressure in a soap bubble of 28mm diameter. (6M)

(OR)

ii.(a) What are various manometers used for the measurement of the pressure? Also explain about the working principle of a piezometer. (3M)

(b) On the suction side of a pump a gauge shows negative pressure of 0. 35bar.Express this pressure in terms of. (7M)

A. Intensity of pressure , kPa
B. N/m^2 absolute
C. Metres of water gauge
D. Metres of oil (specific gravity 0.82)absolute
E. Centimeters of mercury gauge.

Take atmospheric pressure as 76 cm of Hg and relative density of mercury as 13.6

12.(i.) (a) Write short notes on rotational and irrotational flows. (3M)

(b) In a fluid , the velocity field is given by $V=(3x+2y)i+(2z+3x^2)j+(2t-3z)k$ determine.(7M)

A. The velocity components u,v,w at any point in the fluid flow field,
B. The speed at point(1,1,1)
C. The speed at time ,t=2sec. at point (0,0,2)

(OR)

ii)(a). In a pipe of 90mm diameter , water is flowing with a mean velocity of 2m/sce and at a guage pressure of 350 kN/m^2. Determine the total head , if the pipe is 8m above the datum line. Neglect friction losses. (7M)

(b) Sketch and explain the working of a venturimeter. (3M)

13.(i)(a). At a sudden enlargement of a water main from 240mm to 480mm diameter, the hydraulic gradient raises by 10mm. Calculate the rate of flow. (6M)

(b). Write short notes on Darcy-weisbach formula and write the formula. (4M)

(OR)

P.T.O

(ii).(a). Write short notes on major energy and minor energy losses. (4M)

(b). Water flows through a pipe of diameter 300mm with a velocity of 5m/sec. If the coefficient of friction is given by $f=0.015+0.08/Re^{0.3}$ where Re is the Reynold's number,find the head lost due to friction for a length of 10m.Take kinetic viscosity of water as 0.01 stoke. (6M)

14.i)(a). Write the force exerted by a jet of water on a stationery flat plate and on a plate held inclined at an angle θ to the jet. (4M)

(b). A jet of water 75mm in diameter having velocity of 20m/sec. strikes a series of the flat plates arranged around the periphery of a wheel such that each plate appears successively before the jet. If the plates are moving at a velocity of 5m/sec. , compute the force exerted by the jet on the plate , the workdone per second on the plate and the efficiency of the jet. (6M)

(OR)

ii).(a) Sketch and explain the working principle of Kaplan turbine. (4M)

(b) A Pelton wheel has a mean bucket speed of 12 m/sec and is supplied with water at a rate of 750 litres per second under a head of 35 m. If the bucket deflects the jet through an angle of 160^0, find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine if its mechanical efficiency is 80%. (6M)

15. i).(a) Write short notes on indicator diagram of a reciprocating pump. (3M)

(b). A double acting reciprocating pump having piston area $0.1m^2$ has a stroke 0.30 long. The pump is discharging $2.4m^3$ of water per minute at 45rpm through a height of 10m. Find the slip of the pump and the power required to drive the pump? (7M)

(OR)

ii)(a). Write short notes on the advantages of centrifugal pumps over reciprocating pumps. (3M)

(b). Find the power required to drive a centrifugal pump which delivers 40 litres of water per second to a height of 20m through a 150mm diameter and 100m long pipeline. The overall efficiency of pump is 70% and Darcy's f=0.06 for the pipeline. Assume inlet losses in suction pipe is equal to 0.33m. (7M)

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(Aziz Nagar, C.B.Post, Hyderabad -500075) **SUBJECT CODE:** A14315

II B.TECH II SEM EXAM- REGULAR 2017

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES- (MECH)

Time: 3 hours **Max Marks: 75**

Note: *This question paper contains two PARTS A and B.*
PART - A is compulsory and carries 25 marks. Answer all the questions in PART-A.
PART – B consists of 5 Question with internal choice. Answer all the questions

PART-A

ANSWER ALL THE QUESTIONS **25M**

1. A thin blade of steel can be made to float on water. Explain how this is possible. (2M)
2. Classify different manometers. (3M)
3. Differentiate steady and unsteady flow and uniform and nonuniform flow. (3M)
4. What are various applications of momentum equation in fluid dynamics. (2M)
5. Write about , total energy line and hydraulic gradient line (3M)
6. Define lift and drag force. (2M)
7. Define the terms speed ratio, flow ratio and jet ratio (2M)
8. What are unit quantities? Define the unit quantities for a turbine. (3M)
9. What is priming? Why it is necessary? (2M)
10. Explain the working of a reciprocating pump. (3M)

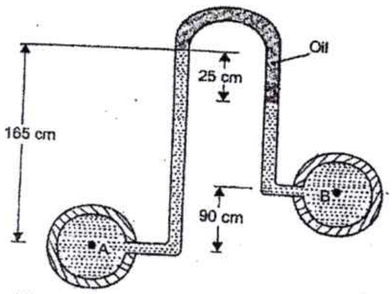
PART-B

ANSWER ALL THE QUESTIONS **5X10=50M**

11. i) An oil film of thickness 10mm is used for lubrication between the two square parallel plates of size 0.9m×0.9m each, in which the upper plate moves at 2m/s required a force of 100N to maintain this speed. Determine (a) dynamic viscosity of oil and (b) kinematic viscosity of oil , if the specific gravity of the oil is 0.95 [10M]

[OR]

ii).Find the difference in pressure in the pipes A and B containing water and connected to an inverted differential manometer as shown in figure. The gauge liquid is oil of specific gravity 0.9 [10M]



12. i) What is a Venturimeter? Derive an expression for the rate of discharge through the Venturimeter [10M]

[OR]

ii) Derive Euler's equation of motion along a stream line and hence derive Bernoulli's equation from that. [10M]

13. i) Derive Darcy's equation from fundamentals [10M]

[OR]

b) Derive expressions for displacement thickness, momentum thickness and energy thickness. [10M]

14.i) A jet of water of water impinges on a curved vane with the inlet angle being zero degree. The diameter of the jet is 50 mm and it is deflected through an angle of 160^0. The rate of flow through the nozzle is 200 lit/sec. determine

a) magnitude and direction of the fixed vane
b) magnitude and direction of the force on the fixed vane if vane moves with velocity of 30 m/s in the same direction as the jet. Also power developed and efficiency.
c) power developed and the efficiency if a series of vanes are mounted on a wheel, the tangential velocity being 30 m/s [10M]

[OR]

ii) Design a Pelton wheel which is required to develop 1500 kw, when working under a head of 160 m. At a speed of 420 r.p.m.The overall efficiency may be taken as 85% and assume some data required. [10M]

15.i) A three stage centrifugal pump has impellers 400 mm in diameter and 20 mm wide at outlet. The vanes are curved back at the outlet 45^0 and reduce the circumference area by 10%. The manometric efficiency is 90% and the overall efficiency is 80%. Determine the head generated by the pump when running at 1000 rpm delivering 50 litres per second. What should be the shaft power? [10M]

[OR]

ii) a). Explain the circumferences under which separation can occur in a reciprocating pump? [5M]
b). Derive equations for discharge, work done and power required to drive double acting pump. [5M]

*****VJIT (A) *****

15. SAMPLE COPIES OF ASSIGNMENTS

(A.Y. 20-21)

Assignment - I

5/5

19911A0361

1) Define Surface tension. Describe the relationship between surface tension and pressure inside a droplet of liquid in excess of outside pressure is given by $p = 4\sigma/d$.

Ans: **Surface Tension:**

It is defined as the tensile force acting on a liquid or surface of liquid in contact with gas. The units of Surface Tension is N/m.

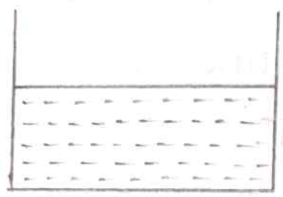
units : N/m (SI System)

kgf/m (mks)

→ Denoted by "σ".

Surface Tension in a liquid Drop:

let us assume the droplet is cut into 2 (types) halfs.



σ → Surface Tension in the droplet

p → pressure acting in the droplet

The Surface tension is acting at the circumference.

∴ We can write $= \sigma \times \pi d$

& The pressure 'p' is acting Entire area in the droplet $= p \times \frac{\pi d^2}{4}$

∴ Intensity of 'p' in droplet = Surface Tension of the droplet at the circumference

$$\sigma \times \pi d = p \times \frac{\pi d^2}{4}$$

$$p = \frac{\sigma(4)}{d}$$

$$\boxed{p = \frac{4\sigma}{d}}$$

Where,

p → pressure of water drop with surface tension.

---

2) Differentiate between Simple Manometers and differential manometers.

An:

Simple Manometers	Differential Manometers
→ It consists of a glass tube, whose one end is connected to the gauge point, where pressure is calculated and the other end is open to the atmosphere.	→ These are used to measure the pressure difference between two points in a pipe.
→ Types: i) piezometer ii) U-tube manometer iii) Single column manometer	→ Types: i) Two piezometer manometer ii) Inverted U-tube manometer iii) U-tube differential manometer iv) Micrometer

3) Explain Euler's Equation of Motion. Describe Bernoulli's Equation from Euler's Equation.

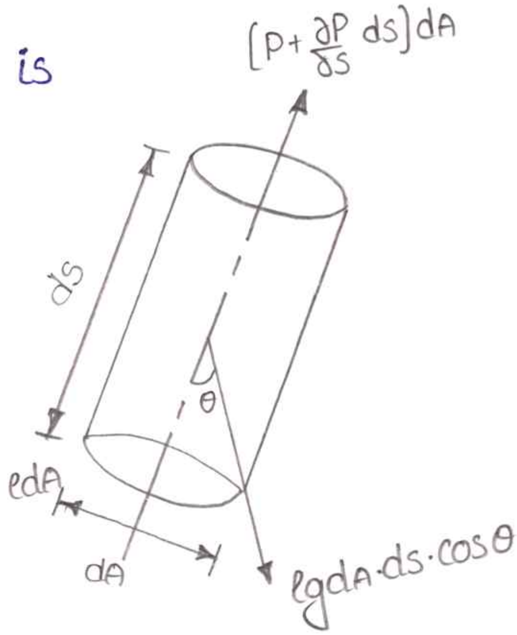
An: <u>Euler's Equation of Motion:</u>

Let us consider a cylinder of dia 'dA'. length of 'ds'.

→ The motion of the fluid is upwards.

This is the Equation of motion in which the force due to gravity & pressure are considered.

Let us consider the flow is stream line & it is in the 's' direction.



The forces acting on the cylindrical Element are:

1) $p\,dA$ – pressure force in the direction of flow.

2) $\left(p+\frac{\partial p}{\partial s}ds\right)dA$ pressure force

3) Weight of the element $\rho g \cdot dA \cdot ds$

The rate of change of momentum = force x acceleration

$$p\,dA - \left(p+\frac{\partial A}{\partial s}ds\right)dA - \rho g\,dA\,ds\cos\theta = \rho\,dA\,ds \times a_s \quad \text{—①}$$

Where a_s → acceleration due to gravity where s & t are the functions of acceleration.

$$a_s = \frac{du}{dt}$$

let us consider a small element then acceleration

$$a_s = \frac{\partial u}{\partial s}\frac{ds}{dt} + \frac{du}{dt}$$

for steady flow $\frac{du}{dt} = 0$ (constant)

$$\boxed{a_s = v\frac{\partial u}{\partial s}}$$

from Equation ①

$$\Rightarrow -\frac{\partial P}{\partial s} ds\, dA - \rho g\, dA\, ds \cos\theta$$

$$= \rho\, dA\, ds \times v\frac{\partial u}{\partial s}$$

Dividing by $\rho\, dA\, ds$

$$-\frac{\partial P}{\partial s} \times \frac{1}{\rho} - g\cos\theta = v\frac{\partial u}{\partial s}$$

$$-\frac{\partial P}{\partial s} \times \frac{1}{\rho} - g\cos\theta - v\frac{\partial u}{\partial s} = 0$$

$$\frac{\partial P}{\partial s} \times \frac{1}{\rho} + g\cos\theta + v\frac{\partial u}{\partial s} = 0$$

let us consider the vertical distance of cylinder is of some 'dz'.

then $\cos\theta = \frac{dz}{ds}$

$$\frac{dP}{ds} \times \frac{1}{\rho} + g\frac{dz}{ds} + v\frac{du}{ds} = 0$$

$$\boxed{\frac{dP}{\rho} + g\,dz + u\,du = 0}$$

Where

$\frac{dP}{\rho} \rightarrow$ pressure head

$v\,dv \rightarrow$ velocity head

$g\,dz \rightarrow$ Datum head.

Bernouli's Equation of motion:

To define motion of a fluid bernouli's equation is to be considered.

By integrating the Euler's Equation we can get the bernouli's equation.

$$\frac{dP}{\rho} + g\,dz + v\,dv = 0$$

By integrating the above Eqⁿ.

$$\int \frac{dP}{\rho} + \int g\,dz + \int v\,dv = 0$$

$$\frac{1}{\rho}P + gz + \frac{v^2}{2} = 0$$

dividing by 'g'

$$\frac{P}{\rho g} + z + \frac{v^2}{2g} = 0$$

Where,

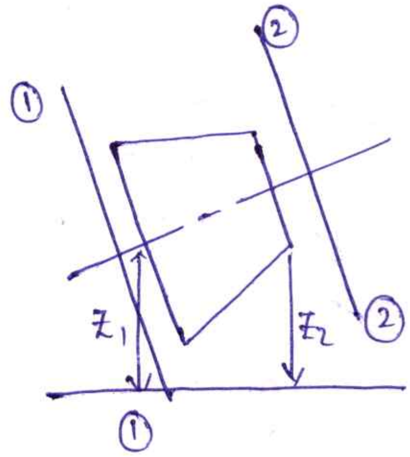
$\frac{P}{\rho g} \rightarrow$ change in the pressure head

$\frac{v^2}{2g} \rightarrow$ change in the velocity head

$z \rightarrow$ datum head.

Let us consider a pipe. There are 2 sections section I & section II.

The change in the pressure head, change in the velocity head, change in the datum head always remains Equal.



$\frac{P_1}{\rho g}$ pressure head at sctn 1

$\frac{v_1^2}{2g}$ velocity head at sctn 1

z_1 datum head at sctn 1

& vice versa

∴ We can write as

$$\boxed{\frac{P_1}{\rho g} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{v_2^2}{2g} + z_2}$$

4) Identify the expression for the force exerted by the fluid flow in a pipe bend.

An: Force Exerted by a flowing fluid on a pipe bend:

The impulse-momentum Equation is used to determine the resultant force Exerted by a flowing fluid on a pipe bend.

Consider two sections ① and ②.

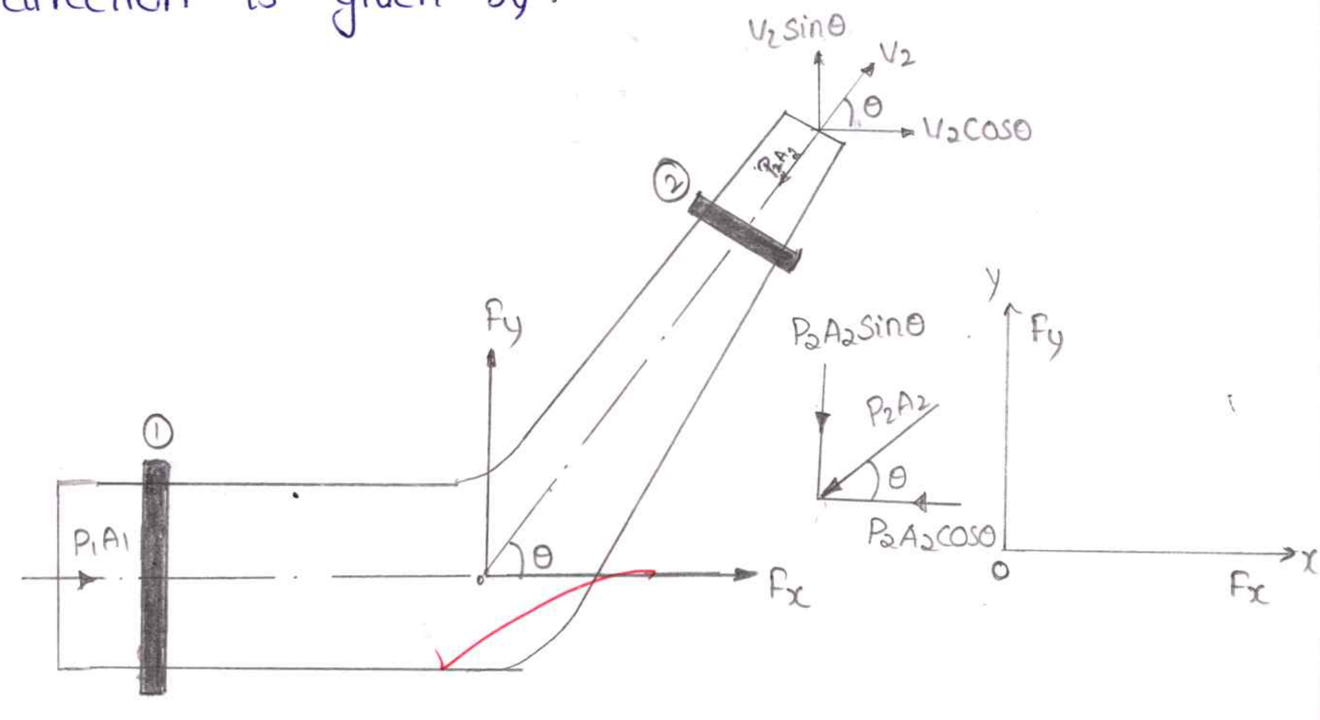
V_1 = velocity of flow at sctn ①

P_2, A_2, V_2 = Corresponding values of velocity, pressure & area at sctn ②

P_1 = pressure intensity at sctn ①

A_1 = area of cross-section of pipe at sctn ①

let F_x and F_y be the components of the forces exerted by the flowing fluid on the bend in x and y directions respectively. Then the force exerted by the bend on the fluid in the directions of x and y will be equal to F_x and F_y but in opposite directions. Here component of the forces exerted by bend on the fluid are P_1A_1 and P_2A_2 on the sections (1) and (2) respectively. Then momentum equation in x-direction is given by.



Net force acting on fluid in the direction of x = Rate of change of momentum in x-direction.

$$P_1 A_1 - P_2 A_2 \cos\theta - F_x = \text{(Mass per sec) (change of velocity)}$$

$$= \rho Q (V_2 \cos\theta - V_1)$$

$$F_x = \rho Q (V_1 - V_2 \cos\theta) + P_1 A_1 - P_2 A_2 \cos\theta$$

ll'y the momentum equation in y-direction gives

$$0 - P_2 A_2 \sin\theta - F_y = \rho Q (V_2 \sin\theta - 0)$$

$$F_y = \rho Q (-V_2 \sin\theta) - P_2 A_2 \sin\theta$$

Now the resultant force (F_R) acting on the bend

$$= \sqrt{F_x^2 + F_y^2}$$

And the angle made by the resultant force with horizontal direction is given by

$$\boxed{\tan\theta = \frac{F_y}{F_x}}$$

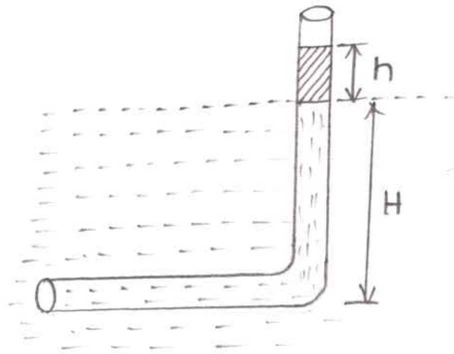
5) Show the Expression for the velocity of flow by using pitot static tube.

An: pitot tube:

It is defined to calculate velocity head of a fluid at any point of the flow.

It is a 'L' shaped tube.

By applying Bernoulis equation.



$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + Z_2$$

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} = \frac{P_2}{\rho g} + \frac{V_2^2}{2g}$$

$$H + \frac{V_1^2}{2g} = H + h + \frac{V_2^2}{2g}$$

$$H + \frac{V_1^2}{2g} = H + h \quad (V_2 = 0)$$

$$\frac{V_1^2}{2g} = h$$

$$V_1^2 = 2gh$$

$$\boxed{V_1 = \sqrt{2gh}}$$

i.e $V = 2gh$

$$\boxed{V = C_v \sqrt{2gh}}$$

where $C_v \rightarrow$ coefficient of velocity in pitot tube

(A.Y. 20-21)

Assignment - II

5/5

19911A0391

1) Explain the term Boundary Layer ? Describe the characteristics along thin plate for Laminar & turbulent boundary layers ?

An: Boundary layer Concepts:

let us consider a river is flowing with velocity 'u' Exactly at the Center of the river the velocity is max. At the end of the river the water is attached with land it forms Small thickness of layer which is stick at the End of the shore the velocity of the water is '0'. This thickness of the layer of the Water is said to be the boundary.

These are many types of boundaries Considering boundary of water & oil.

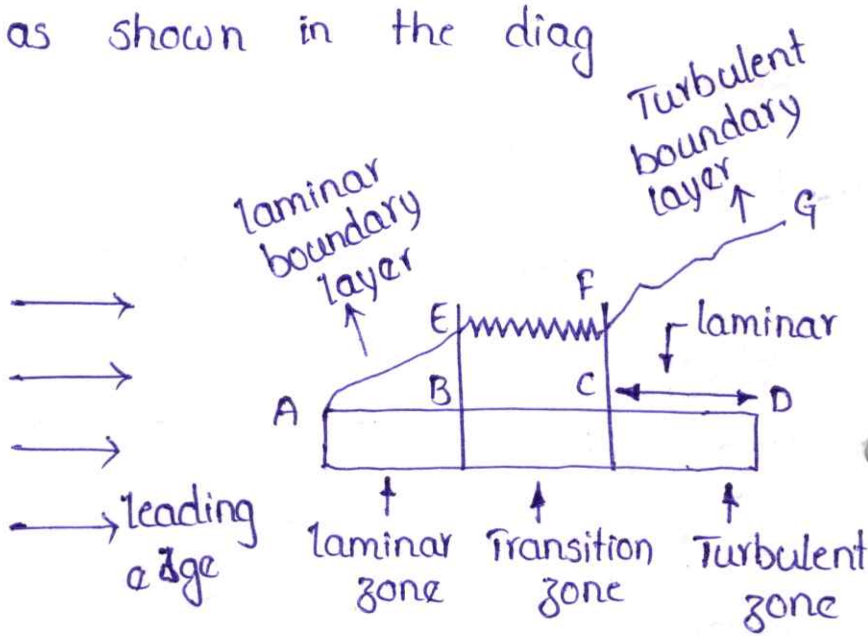
→ If the oil is moving with velocity 'U' then the boundary b/w water & oil is having the same velocity as the oil. Here the velocity as the boundary is also 'U'.

→ let us consider a flat plate is placed at the Centre of the river.

∴ Their shud also be a boundary with the plate.

It can be divided into 3 zones

1. laminar zone
2. Transition zone (converting)
3. Turbulent zone as shown in the diag



Considering the flow of fluid 'having free' stream velocity (river velocity) 'U' over a smooth thin plate which is flat & placed ‖ to the direction of free stream as shown in the diagram. Let us consider the flow with '0' pressure gradient on one sider of the plate which is stationary.

The velocity of the fluid on the surface of the plate should be = the velocity of the plate but the plate is stationary & hence the velocity of fluid on the surface of the plate is '0'.

Characteristics of a Boundary layer:

i) 'δ' [Thickness of boundary region layer] increases as distances from leading edge 'n' increases.

ii) 'δ' decreases as 'U' increases.

iii) 'δ' increases as kinematic viscosity increases

iv) $\tau_0 = \mu\left(\frac{v}{g}\right)$

$\therefore \tau_0 \downarrow$ as 'x' $\uparrow$.

However as boundary layer becomes turbulent, it shows a sudden increase & then decrease with increasing 'u'.

v) When 'U' increases ~~in~~ downward direction, boundary layer growth is (~~increased~~) reduced.

vi) If $\frac{Un}{V} < 5\times10^5$

boundary layer is laminar [velocity distribution is parabolic]

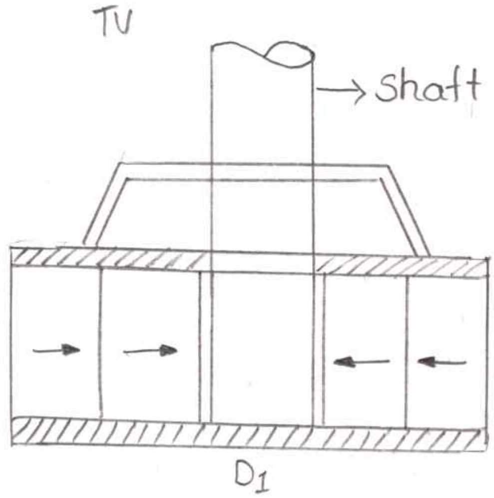
vii) If $\frac{Un}{V} > 5\times10^5$ .... Boundary layer is turbulent on that portion [velocity distribution follows log law (or) power law].

Laminar Sub Layers : This region in the turbulent boundary layer zone, adjacent to the solid surface of the flame. In this zone the velocity variation influenced only by viscous effects. Through though the velocity distribution would be parabolic curve in the laminar sublayer zone.

∴ The shear stress in the laminar sub layer should be constant & is equal to the boundary shear stress (τ).

2) Express the work done per second per unit weight of water in a reaction turbine is given as :

$= \frac{1}{g} [V_{w_1} u_1 + V_{w_2} u_2]$



Inward flow reaction turbine :

$D_1 \rightarrow$ dia of 1 at outlet

$D_2 \rightarrow$ dia at at inlet at exit

If the water enters from the blades then

In inward flow reaction turbine

$D_1 > D_2$

∴ speed of the blade $U_1 = \frac{\pi D_1 N}{60}$, $U_2 = \frac{\pi D_2 N}{60}$

Where D_o is the dia at outer dia

$D_i \rightarrow$ inner dia

WD per second per unit of water per sec

$$WD = \frac{\rho a v \left(V_{w_1} u_1 \pm V_{w_2} u_2 \right)}{\rho a v \times g}$$

β is acute

$$WD = \frac{1}{g} \left[V_{w_1} u_1 \pm V_{w_2} u_2 \right]$$

If $\beta = 90°$, $V_{w_2} = 0$

$$WD = \frac{1}{g} \left(V_{w_1} U_1 \right)$$

If β is obtuse $= \frac{1}{g} \left[V_{w_1} U_1 - V_{w_2} U_2 \right]$

4) Define Specific speed of a turbine. D Explain its expression and compare it with unit speed. Describe its application?

An: Specific Speed:

It is defined as the speed of the turbinl which is identical in shape & geometrical dimensions, blade angle, gate openings etc with the actual turbine bt such a state size that it will develop a unit power working under a unit head. Denoted as (N_s).

WKT

$$\eta_0 = \frac{SP}{WP} \quad \text{--- (1)}$$

$\therefore$ we can write as $\eta_0 = \dfrac{P}{\frac{\rho g Q H}{1000}}$

$$P = \eta_0 \times \frac{\rho g Q H}{1000}$$

Here, We can write as $P \propto Q \;\&\; H$ — (2)

$$P \propto Q \times H$$

The absolute velocity, tangential velocity & head on the turbine are related as $u \propto V$.

& further $V \propto \sqrt{H}$ from $V = C_v \sqrt{2gH}$

$\therefore$ We can write as $u \propto \sqrt{H}$ — (3)

But $u = \dfrac{\pi D N}{60}$ — (4)

$\therefore$ We can write as $u \propto DN$ — (5)

from (3) & (4)

$$\sqrt{H} \propto DN$$

$$D \propto \frac{\sqrt{H}}{N} \quad \text{--- (6)}$$

we know that $Q = A \times V$ (Q-discharge)

if $A = B \times D$ if $B = D$

then $A = D^2$

$\therefore$ we can write as $Q \propto D^2 \propto \sqrt{H}$

$$Q \propto \frac{H}{N^2} \propto \sqrt{H} \quad \text{--- (7)}$$

$$Q \propto \frac{H^{3/2}}{N^2}$$

sub ⑦ in ①

$$P \propto Q \propto H \Rightarrow P \propto \frac{H^{3/2}}{N^2} \times H$$

$$P \propto \frac{H^{5/2}}{N^2}$$

for unit head & unit power

∴ we can write as $P=1,\ H=1,\ N=N_s$

$$P = K\frac{H^{5/2}}{N^2} \quad \text{—⑨}$$

$$1 = K\frac{(1)^{5/2}}{N_s}$$

$$\boxed{N_s^2 = K} \quad \text{—⑩}$$

put ⑩ in ⑨

$$P = K\frac{H^{5/2}}{N^2}$$

$$= N_s^2\frac{H^{5/2}}{N^2}$$

$$\boxed{N_s = \frac{N\sqrt{P}}{H^{5/4}}}$$

Applications:

1) Specific speed plays an important role in the selection of type of turbine.
2) By knowing specific speed of turbine, performance of turbine can be predicted.

3) A Kaplan turbine working under a head of 20m, develops 11772 KW shaft power. The outer dia of runner is 3·5 m and hub diameter is 1·75 m. The guide blade angle at the extreme edge of runner is 35°. The hydraulic & overall efficiency of turbine are 88 % & 84 %. If velocity of whirl is zero. Find

i) Runner vane angles at inlet & outlet

ii) Speed of turbine

An: Given

Head (H) = 20 m

S·P = 11772 KW

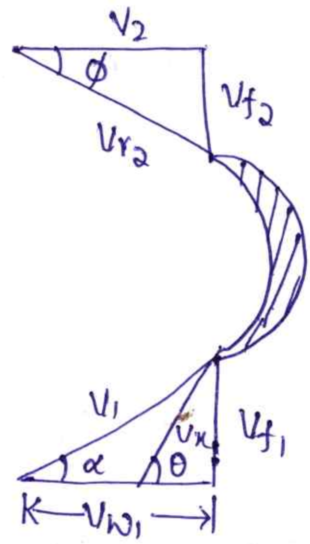
$\eta_h = 88\%$

$\eta_o = 84\%$

Douter = D_o = 3·5 m

D Hub = D_b = 1·75 m

Guide blade angle $\alpha = 35°$



WKT

$$\eta_o = \frac{SP}{WP}$$

$$Wp = \frac{\rho g Q H}{1000}$$

$$0.84 = \frac{11772}{\frac{\rho g Q H}{1000}}$$

$$Q = \frac{11772 \times 1000}{0.84 \times 1000 \times 9.81 \times 20} = 71.428 \text{ m}^3/\text{sec}$$

using $Q = \frac{\pi}{4}(D_o^2 - D_b^2) \times V_{f_1}$

$$71.428 = \frac{\pi}{4}\left[(3.5)^2 - (1.75)^2\right] \times V_{f_1}$$

$$V_{f_1} = \frac{71.428}{7.216} = 9.9 \text{ m/s}$$

from inlet velocity triangle,

$$\tan \alpha = \frac{V_{f_2}}{V_{w_1}}$$

$$V_{w_1} = \frac{9.9}{\tan 35} = 14.14 \text{ m/s}$$

Also, $$\eta_h = \frac{V_{w_1} U_1}{gH}$$

$$0.88 = \frac{14.14 \times u_1}{9.81 \times 20}$$

$$\boxed{U_1 = 12.21 \text{ m}}$$

i) Runner vane angles :

$$\tan \theta = \frac{V_{f_1}}{V_{w_1} - U_1}$$

$$= \frac{9.9}{(14.14 - 12.21)} = 5.13$$

$$\theta = \tan^{-1}(5.13)$$

$$\boxed{\theta = 78.97^\circ}$$

for Kaplan turbine

$$U_1 = U_2 = 12.21 \text{ m/s}$$

$$V_{f_1} = V_{f_2} = 9.9 \text{ m/s}$$

for outlet velocity triangle

$$\tan \phi = \frac{V_{f_2}}{U_2} = 0.811$$

$$\phi = \tan^{-1}(0.811) = 39.035^\circ$$

ii) Speed of turbine is

$$U_1 = U_2 = \frac{\pi D_0 N}{60}$$

$$12.21 = \frac{\pi \times 3.5 \times N}{60}$$

$$N = \frac{60 \times 12.21}{\pi \times 3.50}$$

$$\boxed{N = 66.63 \text{ rpm}}$$

5. A centrifugal pump with 1.2m diameter runs at 200 rpm and pumps 1880 lit/s the avg lift being 6m. The angle which the vanes makes at exit with the tangent to the impeller is 26° & the radial velocity flow is 2.5 m/s. Determine η_{mano} and the least speed to start pumping aganist a head of 6m. The inner dia of impeller being 0.6m.

Sol: Given

Dia at outlet = $D_2 = 1.2m$

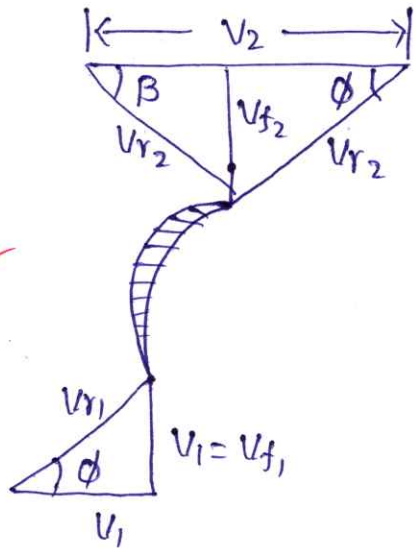
Speed $(N) = 200$ rpm

Discharge $(Q) = 1880$ lit/sec $= 1.88\ m^3/sec$

manometric head $(H_m) = 0.6m$

$\phi = 26°$

$V_{f_2} = 2.5\ m/s$ & $D_1 = 0.6m$



i) manometric Efficiency:

$$\eta_{man} = \frac{gH_m}{V_{w_2} \times u_2}$$

But $U_2 = \frac{\pi D_2 N}{60} = \frac{\pi \times 1.2 \times 200}{60} = 12.56\ m/s$

$$\tan\phi = \frac{V_{f_2}}{u_2 - V_{w_2}}$$

$$u_2 - V_{w_2} = \frac{V_{f_2}}{\tan\phi} = \frac{2.5}{\tan 26^\circ} = 5.13$$

$$V_{w_2} = U_2 - 5.13$$

$$V_{w_2} = 7.43\ m/s$$

$$\eta_{mano} = \frac{9.81 \times 60}{7.43 \times 12.56} = 0.63$$

$$= 63\ \%$$

ii) least speed to start pump:

It is given by

$$\frac{U_2^2}{2g} - \frac{U_1^2}{2g} = H_m$$

But $U_2 = \omega \times r_2$

$U_1 = \omega \times r_1$

$$\therefore \frac{(\omega \times r_2)^2}{2g} - \frac{(\omega \times r_1)^2}{2g} = H_m = 6.0$$

$$\omega^2 = \frac{6.0 \times 2.0 \times 9.81}{0.36 - 0.9} = 436$$

$$\left\{\therefore \omega = \frac{2\pi N}{60}\right\}$$

least speed required

$$N = \frac{60 \times 20.88}{2 \times \pi}$$

$$\boxed{N = 250 \text{ rpm}}$$

$$\left\{\therefore \omega = \frac{2\pi N}{60}\right.$$

$$\left. 20.88 = \frac{2\pi N}{60} \right\}$$

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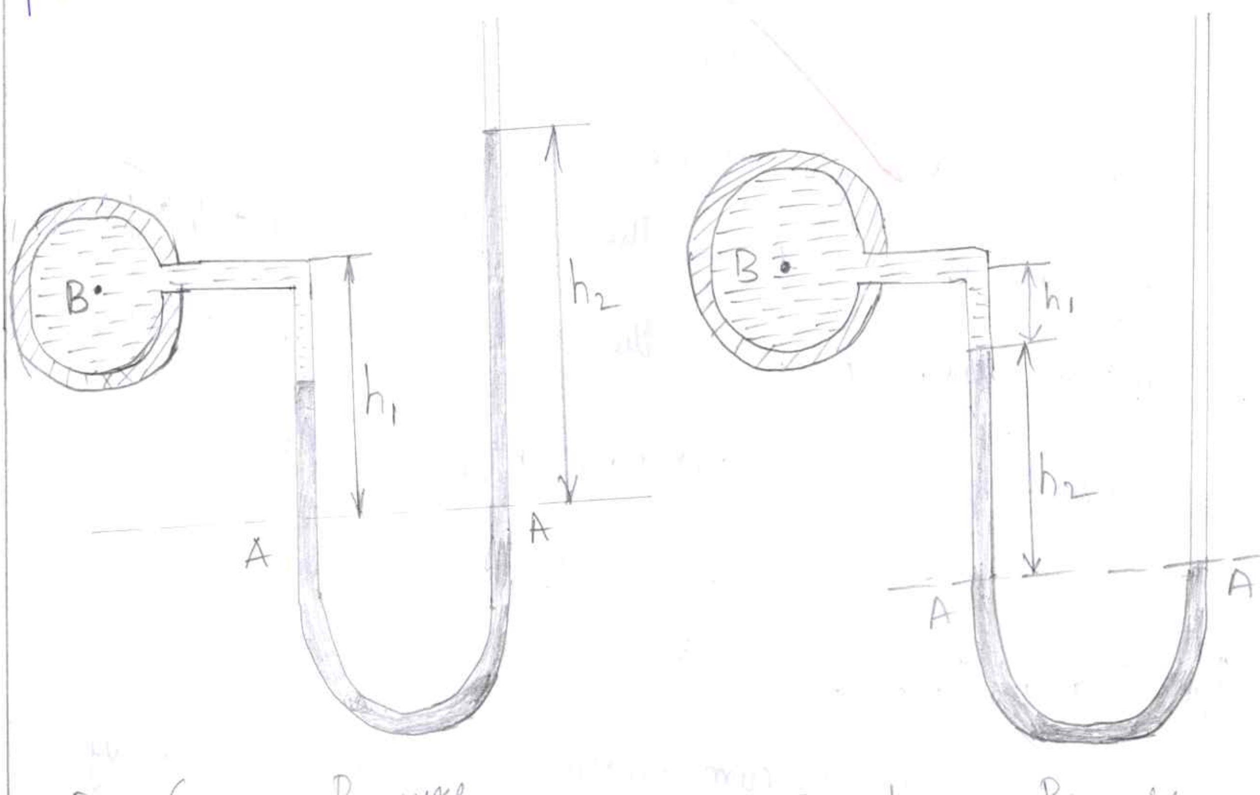
2) Explain the working principle of simple U-tube manometer. Discuss the advantanges of this manometer over a piezometer.

As: It consists of glass tube bent in U-shape, one end of which is connected to a point at which pressure is to be measured and other end remains open to the atmosphere as shown in figure. The tuber generally contains mercury or any other liquid whose specific gravity is greater than the specific gravity of the liquid whose pressure is to be measured.



(a) For Gauge Pressure (b) For Vaccum Pressure

a) For Gauge Pressure:

Let B is the point at which pressure is to be measured, whose value is p. The datum line is A-A.

Let, h_1 = Height of light liquid above the datum line.

h_2 = Height of heavy liquid above the datum line.

S_1 = Sp. gravity of liquid

ρ_1 = Density of light liquid = $1000 \times S_1$

S_2 = Sp. gravity of heavy liquid.

ρ_2 = Density of heavy liquid = $1000 \times S_2$

As the pressure is the same for the horizontal surface. Hence pressure above the horizontal datum line A-A in the left column and in the right column of U-tube manometer should be same.

Pressure above AA in the left column = $p + \rho_1 * g \times h_1$

Pressure above A-A in the right column = $\rho_2 \times g \times h_2$

Hence equating the two pressure, $p + \rho_1 g_1 h_1 = \rho_2 g_2 h_2$

$$\therefore P = (\rho_2 g_2 h_2 - \rho_1 g_1 h_1)$$

b) For Vaccum Pressure:

For measuring vaccum pressure, the level of the heavy liquid in the manometer will be as shown. Then

Pressure above A-A in the left column $= \rho_2 g h_2 + \rho_1 g h_1 + P$

Pressure head in the right column above A-A $= 0$

$$\rho_2 g h_2 + \rho_1 g h_1 + P = 0$$

$$P = -(\rho_2 g h_2 + \rho_1 g h_1)$$

Advantages over a Piezometer.

1. Piezometer cannot be used when large pressures in the lighter liquids are to be measured.

2. Since, this would require very long tubes, which cannot be handled conveniently.

3. Further more gas pressures cannot be measured by means of piezometers because a gas forms no free atmospheric surface.

4) Derive the Darcy-weisbach equation & chezy's formula by using loss of head due to friction.

Ans The intensity of pressure will be reduced in the direction of the flow by virtue of frictional losses and loss of head due to friction h_f.

Frictional resistance,

F_1 = resistance per unit wetted area per unit velocity X wetted area x (velocity)^2

$f_1 = f' \times$ perimeter $\times$ length $\times$ velocity^2

$= f' \times 2\pi r \times l \times v^2$

$= f' \times \pi d \times l \times v^2$

$F_1 = f' \times P \times l v^2$ (P = perimeter)

Flows acting during the flow of fluid in the pipe.

1) P_1A_1 = along the flow at (1)

2) P_2A_2 = opposite to the flow at (2)

3) F_1 = resistance force.

In order to balance condition;

$P_1A_1 - P_2A_2 - F_1 = 0$ $(\because A_1 = A_2 = A)$

$(P_1 - P_2)A = F_1$

$\therefore$ from relation;

$$\frac{P_1}{\rho g} - \frac{P_2}{\rho g} = h_f$$

$(P_1 - P_2) = \rho g h_f$

$$A(\rho g h_f) = f' \times \pi d \times l \times v^2$$

$$h_f = \frac{f' \times \pi d \times l \times v^2}{\rho g A}$$

$$= \frac{f'}{\rho} \times \frac{\pi d}{\frac{\pi}{4} d^2} \times \frac{l \times v^2}{g}$$

$$h_f = \frac{4 f' v^2 l}{\rho g d} = \frac{f'}{\rho g} \times \frac{4 l v^2}{d}$$

If, f = coefficient of friction

$$\frac{f'}{\rho} = \frac{f}{2}$$

substitute the value,

$$h_f = \frac{f}{2} \times \frac{4 l v^2}{g d}$$

$$\boxed{h_f = \frac{4 f l v^2}{2 g d}}$$ → Darcy weisbach equation.

Expression for chezy's equation:-

$$h_f = \frac{f'}{\rho g} \times \frac{P}{A} \times l \times v^2$$

The ratio, $\frac{A}{P} = \frac{\text{area}}{\text{perimeter}}$ = hydraulic mean depth

$$m = \frac{A}{P} \Rightarrow m = \frac{\pi d^2/4}{\pi d}$$

$$m = \frac{d}{4}$$

$$h_f = \frac{f'}{\rho g} \times \frac{1}{m} \times l \times V^2$$

$$V^2 = \frac{h_f \times \rho g m}{f' \times l}$$

$$V = \sqrt{\frac{h_f \times \rho g m}{f' \times l}} = \sqrt{\frac{\rho g}{f'}} \times \sqrt{\frac{m h_f}{l}}$$

where $\sqrt{\frac{\rho g}{f'}} = C$ = chezy's constant.

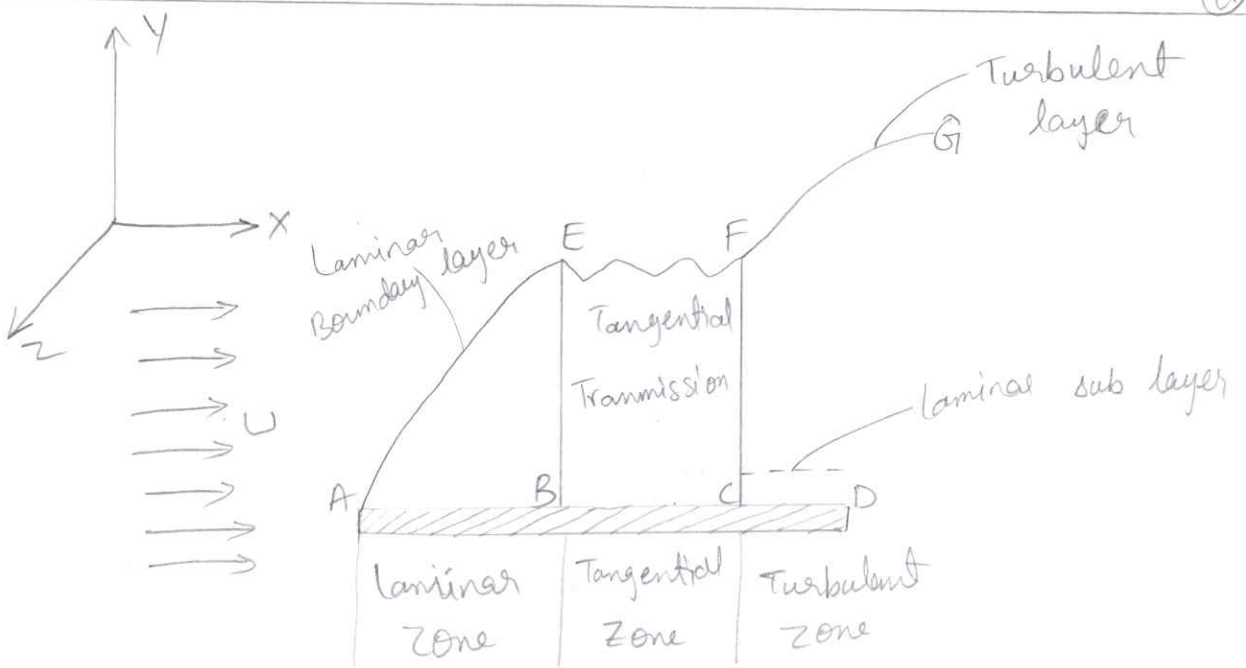
$\frac{h_f}{l} = i$ = loss of head per length.

Substitute the values,

$$V = C\sqrt{mi}$$

5. Explain the boundary layer of flow. Describe its formation along a long thin plate with a neat sketch.

Ans It is denoted by δ can be defined as the distance from the boundary of the solid body measured is the y-direction to the point, where the velocity of the fluid is approx. equal to 0.99 times. The free stream velocity of the fluid (U).



In case of laminar and turbulant zone

δ_{lam} = Thickness of laminar layer

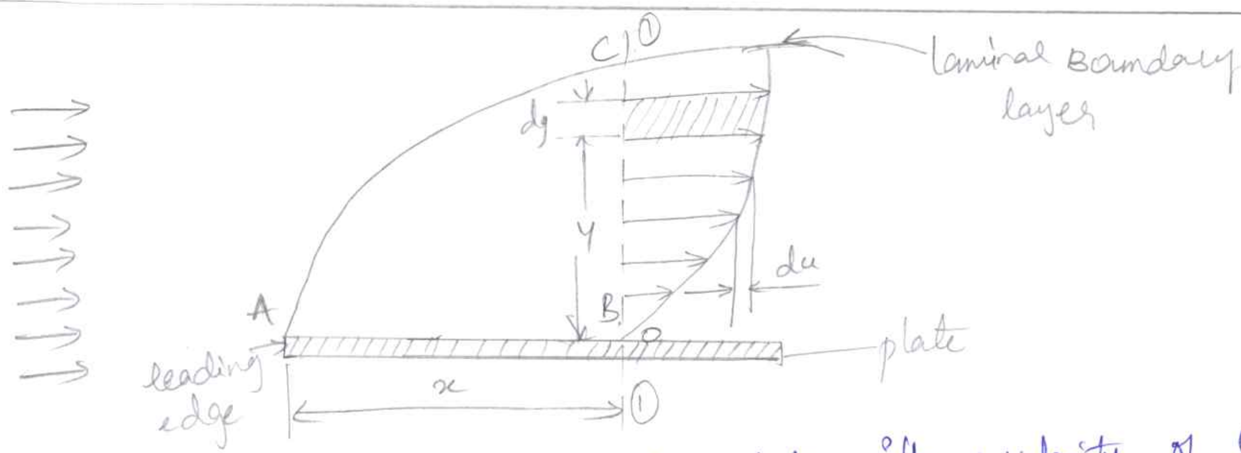
δ_{tur} = Thickness of turbulant layer

δ' = Thickness of laminar sub layer.

Displacement thickness denoted as δ^*

It is defined as the distance measured perpendicular to the boundary of the solid body by which the boundary should be displaced two compensate for the reduction in flow rate on the account of boundary layer formation.

Expression for displacement thickness (δ^*)



Consider a fluid flowing over thin plate with a velocity of 'U'

At a distance 'x' from the leading edge, consider the section ① - ①.

The velocity at the point B is zero & the velocity at the point 'C' is maximum = 'U'

Thus the velocity changes from 0 to U, when the thickness of the layer = BC.

Let the distance, BC = δ

At section 1-1, consider an elemental strip.

Let, y = distance of the elemental strip from the boundary.

dy = thickness of the elemental strip.

b = width of the strip.

u = velocity of the elemental strip.

Area of the elemental strip 'dA' = $b \times dy$.

Mass of fluid/second flowing through the elemental strip.

= density × Area × velocity.

= $\rho \, dA \times u$

= $\rho \times b \times dy \times u$ — ①

If there has been no plate, then the fluid will move with a constant velocity which is equal to 'U' through the sec-①

Then, mass of fluid/second through the elemental strip.

$$= \rho \times b \times dy \times U \quad - ②$$

∴ Reduction in mass of fluid/sec through the elemental strip $= \rho b (U \cdot dy - u \cdot dy)$

Total reduction in mass of fluid/sec $= \int_0^{\delta} \rho b (U \cdot dy - u \cdot dy)$

$$= \rho b \int_0^{\delta} (U - u)\, dy \quad - ③$$

Let the plate is displaced by distance δ^* and the velocity of the flow for the distance is given by the free stream ~~velocity~~ of flow 'U'.

Loss of mass of fluid/sec for the distance $\delta^* = \rho \times b \times U \times \delta^*$ — ④

(Area $= \delta^* \times b$)

equate eqn ③ with ④

$$\rho b U \delta^* = \rho b \int_0^{\delta} (U - u)\, dy$$

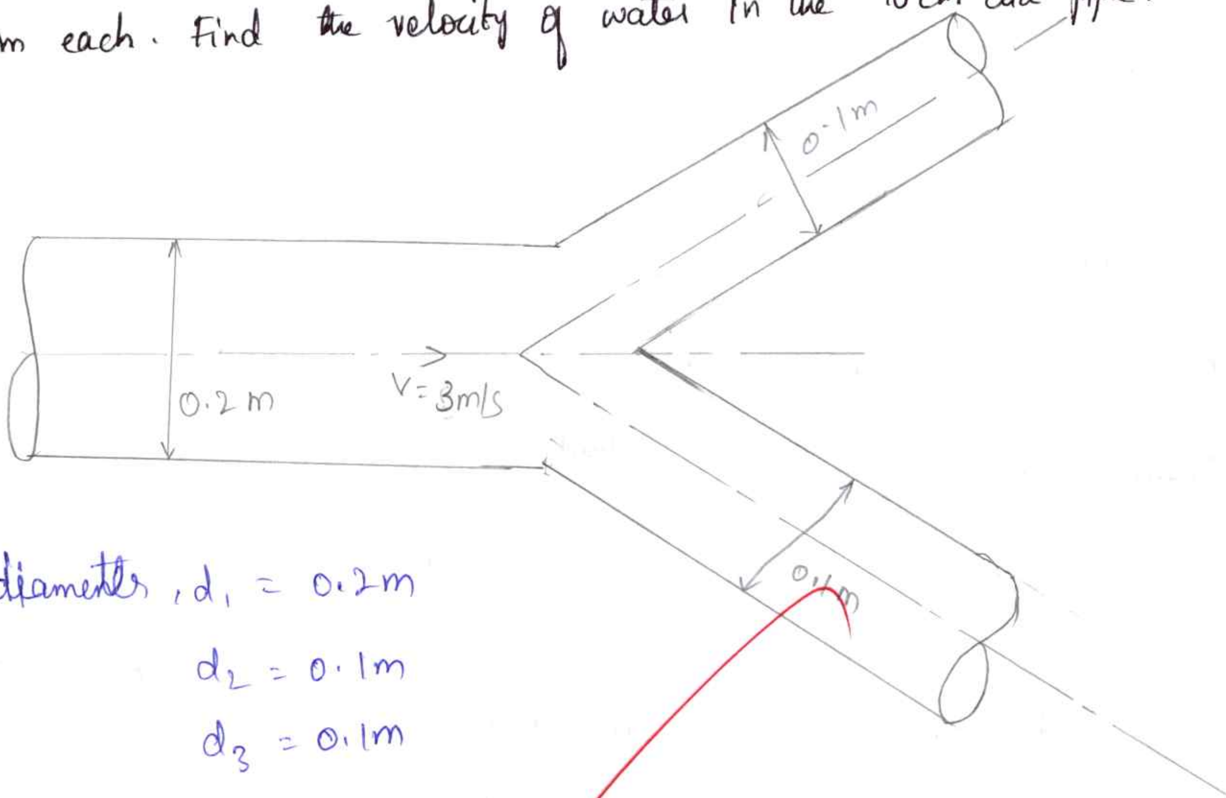
$$\delta^* = \frac{1}{U} \int_0^{\delta} (U - u)\, dy$$

$$\delta^* = \int_0^{\delta} \frac{U - u}{U}\, dy$$

$$\boxed{\delta^* = \int_0^{\delta} \left(1 - \frac{u}{U}\right) dy}$$

3) A pipe of 20 cm dia. is carrying water with a mean velocity of 3 m/s. Calculate the discharges, if the pipe bifurcates into two pipes of 10 cm each. Find the velocity of water in the 10 cm dia. pipe.

Sol



diameter, $d_1 = 0.2m$

$d_2 = 0.1m$

$d_3 = 0.1m$

velocity, $V = 3m/s$

discharge, $Q_1 = a_1 V_1$

$a_1 = \frac{\pi}{4}(d_1)^2$

$= \frac{\pi}{4}(0.2)^2$

$a_1 = 0.0314\ m^2$

$Q_1 = 0.0314 \times 3$

$Q_1 = 0.0942\ m^3/s$

$Q_1 = Q_2 + Q_3$

$Q_2 + Q_3 = 2Q$

$Q_1 = 2Q$

$Q_1 = 2 \times a_2 \times V_2$

$0.0942 = 2 \times (7.853 \times 10^{-3}) \times V_2$

$$V_2 = 5.99 \text{ m/s}$$

(1) A piston 99.5 mm diameters works in a cylinder 100mm diameter, 120mm long. The space between the two is filled with lubricating oil of viscosity 0.05 poise. Calculate the speed of the piston through the cylinder under the action of an axial force of 5N.

Sol Given data,

$d_1 = 99.5 \text{ mm} = 0.0995 \text{ m}$

$d_2 = 100\text{mm} = 0.1 \text{ m}$

$l = 120 \text{ mm} = 0.12 \text{ m}$

viscosity, $\mu = 0.05$ poise $= 5 \times 10^{-3} \frac{Ns}{m^2}$

force, $f = 5$ N.

Speed, $N = ?$

$u = \frac{\pi D N}{60}$

$F = \tau \times \text{Area}.$

$S = \tau \times \pi \times d_1 \times L$

$S = \tau \times \pi \times 0.0995 \times 0.12$

$S = 0.037\,\tau$

$\tau = \frac{5}{0.037}$

$\tau = 135.135\ N/m^2$

$\tau = \mu \times \frac{du}{dy}$

$135.135 = (5 \times 10^{-3}) \times \frac{du}{dy}$

$dy = d_2 - d_1$

$= 100 - 99.5 = 0.5\ mm$

$dy = 0.5 \times 10^{-4}\ m$

$135.135 = (5 \times 10^{-3}) \times \frac{du}{0.5 \times 10^{-4}}$

$\frac{du}{0.5 \times 10^{-4}} = 27027$

$du = 13.513\ m/s$

$\therefore du = u$

$u = \frac{\pi D N}{60}$

$N = \frac{u \times 60}{\pi D} = \frac{13.513 \times 60}{\pi \times 0.095}$

$N = 2593.76\ rpm.$

A.Y. 2018-19 (5/5) 17911A0339

Assignment - II

1 Derive the Darcy - Weisbach equation and chezy's formula by using loss of head due to friction?

Sol: Equation for head loss in pipes due to friction due to friction - Darcy - Weisbach equation.

Consider a horizontal pipe of cross-sectional area A carrying a fluid with a mean velocity V. let 1 and 2 be the two sections of pipe L distance apart, where let the intensities of pressure be P_1 and P_2 respectively.

By applying Bernoullis equation

$$\frac{P_1}{w_1} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{w} + \frac{V_2^2}{2g} + Z_2 + h_f$$

$$V_1 = V_2 = V \quad \& \; Z_1 = Z_2$$

$$\text{loss of head} = h_f = \frac{P_1}{w} - \frac{P_2}{w}$$

Flow through pipes:

The pressure intensity will be reduced by frictional resistance in the directionof flow

f is frictional resistance per unit area at Unit velocity

Frictional resistance

$= f \times area \times V^2$

$= f \times PL \times V^n$

(a) Chezy's Formula:

The ratio $\frac{h_f}{L}$ represents the slope of hydrolic grade line or energy grade line and it is usually represented by 'i' or 's' ie $\left(\frac{h_f}{L}\right) = i$ (or) S

$$V^2 = \frac{W}{f'} \times m \times \frac{h_f}{L} = \frac{W}{f'}(m_i)$$

$$n = 2 \quad \text{and} \quad C = \sqrt{\frac{W}{f'}}$$

$$V = C\sqrt{mi} \quad \text{(or)} \quad V = C\sqrt{RS}$$

$C \rightarrow$ chezy's coefficient

2 A Pelton wheel is working under head of 45m and the discharge is 0.8 m^3/sec. The mean bucket speed is 14 m/s. Find the power produced if jet is deflected by blades angle 165°. The coefficient of velocity is 0.985

Sol

$H = 45m$

$Q = 0.8\ m^3/s$

$u = u_1 = u_2 = 14\ m/sec$

$C_v = 0.985$

Angle of deflection $= (180 - 165) = 15^\circ$

$$\text{Power} = \frac{\rho a v_1 (v_{w_1} + v_{w_2}) u}{1000}$$

Vel of jet $V_1 = C_v \sqrt{2gh}$

$= 0.985 \sqrt{2 \times 9.8 \times 45}$

$= 29.29\ m/sec$

$V_{r_1} = V_1 - u = 29.28 - 14$

$= 15.28\ m/s$

$V_{r_1} = V_{r_2} = 15.28$

$V_{w_1} = V_1 = 29.28$

$V_{w_2} = V_{r_2} \cos\phi - u$

$= 15.28 \cos(15) - 14$

$= 0.759$

$Q = a v_1 = 0.8\ m^3/sec$

$$\text{power} = \frac{1000 \times 0.8 (29.28 + 0.759) \times 14}{1000}$$

$= 33.6.43\ kw$

5 A double acting reciprocating pump, running at 50 rpm is discharging 900 lit of water per min, The pump has a stroke 400 mm. the diameter of piston is 250mm. The delivery and suction heads are 25m and 4m respectively. Find the slip of pump and power required to drive the pump.

Sol:

$N = 50$ rpm

$Q_{act} = 900$ lit/m $= 0.9\ m^3/min$

$= 0.015\ m^3/sec$

$L = 400m = 400 \times 10^{-3}$

$D = 250mm = 250 \times 10^{-3}$

$h_d = 25m \quad h_s = 4m$

$$Q_{th} = \frac{2ALN}{60} = \frac{2 \times \frac{\pi}{4}(250 \times 10^{-3})^2 \times 4000 \times 10^{-3} \times 50}{60}$$

$= 0.0327$

$Slip = Q_{th} - Q_{act}$

$= 0.0327 - 0.015$

$= 0.0177$

$W/sec = \rho g Q (h_s + h_d) = 1000 \times 9.81 \times 0.0327 (25+4)$

$= 9302.823$

$$\text{power} = \frac{W/\text{sec}}{1000} \text{ kW}$$

$$= 9.302 \text{ kW}.$$

Q Define Specific Speed of Turbine. Explain its expression and compare it with Unit Speed. Describe its application

Specific Speed: It is defined as speed of Turbine which is identical in shape, geometrical dimensions, blade angles etc., with actual turbine but of such size that it will develop under Unit power when working under Unit head.

Derivation of specific Speed

$$\eta_o \text{ (overall efficiency)} = \frac{\text{Shaft power}}{\text{water power}}$$

$$= \frac{\text{power developed}}{\frac{\rho \times g \times Q \times H}{1000}}.$$

$$= \frac{P}{\frac{\rho \times g \times Q \times h}{1000}}$$

$$P = \eta_o \times \frac{\rho \times g \times Q \times h}{1000}$$

$$u \propto V \qquad V \propto \sqrt{H}$$

$$u \propto \sqrt{H}$$

$$u = \frac{\pi D N}{60} \propto DN$$

$$\sqrt{H} \propto DN \quad (\text{or}) \quad D \propto \frac{\sqrt{H}}{N}$$

$$Q = \text{area} \times \text{vel}$$

$$\text{Area} = B \times D$$

$$\propto D^2$$

$$\text{vel} \propto \sqrt{H}$$

$$Q \propto D^2 \times \sqrt{H}$$

$$\propto \left(\frac{\sqrt{H}}{N}\right)^2 \times \sqrt{H}$$

$$\propto = \frac{H^{3/2}}{N^2}$$

$$P = \frac{H^{3/2}}{N^2} \times H \propto \frac{H^{5/2}}{N^2}$$

$$P = K \times \frac{H^{5/2}}{N^2}$$

K = const. of prop.

$P = 1$, $H = 1$ speed N = Specific speed N_s

$$1 = \frac{K \times 1^{5/2}}{N_s^2} \quad (\text{or}) \quad N_s^2 = K$$

$$P = N_s^2 \frac{H^{5/2}}{N^2} \quad (\text{or}) \quad N_s^2 = \frac{N^2 P}{H^{5/2}}$$

$$N_s = \sqrt{\frac{N^2 P}{H^{5/2}}} = \frac{N\sqrt{P}}{H^{5/4}}$$

P is taken in metric horse power

Significance:

→ Specific speed plays an imp role for Selecting the type of turbine

→ And, the performance of turbine can also be known by specific speed of turbine

Fmhm Assignment (5/5)

A.Y.2018-19 17911A03K3

1\. A glass tube 20mm in diameter contains a mercury column with water above the mercury. The surface tension of mercury in contact with water is 0.36 N/m Determine the capillary depression of mercury take $\theta = 130°$

Sol Given

$\theta = 130°$

$d = 20mm = 20\times10^{-3}$

$\sigma = 0.36$ N/m

∴ Expression for capillary depression is

$$h = \frac{4\sigma\cos\theta}{\rho g d}$$

$$= \frac{4\times0.36\cos(130°)}{1000\times9.81\times0.02}$$

$$= 4.71\times10^{-3} m$$

2\. Differentiate between simple manometer and differential manometers.

Ans Simple manometer

A simple manometer consists of a glass tube having one of its ends connected to a point where pressure is to measured and other end remains open to atmosphere

Types of simple manometer

1. Piezometer 2. U-tube manometer 3. Single column manometer

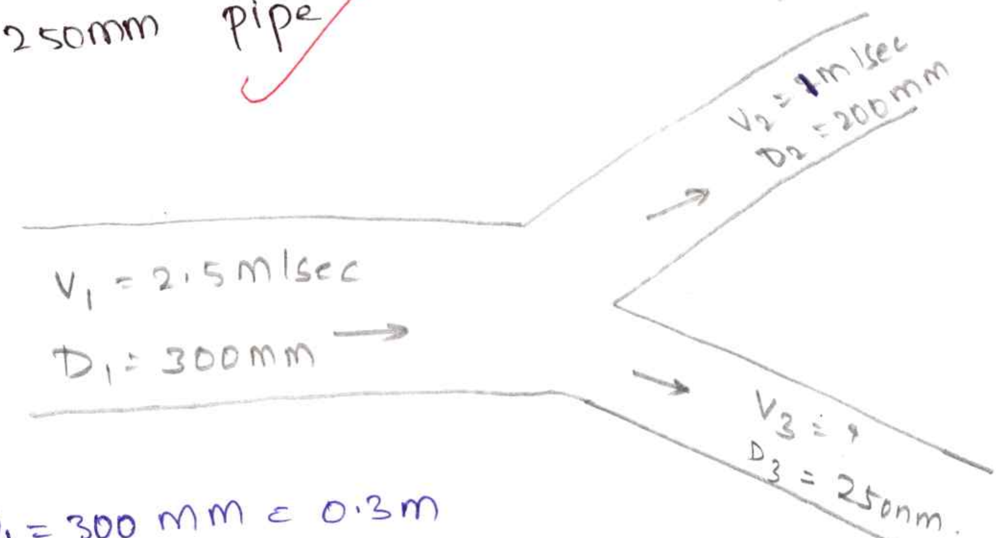
Differential manometer

Differential manometers are the devices used for measuring the difference of pressure b/w 2 points in a pipe (or) in 2 different pipes. A differential manometers consists of U-tube, containing a heavy liquid.

Types of differential manometer

1. U-tube differential manometer
2. Inverted U-tube differential manometer

3. A 300mm diameter pipe conveying water branches into 2 pipes of diameter 250mm and 200mm respectively. If the average velocity in the 300mm and 200mm pipes are 2.5 m sec & 1 m/sec. Calculate the velocity in 250mm pipe



$D_1 = 300$ mm $= 0.3$ m

$D_2 = 200 = 0.2$ m

$D_3 = 250 = 0.25$ m

$V_1 = 2.5$ m/sec

$V_2 = 1$ m/sec

$V_3 = ?$

$A_1 = \frac{\pi}{4} D^2$

$= \frac{\pi}{4} (0.3)^2 = 0.0706 m^2$

$A_2 = \frac{\pi}{4} (0.2)^2$

$= 0.03141$

$A_3 = \frac{\pi}{4} (0.25)^2 = 0.0490 m^2$

Dischauge $Q_1 = Q_2 + Q_3$

$Q_1 = A_1 V_1$ $Q = A_2 V_2$ $Q_3 = A_3 V_3$

$Q_1 = 0.0706 \times (2.5)$ $= (0.03141)(1)$

$= 0.1765$ $= 0.03141$

$Q_3 = Q_1 - Q_2$

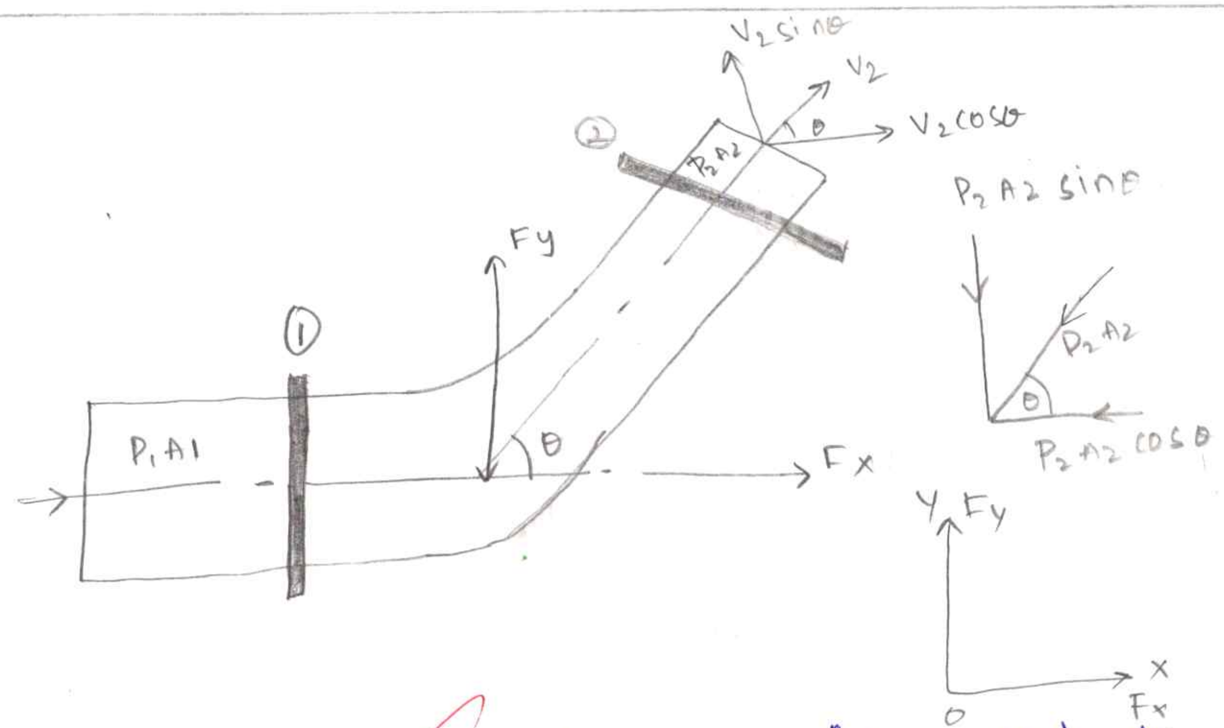
$Q_3 = 0.1451$

$0.0490 (V_3) = 0.1451$

$V_3 = 2.96 m/s$

Velocity in 250mm pipe is 2.961 m/s

4. Drive the expression for the force exerted by the fluid flow in a pipe bend.



The impulse-momentum eqn is used to determine the resultant force exerted by a flowing fluid on pipe bend

Consider section (1) & (2)

let V_1 = velocity of flow at section (1)

P_1 = pressure intensity at section (1)

A_1 = area of cross-sectional of pipe at section (1)

V_2, P_2, A_2 = corresponding velocity, pressure, area at section - (2)

Net force acting on fluid in the direction of x = Rate of change of momentum in x- direction

$P_1 A_1 - P_2 A_2 \cos\theta - F_x$ = mass/sec × change of velocity

$= \rho Q$ (final vel - Initial vel at x direction)

$= \rho Q (V_2 \cos\theta - V_1)$

$$F_x = \rho Q\ (V_1 - V_2 \cos\theta) + P_1 A_1 - P_2 A_2 \cos\theta$$

Similarly the momentum equation in y-direction

$$0 - P_2 A_2 \sin\theta - F_y = \rho Q\ (V_2 \sin\theta - 0)$$

$$F_y = \rho Q\ (-V_2 \sin\theta) - P_2 A_2 \sin\theta$$

The resultant force (F_R) acting on the bend

$$F_R = \sqrt{F_x^2 + F_y^2}$$

An Angle made by the resultant force with horizontal direction give by

$$\tan\theta = \frac{F_y}{F_x}$$

5. Examine whether or not the following velocity profiles satisfy the essential boundary conditions for velocity distribution in the laminar boundary layer on a flat plate.

Von Karman momentum integral equation for boundary layer flows

This is applied to

1. Laminar boundary layers
2. Transition boundary layers
3. Turbulent boundary layers.

For a given velocity profile in laminar zone transition zone or turbulent zone of a boundary layer, the shear stress τ_0 is obtained. The drag force on a small distance Δx of the plate is obtained from eqn

$$\Delta F_D = \tau_0 \times \Delta x \times b$$

The total drag on the plate of length L one side is

$$F_D = \int \Delta F_D = \int_0^L \tau_0 \times b \times dx \quad [\because \Delta x = dx]$$

Local co-efficient of Drag $C_D^* = \dfrac{\tau_0}{\frac{1}{2}\rho U^2}$

Average co-efficient of Drag $C_D = \dfrac{F_D}{\frac{1}{2}\rho A U^2}$

Where A = Area of surface (on plate)

U = Free stream velocity

ρ = Mass density of fluid.

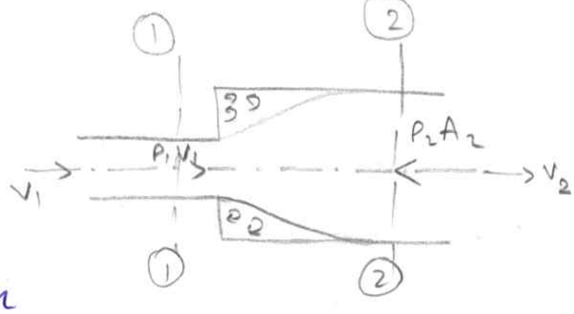
Boundary conditions for the velocity profiles

1. At $y=0$, $u=0$ and $\frac{du}{dy}$ has some finite value
2. At $y=\delta$ $u=U$
3. At $y=\delta$, $\frac{du}{dy}$

This conditions which must be satisfied by any velocity profile.

A.Y. 2019-20 Assignment - II 18911A0394 5/5

1. Derive the expression for the loss of head due to sudden enlargement in case of minor loss.



consider a liquid flowing through a pipe which has sudden enlargment. consider two section 1-1 & 2-2 before and after the enlargement.

P_1, P_2 = pressure intensity and ①-① & ②②

v_1 v_2 = velocity of flow at section 1-1 and 2-2

A_1, A_2 = area of pipe at section 1-1 and 2-2

Due to sudden change of diameter of pipe from D_1 to D_2, the liquid flowing from the smaller pipe is not able to flow the abrupt change of the boundry. Thus the flow separates from the boundry and turbulent eddies are formed. The loss of head takes place due to formation of these eddies.

P' = Pressure intensity of the liquid eddies on the area $A_2 - A_1$

h_e = loss of head due to sudden enlargement section 1-1 and 2-2

Applying Bernoulli's equation at section 1-1 & 2-2

$$\frac{P_1}{\rho g} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{v_2^2}{2g} + z_2 + \text{loss of head due to sudden enlargement}$$

But $z_1 = z_2$ as pipe is horizontal

$$\frac{P_1}{\rho g} + \frac{v_1^2}{2g} = \frac{P_2}{\rho g} + \frac{v_2^2}{2g} + h_e$$

$$h_e = \left(\frac{P_1 - P_2}{\rho g}\right) + \left(\frac{v_1^2 - v_2^2}{2g}\right)$$

consider control volume of liquid between section 1-1 and 2-2. Then the force acting on the liquid in the control volume in the direction of flow is given by $F_x = P_1 A_1 + P'(A_2 - A_1) - P_2 A_2$

By experimentally $P' = P_1$

$$F_x = P_1 A_1 + P_1 (A_2 - A_1) - P_2 A_2 = P_1 A_2 - P_2 A_2$$

$$F_x = (P_1 - P_2) A_2$$

Momentum of liquid/sec at section 1-1 =

= mass x velocity $= \rho A_1 V_1 \times V_1 = \rho A_1 v_1^2$

at section 2-2 $= \rho A_2 v_2 \times v_2 = \rho A_2 v_2^2$

change of momentum/sec $= \rho A_2 v_2^2 - \rho A_1 v_1^2$

From continuity equation

$$A_1 v_1 = A_2 v_2 \rightarrow A_1 = \frac{A_2 v_2}{v_1}$$

Change of momentum/sec $= \rho A_2 v_2^2 - \rho \frac{A_2 v_2}{v_1} v_1^2$

$$= \rho A_2 v_2^2 - \rho A_2 v_1 v_2 = \rho A_2 (v_2^2 - v_1 v_2)$$

Net force acting on control volume must be equal to rate of change of momentum/sec

$$(P_1 - P_2) A_2 = \rho A_2 (v_2^2 - v_1 v_2)$$

Dividing by g on both sides

$$\frac{P_1 - P_2}{\rho g} = \frac{v_2^2 - v_1 v_2}{g} \text{ or}$$

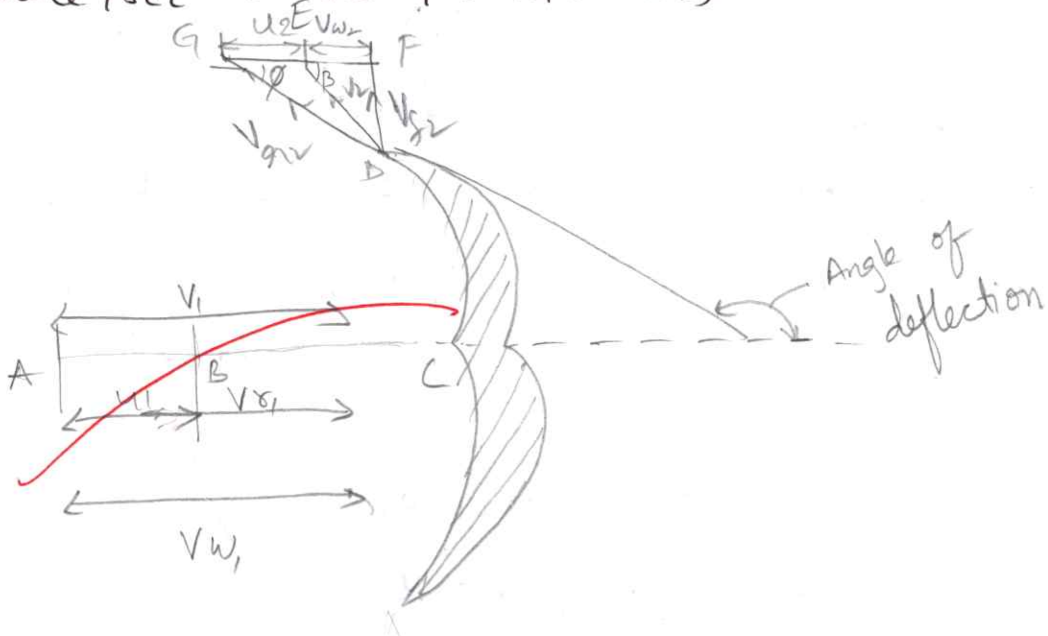
substituting this value in equation ① i.e h_e

$$h_e = \frac{v_2^2 - v_1 v_2}{g} + \frac{v_1^2}{2g} - \frac{v_2^2}{2g} = \frac{2v_2^2 - 2v_1 v_2 + v_1^2 - v_2^2}{2g}$$

$$= \frac{v_2^2 + v_1^2 - 2v_1 v_2}{2g} = \frac{(v_1 - v_2)^2}{2g}$$

$$h_e = \frac{(v_1 - v_2)^2}{2g}$$

2. Prove that the work done per second on a series of moving curved vanes by a jet of water strikes on one of the tips of the vane is given by, work done / sec $= \rho a v_1 (V_{w_1} \pm V_{w_2}) u$



For a radial curve vane the radius of the vane at inlet and outlet is different and hence the tangential velocities of the radial vane at inlet and outlet will not be equal.

Consider a series of radial curved vane mounted on a wheel. The jet of water strikes the vane and wheel start rotating at constant angular speed.

R_1 = Radius of wheel at inlet of the vane

R_2 = Radius of wheel at outlet of vane.

ω = Angular speed of wheel

$u_1 = \omega R_1$ $\quad u_2 = \omega R_2$

The mass of water striking per second for a series of vanes = Mass of water coming out from nozzle / sec

$= \rho a v_1$

a = Area of jet $\quad v_1$ = Velocity of jet

Momentum of water striking the vanes in the tangential direction per sec at inlet

= Mass of water/s × V_1 component in tangential direction

$= \rho a v_1 \times V_{w_1}$ $\quad (V_1 \cos\alpha = V_{w_1})$

similarly momentum of water at outlet/sec

$= \rho a v_1 \times$ component of $v_2 = \rho a v_1 \times (-V_2 \cos\beta)$

$= \rho a v_1 \times V_{w_2}$

-ve sign is taken as the velocity V_2 at outlet in opposite

Angular momentum per second at inlet

= Momentum at inlet × Radius at inlet

$= \rho a v_1 \times V_{w_1} \times R_1$

at outlet = Momentum at outlet × Radius at out

$= -\rho a v_1 \times V_{w_2} \times R_2$

Torque exerted = Rate of change of angular momentum

$T = \rho a v_1 V_{w_1} R_1 - (-\rho a v_1 V_{w_2} R_2) = \rho a v_1 (V_{w_1} R_1 + V_{w_2} R_2)$

Work done/s $= T \times \omega = \rho a v_1 (V_{w_1} \times R_1 + V_{w_2} R_2) \times \omega$

$= \rho a v_1 (V_{w_1} \times R_1 \times \omega + V_{w_2} R_2 \times \omega)$

$= \rho a v_1 (V_{w_1} u_1 + V_{w_2} u_2)$ $(\because u = \omega R)$

if β angle is obtuse then work done/sec

$= \rho a v_1 (V_{w_1} u_1 - V_{w_2} u_2)$

$\therefore$ The general expression for work done/sec

$= \rho a v_1 (V_{w_1} u_1 \pm V_{w_2} u_2)$

(3). A Francis turbine with an $\eta_{overall}$ 75 is required to produce 148.25 kW power. It is working under a head of 7.62 m. The peripheral velocity $= 0.26 \times (2gH)^{1/2}$. The wheel runs at 150 rpm and the hydraulic losses to the turbine are 22% of the available energy. Assume radial discharge, Calculate

i) guide blade angle

ii) Wheel vane angle

iii) Dia of wheel at inlet

iv) Width of wheel at inlet

$\eta_o = 0.75$ Power = 148.25 kW $H = 7.62 m$

$u_1 = 0.26\sqrt{2gH} = 0.26\sqrt{2\times 9.81\times 7.62} = 3.179 m/s$

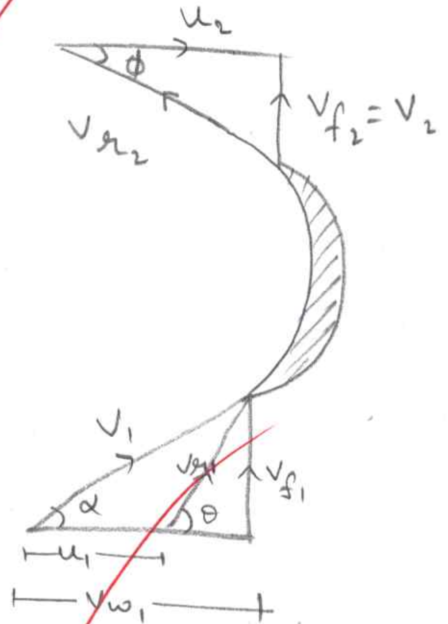
$v_{f_1} = 0.96\sqrt{2gH} = 0.96\sqrt{2\times 9.81\times 7.62} = 11.738 m/s$

$N = 150$ rpm Hydraulic loss = 22% of available energy

Discharge at outlet = Radial

$V_{w_2} = 0 \quad V_{f_2} = V_2$

$$\eta_h = \frac{\text{Total head at inlet} - \text{Hydraulic loss}}{\text{Head at inlet}}$$



$$= \frac{H - 0.22H}{H} = \frac{0.78H}{H} = 0.78$$

$$\eta_h = \frac{V_{w_1} u_1}{gH}$$

$$\frac{V_{w_1} u_1}{gH} = 0.78$$

$$v_{w_1} = \frac{0.78\times g\times H}{u_1}$$

$$= \frac{0.78\times g\times H}{3.179} = 18.34 m/s$$

i) $\tan\alpha = \frac{V_{f_1}}{V_{w_1}} = \frac{11.738}{18.34} = 0.64$

$$\alpha = \tan^{-1}(0.64) = 32.619°$$

ii) $\tan\theta = \frac{V_{f_1}}{V_{w_1} - u_1} = \frac{11.738}{18.34 - 3.179} = 0.774$

$\theta = \tan^{-1}(0.774) = 37.74$

iii) $u_1 = \frac{\pi D_1 N}{60} \Rightarrow D_1 = \frac{60 \times u_1}{\pi \times N} = \frac{60 \times 3.179}{\pi \times 50}$

$D_1 = 0.4047$

iv) $\eta_o = \frac{S.P}{W.P} = \frac{148.25}{W.P}$

$W.P = \frac{WH}{1000} = \frac{\rho g Q H}{1000} = \frac{1000 \times 9.81 \times Q \times 7.62}{1000}$

$\eta_o = \frac{148.25}{\frac{1000 \times 9.81 \times Q \times 7.62}{1000}} = \frac{148.25 \times 1000}{1000 \times 9.81 \times Q \times 7.62}$

$Q = \frac{148.25 \times 1000}{1000 \times 9.81 \times 7.62 \times \eta_o} = 2.644\ m^3/s$

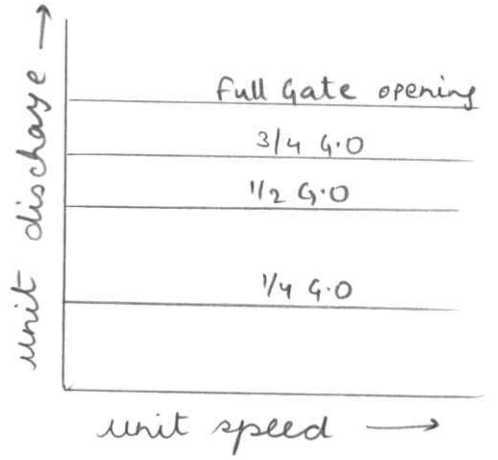
$Q = \pi D_1 B_1 \times V_{f_1}$

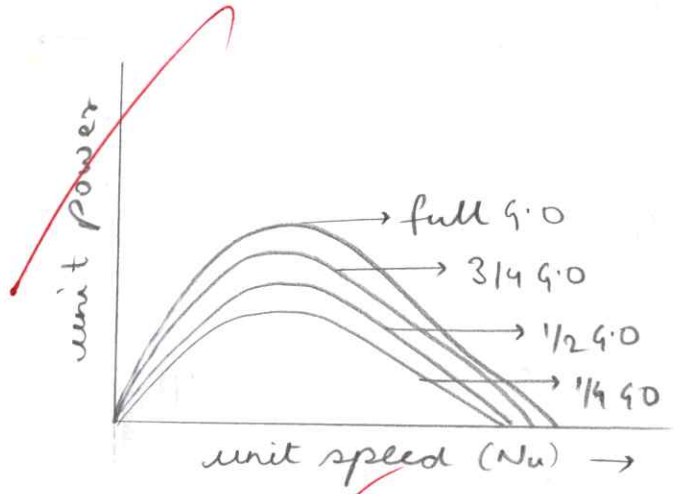
$B_1 = \frac{Q}{\pi D_1 V_{f_1}} = \frac{2.644}{\pi \times 0.4047 \times 11.738} = 0.177\,m$

(4). Explain the constant head characteristics curve of a turbine.

Characteristics curve of a hydraulic turbine are the curves, with the help of which the exact behaviour and performance of the turbine under different conditions can be known.

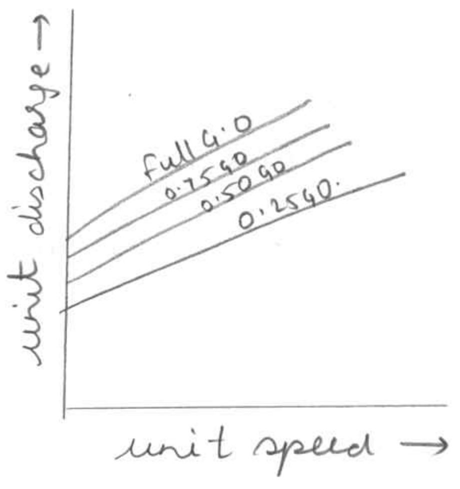
Main characteristic curves are obtained by maintaining a constant head and a constat gate opening on the turbine. The speed of the turbine is varied by changing load on turbine. For each value of speed, the corresponding values of powe P and discharge Q are obtained. Then the overall efficiency for each value of speed is calculated. from these readings the values of unit speed (N_u), unit power P_u and unit discharge are determined

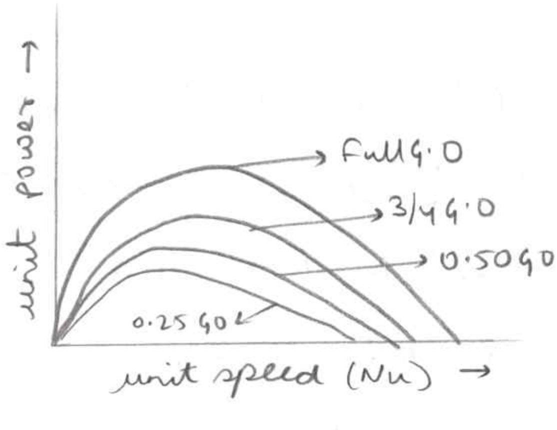




a) for pelton wheel

b) for kaplan turbine





⑤. Explain the priming of a centrifugal pump Discuss the different priming arrangements employed for small and big pumping units.

Priming of a centrifugal pump is defined as the operation in which the suction pipe, casing of the pump and a portion of the delivery pipe upto the delivery ~~pipe~~ is value is completely filled up from outside source with the liquid to be raised by the pump before starting the pump. Thus the air from these parts of the pump is removed and these parts are filled with the liquid to be pumped.

The work done by the impeller per unit weight of liquid per sec is known as the head generated by the pump. Head generated by the pump is given as $= \frac{1}{g} V_{w_2} u_2$ metre.
This equation is independent of the density of liquid. This means the pump is running in air, the head generated is in terms of meter of air. If the pump is primed with water the head generated is same metre of water But as the density of air is very low, the generated head of air in terms of equivalent metre of water head is neglégibe and hence

the water may not be sucked from the pump. To avoid this difficulty, priming is necessary.

16. ASSESSMENT SHEET – CO WISE (DIRECT ATTAINMENT)

CO ATTAINMENT		
Batch: 2017-2021	**Year-Sem: II-II**	**Course: MOFHM**

Mid 1

MOFHM_M1	Part A			Part B			Assignment					Total Marks
Roll No:	Q1	Q2	Q3	Q4	Q5	Q6	A_Q1	A_Q2	A_Q3	A_Q4	A_Q5	
17911A0301	2	2	2	5	4	4	1	1	1	1	1	24
17911A0302	1	2	2	3	3	3	1	1	1		1	18
17911A0303	1	2	2	3	3	4	1	1	1		1	19
17911A0304	2	2	2	5	5	4	1	1	1	1	1	25
17911A0305	2	2	2	5	5	4	1	1	1	1	1	25
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17911A0307	2		2	2	2	2	1			1	1	13
17911A0308	2	2	1	3	3	3	1	1	1		1	18
17911A0309	2	2	2	4	4	4	1	1	1	1	1	23
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18915A0328	2	2	2	4	3	4	1	1	1	1	1	22
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18915A0330	2	2	1	3	3	3	1	1	1		1	18
18915A0331	2	2	2	5	5	4	1	1	1	1	1	25
18915A0332	2	2	2	5	4	4	1	1	1	1	1	24
18915A0333	2	2	2	5	4	4	1	1	1	1	1	24
18915A0334	2	1	2	3	3	4	1	1	1		1	19
18915A0335	2	2	2	4	4	4	1	1	1	1	1	23
18915A0336	1	2	2	2	2	4	1	1	1		1	17
18915A0337	1	2	2	3	3	3	1	1	1		1	18
18915A0338	2	2	2	5	5	4	1	1	1	1	1	25
18915A0339	2	2	2	3	3	3	1	1	1	1	1	20
18915A0340	2	2	2	4	4	4	1	1	1	1	1	23
18915A0341	2	2	2	3	3	3	1	1	1	1	1	20
18915A0342	1	2	2	2	2	4	1	1	1		1	17
18915A0343	2	2		2	2	2	1			1	1	13
18915A0344	1	2	2	2	2	4	1	1	1		1	17
18915A0345	1	2	2	3	3	3	1	1	1		1	18
18915A0346	1	2	2	3	3	4	1	1	1		1	19
18915A0347	2	2	2	3	3	3	1	1	1	1	1	20
18915A0348	1	2	2	2	2	3	1	1	1		1	16
18915A0349	2	2	2	3	3	3	1	1	1	1	1	20
18915A0350		2	2	1	1	2	1			1	1	11
18915A0351	2	1	2	3	3	4	1	1	1		1	19
18915A0352	2	2	2	3	3	4	1	1	1	1	1	21
18915A0353	2	2	2	3	3	3	1	1	1	1	1	20
No of students attempted	233	237	231	243	243	250	256	256	256	256	256	
No of students who scored >= 60% Marks	193	207	207	153	153	236	251	190	212	165	234	
% of students who scored >= 60% Marks	83	87	90	63	63	94	98	74	83	64	91	
Attainment	3	3	3	2	2	3	3	3	3	2	3	

Mid 2												
MOFHM_M2	Part A			Part B			Assignment					Total Marks
Roll No:	Q1	Q2	Q3	Q4	Q5	Q6	A_Q1	A_Q2	A_Q3	A_Q4	A_Q5	
17911A0301	2	2	2	3	3	3	1	1	1	1	1	20
17911A0302	1	2	2	2	2	3	1	1	1		1	16
17911A0303	2	2	2	3	3	4	1	1	1	1	1	21
17911A0304	2	2	2	4	4	4	1	1	1	1	1	23
17911A0305	2	2	2	4	4	4	1	1	1	1	1	23
17911A0306	2	2	2	4	4	4	1	1	1	1	1	23
17911A0307	2	2	1	2	2	4	1	1	1		1	17
17911A0308	2	2	2	3	3	5	1	1	1	1	1	22
17911A0309	2	2	2	4	4	4	1	1	1	1	1	23
17911A0311	2	2	2	4	4	4	1	1	1	1	1	23
17911A0312	2	2	2	4	5	5	1	1	1	1	1	25
17911A0313	1	2	2	3	3	4	1	1	1		1	19
17911A0314	1	2	2	3	3	4	1	1	1		1	19
17911A0315	1	2	2	2	2	3	1	1	1		1	16
17911A0316			2									02
17911A0317	2	2	2	4	4	4	1	1	1	1	1	23
17911A0319	2	1	2	3	3	4	1	1	1		1	19
17911A0320	2	2	2	4	4	4	1	1	1	1	1	23
17911A0321	1	2	2	2	2	4	1	1	1		1	17
17911A0322	2	2	2	3	3	4	1	1	1	1	1	21
17911A0323	1	2	2	3	3	3	1	1	1		1	18
17911A0324	2	2	2	3	3	3	1	1	1	1	1	20
17911A0325	2	2	2	4	4	5	1	1	1	1	1	24
17911A0327	2	2	2	3	3	5	1	1	1	1	1	22
17911A0328	2	2	2	3	3	5	1	1	1	1	1	22
17911A0329	2	2	2	4	5	5	1	1	1	1	1	25
17911A0330	2	2	2	4	4	4	1	1	1	1	1	23
17911A0331	2	2	2	4	5	5	1	1	1	1	1	25
17911A0332	2	2	2	4	4	5	1	1	1	1	1	24
17911A0333	2	2	1	3	3	4	1	1	1		1	19
17911A0334		1	1									02
17911A0335	2	2	2	3	3	3	1	1	1	1	1	20
17911A0336	2	2	2	4	4	4	1	1	1	1	1	23
17911A0337	2	2	2	4	4	4	1	1	1	1	1	23
17911A0338	2	2	2	4	5	5	1	1	1	1	1	25
17911A0339	2	2	2	4	4	4	1	1	1	1	1	23
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17911A0341	2	1	2	2	2	4	1	1	1		1	17
17911A0342	1	2	2	2	2	3	1	1	1		1	16
17911A0343	2	2	2	3	3	4	1	1	1	1	1	21
17911A0344	1	2	2	3	3	3	1	1	1		1	18
17911A0345	1	2	2	3	3	3	1	1	1		1	18
17911A0346	2		2	1	1	3	1			1	1	12
17911A0347	2	2	2	3	3	3	1	1	1	1	1	20
17911A0349	2	2	2	3	3	4	1	1	1	1	1	21
17911A0350	2	2	2	4	5	5	1	1	1	1	1	25
17911A0351	2	2	2	3	3	4	1	1	1	1	1	21
17911A0352	2	2	2	3	3	5	1	1	1	1	1	22
17911A0354	2	2	2	3	3	5	1	1	1	1	1	22
17911A0355	2	2	2	4	5	5	1	1	1	1	1	25
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17911A0359	1	2	2	2	2	3	1	1	1		1	16

17911A0360		2	2	2	2	3	1			1	1	14
17911A0361	2	1	2	3	3	4	1	1	1		1	19
17911A0362	2	1	2	3	3	4	1	1	1		1	19
17911A0363	2	1	2	2	2	3	1	1	1		1	16
17911A0364		2	2	1	1	3	1			1	1	12
17911A0365	2	2	1	3	3	3	1	1	1		1	18
17911A0367	2	2	1	3	3	4	1	1	1		1	18
17911A0368	1	2	2	3	3	4	1	1	1		1	19
17911A0369	2	2		2	2	3	1			1	1	14
17911A0371	2	2	2	4	5	5	1	1	1	1	1	25
17911A0372	2	2	2	4	5	5	1	1	1	1	1	25
17911A0373	1	2	2	3	3	4	1	1	1		1	19
17911A0374	2	2	2	3	3	4	1	1	1	1	1	21
17911A0375	2	1	2	3	3	3	1	1	1		1	18
17911A0376	2	2	2	3	3	5	1	1	1	1	1	22
17911A0377	2	1	2	3	3	3	1	1	1		1	18
17911A0378			2						1			03
17911A0379		2	2	2	2	2	1			1	1	13
17911A0380		2	2	2	2	3	1			1	1	14
17911A0381	2	2	2	3	3	3	1	1	1	1	1	20
17911A0382	1	2	2	3	3	4	1	1	1		1	19
17911A0383	1	2				2	1		1			07
17911A0384	2	2	2	4	5	5	1	1	1	1	1	25
17911A0385	2	2	2	4	5	5	1	1	1	1	1	25
17911A0386	2	2	2	3	3	4	1	1	1	1	1	21
17911A0387	2	2	2	4	5	5	1	1	1	1	1	25
17911A0388	2	2	2	3	3	4	1	1	1	1	1	21
17911A0389	2	2		1	1	2	1			1	1	11
17911A0390	1	2	2	2	2	3	1	1	1		1	16
17911A0391	2	2	1	3	3	4	1	1	1		1	19
17911A0392	2	2	2	3	3	5	1	1	1	1	1	22
17911A0393	2	2	2	3	3	3	1	1	1	1	1	20
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17911A0395	2	2	2	4	4	5	1	1	1	1	1	24
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17911A03A0	2	2	1	2	2	4	1	1	1		1	17
17911A03A1	2	2	2	4	5	5	1	1	1	1	1	25
17911A03A2	2	2	2	3	3	3	1	1	1	1	1	20
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17911A03A4	2	2	2	4	4	5	1	1	1	1	1	24
17911A03A5	2	2	2	4	4	4	1	1	1	1	1	23
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17911A03A7	2	2		2	2	3	1			1	1	14
17911A03A8	2	2	2	4	4	4	1	1	1	1	1	23
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17911A03B0	2	2	2	3	3	3	1	1	1	1	1	20
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17911A03B2	2	2	2	4	5	5	1	1	1	1	1	25
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17911A03B4	2	2	2	3	3	3	1	1	1	1	1	20
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17911A03B6		2	2	1	1	2	1			1	1	11
17911A03B7	2	2	2	4	4	5	1	1	1	1	1	24

17911A03B8	2	2	2	3	3	3	1	1	1	1	1	20
17911A03B9	2	1	2	2	2	3	1	1	1		1	16
17911A03C0		2	2	1	1	2	1			1	1	11
17911A03C1	2	2	2	4	4	4	1	1	1	1	1	23
17911A03C2	2	2	2	3	3	4	1	1	1	1	1	21
17911A03C3		1	2			2	1		1			07
17911A03C4	2		1	1	1	2	1		1			09
17911A03C5	2		2	1	1	3	1			1	1	12
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17911A03C7	2	2	2	4	5	5	1	1	1	1	1	25
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17911A03C9	2	2		2	2	3	1			1	1	14
17911A03D0	2	2		2	2	3	1			1	1	14
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17911A03D2	2	1	2	2	2	3	1	1	1		1	16
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17911A03D4	2	2		2	2	2	1			1	1	13
17911A03D5	2	2		1	1	3	1			1	1	12
17911A03D6	1	2	2	2	2	3	1	1	1		1	16
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17911A03D8	2		2	2	2	3	1			1	1	14
17911A03D9	2	2	2	3	3	3	1	1	1	1	1	20
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17911A03E1	2	2	1	2	2	2	1	1	1		1	15
17911A03E2	2	2	1	3	3	3	1	1	1		1	18
17911A03E3	2		2	2	2	2	1			1	1	13
17911A03E4	2	2	1	2	2	3	1	1	1		1	16
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17911A03E6	2		2	1	1	2	1			1	1	11
17911A03E7	2	2	2	3	3	3	1	1	1	1	1	20
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17911A03E9	1	2	2	3	3	4	1	1	1		1	19
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17911A03F1	2	2	2	3	3	4	1	1	1	1	1	21
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17911A03F4	2	2	2	3	3	4	1	1	1	1	1	21
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17911A03G0	1	2	2	3	3	4	1	1	1		1	19
17911A03G1	1	2	2	2	2	3	1	1	1		1	16
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17911A03G3	1	2	2	2	2	4	1	1	1		1	17
17911A03G4	1	2		1	1	2	1		1			09
17911A03G5		2	2	1	1	3	1			1	1	12
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17911A03G7	2		2	1	1	3	1			1	1	12
17911A03G8		1	1			1			1			04
17911A03G9		1	1						1			03
17911A03H0	2	2	1	2	2	4	1	1	1		1	17
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17911A03H3	2	2	2	4	5	5	1	1	1	1	1	25

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17911A03H6	2	2	2	3	3	4	1	1	1	1	1	21
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17911A03H9	2	2	2	4	5	5	1	1	1	1	1	25
17911A03J1	2	2	2	3	3	4	1	1	1	1	1	21
17911A03J2	1	2				1	1		1			06
17911A03J3	2	2		2	2	2	1			1	1	13
17911A03J4	2	2	2	3	3	4	1	1	1	1	1	21
17911A03J5	2	2	2	4	4	4	1	1	1	1	1	23
17911A03J6	2	2	2	4	4	4	1	1	1	1	1	23
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17911A03J8	2		2	2	2	3	1			1	1	14
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17911A03K7	2	2		1	1	3	1			1	1	12
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17911A03K9	2	2		1	1	3	1			1	1	12
17911A03L0	2	2	2	4	4	5	1	1	1	1	1	24
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17911A03L3	2	2		1	1	3	1			1	1	12
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17911A03L9		1	2			2	1		1			07
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17911A03M3		1	1						1			03
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18915A0314	2	2	2	3	3	3	1	1	1	1	1	20
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18915A0327	2	2	2	3	3	4	1	1	1	1	1	21
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18915A0333	2	2	2	3	3	5	1	1	1	1	1	22
18915A0334	2	1	2	3	3	4	1	1	1		1	19
18915A0335	2	2	2	4	5	5	1	1	1	1	1	25
18915A0336	2	2	2	3	3	4	1	1	1	1	1	21
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18915A0338	2	2	2	4	5	5	1	1	1	1	1	25
18915A0339	2	2	2	4	4	5	1	1	1	1	1	24
18915A0340	2	2	2	4	5	5	1	1	1	1	1	25
18915A0341	2	2	2	4	4	5	1	1	1	1	1	24
18915A0342	1	2	2	3	3	4	1	1	1		1	19
18915A0343	1	2	2	2	2	4	1	1	1		1	17
18915A0344	2	2	2	3	3	4	1	1	1	1	1	21
18915A0345	2	2	2	3	3	3	1	1	1	1	1	20
18915A0346	1	2	2	2	2	2	1	1	1		1	15
18915A0347	2	2	2	4	4	5	1	1	1	1	1	24
18915A0348	2	2	2	3	3	3	1	1	1	1	1	20
18915A0349	2	1	2	3	3	3	1	1	1		1	18
18915A0350		1	2	1	1	2	1		1			9
18915A0351	2	1	2	2	2	4	1	1	1		1	17
18915A0352	2	2	2	3	3	4	1	1	1	1	1	21
18915A0353	2	1	2	3	3	3	1	1	1		1	18
No of students attempted	231	238	233	239	239	250	256	256	256	256	256	
No of students who scored >= 60% Marks	196	205	213	163	163	242	248	193	217	170	232	
% of students who scored >= 60% Marks	85	86	91	68	68	97	97	75	85	66	91	
Attainment	3	3	3	2	2	3	3	3	3	2	3	

External	
Roll No:	External Marks
17911A0301	65
17911A0302	13
17911A0303	64
17911A0304	44
17911A0305	66
17911A0306	71
17911A0307	18
17911A0308	64
17911A0309	67
17911A0311	72
17911A0312	72
17911A0313	71
17911A0314	28
17911A0315	64
17911A0316	1
17911A0317	70
17911A0319	40
17911A0320	65
17911A0321	72
17911A0322	60
17911A0323	37
17911A0324	29
17911A0325	72
17911A0327	71
17911A0328	65
17911A0329	66
17911A0330	65
17911A0331	69
17911A0332	71
17911A0333	62
17911A0334	26
17911A0335	29
17911A0336	72
17911A0337	72
17911A0338	70
17911A0339	66
17911A0340	69
17911A0341	67
17911A0342	62
17911A0343	70
17911A0344	30
17911A0345	41
17911A0346	26
17911A0347	71
17911A0349	65
17911A0350	60
17911A0351	60
17911A0352	72
17911A0354	68
17911A0355	63
17911A0356	70
17911A0358	67
17911A0359	63
17911A0360	16

17911A0361	68
17911A0362	8
17911A0363	61
17911A0364	3
17911A0365	12
17911A0367	60
17911A0368	63
17911A0369	26
17911A0371	61
17911A0372	61
17911A0373	36
17911A0374	69
17911A0375	71
17911A0376	7
17911A0377	67
17911A0378	4
17911A0379	7
17911A0380	69
17911A0381	70
17911A0382	66
17911A0383	6
17911A0384	65
17911A0385	66
17911A0386	68
17911A0387	66
17911A0388	64
17911A0389	62
17911A0390	15
17911A0391	29
17911A0392	7
17911A0393	64
17911A0394	13
17911A0395	69
17911A0396	63
17911A0397	68
17911A0398	66
17911A0399	61
17911A03A0	61
17911A03A1	70
17911A03A2	68
17911A03A3	10
17911A03A4	61
17911A03A5	63
17911A03A6	60
17911A03A7	37
17911A03A8	4
17911A03A9	69
17911A03B0	66
17911A03B1	72
17911A03B2	69
17911A03B3	65
17911A03B4	70
17911A03B5	12
17911A03B6	29
17911A03B7	68
17911A03B8	17

17911A03B9	70
17911A03C0	21
17911A03C1	67
17911A03C2	68
17911A03C3	1
17911A03C4	9
17911A03C5	11
17911A03C6	21
17911A03C7	68
17911A03C8	68
17911A03C9	13
17911A03D0	68
17911A03D1	15
17911A03D2	1
17911A03D3	66
17911A03D4	11
17911A03D5	16
17911A03D6	72
17911A03D7	69
17911A03D8	26
17911A03D9	69
17911A03E0	29
17911A03E1	65
17911A03E2	26
17911A03E3	34
17911A03E4	67
17911A03E5	62
17911A03E6	29
17911A03E7	62
17911A03E8	44
17911A03E9	67
17911A03F0	28
17911A03F1	66
17911A03F2	63
17911A03F3	36
17911A03F4	63
17911A03F5	72
17911A03F6	63
17911A03F7	26
17911A03F8	60
17911A03F9	70
17911A03G0	72
17911A03G1	65
17911A03G2	18
17911A03G3	33
17911A03G4	37
17911A03G5	70
17911A03G6	61
17911A03G7	27
17911A03G8	10
17911A03G9	AB
17911A03H0	30
17911A03H1	65
17911A03H2	9
17911A03H3	71
17911A03H4	63

17911A03H5	2
17911A03H6	72
17911A03H7	5
17911A03H8	2
17911A03H9	71
17911A03J1	68
17911A03J2	7
17911A03J3	0
17911A03J4	64
17911A03J5	72
17911A03J6	62
17911A03J7	60
17911A03J8	4
17911A03J9	70
17911A03K0	72
17911A03K1	66
17911A03K2	72
17911A03K3	62
17911A03K5	4
17911A03K6	66
17911A03K7	63
17911A03K8	66
17911A03K9	63
17911A03L0	67
17911A03L1	3
17911A03L2	0
17911A03L3	27
17911A03L4	67
17911A03L5	68
17911A03L6	67
17911A03L7	71
17911A03L8	15
17911A03L9	10
17911A03M0	72
17911A03M1	71
17911A03M2	70
17911A03M3	13
17915A0342	72
18915A0301	69
18915A0302	61
18915A0303	60
18915A0304	33
18915A0305	44
18915A0306	60
18915A0307	66
18915A0308	63
18915A0310	63
18915A0311	61
18915A0312	72
18915A0313	66
18915A0314	44
18915A0315	61
18915A0316	44
18915A0317	60
18915A0318	67
18915A0319	63

18915A0320	66
18915A0321	63
18915A0322	26
18915A0323	67
18915A0324	72
18915A0325	62
18915A0326	19
18915A0327	66
18915A0328	62
18915A0329	26
18915A0330	66
18915A0331	72
18915A0332	63
18915A0333	67
18915A0334	66
18915A0335	67
18915A0336	70
18915A0337	60
18915A0338	68
18915A0339	71
18915A0340	30
18915A0341	62
18915A0342	69
18915A0343	67
18915A0344	72
18915A0345	26
18915A0346	39
18915A0347	68
18915A0348	71
18915A0349	60
18915A0350	62
18915A0351	60
18915A0352	65
18915A0353	72
No of students attempted	253
No: of students who scored more than 60%	173
% of students who scored more than 60%	68
Attainment	2

CO	Method	Value	Average	Attainment Level (Internal)	Attainment Level (External)	CO Direct Attainment (25%Int+75%Ext)
CO1	M1_D_Q1	3	2.75	2.72	2.00	**2.18**
	M1_D_Q4	2				
	M1_A_Q1	3				
	M1_A_Q2	3				
CO2	M1_D_Q2	3	2.50			
	M1_D_Q5	2				
	M1_A_Q3	3				
	M1_A_Q4	2				
CO3	M1_D_Q3	3	2.83			
	M1_D_Q6	3				
	M1_A_Q5	3				
	M2_D_Q1	3				
	M2_D_Q4	2				
	M2_A_Q1	3				
CO4	M2_D_Q2	3	2.75			
	M2_D_Q5	2				
	M2_A_Q2	3				
	M2_A_Q3	3				
CO5	M2_D_Q3	3	2.75			
	M2_D_Q6	3				
	M2_A_Q4	2				
	M2_A_Q5	3				

Direct CO Attainment	2.18
Indirect CO Attainment	2.58
Overall CO Attainment (0.8 * Direct Attainment+ 0.2 * Indirect Attainment)	2.26

CO ATTAINMENT		
Batch: 2016-2020	Year-Sem: II-II	Course: MOFHM

Mid 1												
MOFHM_M1	Part A			Part B			Assignment					Total Marks
Roll No:	Q1	Q2	Q3	Q4	Q5	Q6	A_Q1	A_Q2	A_Q3	A_Q4	A_Q5	
16911A0301	1	2	2	2	2	4	1	1	1		1	17
16911A0303	1	2	2	3	3	4	1	1	1		1	19
16911A0304	1	2	2	3	3	4	1	1	1		1	19
16911A0305	2	2	2	4	4	4	1	1	1	1	1	23
16911A0306	2	1	2	3	3	4	1	1	1		1	19
16911A0307		2	2	2	2	3	1			1	1	14
16911A0308	2	2	2	5	5	4	1	1	1	1	1	25
16911A0309		2	2	1	1	1	1			1	1	10
16911A0310	2	1	2	2	2	3	1	1	1		1	16
16911A0312	2	2	1	3	3	4	1	1	1		1	19
16911A0313	2	2	2	3	3	3	1	1	1	1	1	20
16911A0314	2	2	2	4	3	4	1	1	1	1	1	22
16911A0315	1	2	2	2	2	4	1	1	1		1	17
16911A0317	2	2	2	3	3	4	1	1	1	1	1	21
16911A0318	2	2	2	5	5	4	1	1	1	1	1	25
16911A0319	2	1	2	2	2	4	1	1	1		1	17
16911A0321	2	2	2	3	3	4	1	1	1	1	1	21
16911A0322	2	1	2	2	2	3	1	1	1		1	16
16911A0323	2	1	2	2	2	4	1	1	1		1	17
16911A0324	2	2	2	3	3	3	1	1	1	1	1	20
16911A0325	2	2	2	5	4	4	1	1	1	1	1	24
16911A0326	1	2	2	3	3	3	1	1	1		1	18
16911A0327	1	2	2	2	2	2	1	1	1		1	15
16911A0328	1	2	2	3	3	4	1	1	1		1	19
16911A0329	2	2	2	3	3	4	1	1	1	1	1	21
16911A0330	2	2	2	5	4	4	1	1	1	1	1	24
16911A0331	2	2	2	3	3	3	1	1	1	1	1	20
16911A0332	2	2	1	2	2	3	1	1	1		1	16
16911A0333	2	2	2	3	3	4	1	1	1	1	1	21
16911A0334	2	2	1	3	3	4	1	1	1		1	19
16911A0335	2	2	2	3	3	4	1	1	1	1	1	21
16911A0336	2	2	2	5	4	4	1	1	1	1	1	24
16911A0337	2	2	1	2	2	4	1	1	1		1	17
16911A0338	2	2	1	2	2	4	1	1	1		1	17
16911A0339	2	2	1	3	3	3	1	1	1		1	18
16911A0340	2	2	2	4	4	4	1	1	1	1	1	23
16911A0341	2	2	2	3	3	4	1	1	1	1	1	21
16911A0342	2	2	2	3	3	3	1	1	1	1	1	20
16911A0343	2	2	2	4	4	4	1	1	1	1	1	23
16911A0345	2	2		2	2	2	1			1	1	13
16911A0346	1	2	2	2	2	4	1	1	1		1	17
16911A0347	2	2	2	4	3	4	1	1	1	1	1	22
16911A0348	2	2	1	3	3	4	1	1	1		1	19
16911A0349	2	2	2	4	4	4	1	1	1	1	1	23
16911A0350	1	2				1	1		1			6
16911A0351	2	2	2	3	3	4	1	1	1	1	1	21
16911A0352	2	2		2	2	3	1			1	1	14
16911A0354	2	2	2	3	3	3	1	1	1	1	1	20
16911A0355	1	2	2	2	2	4	1	1	1		1	17
16911A0356	2	1	2	3	3	4	1	1	1		1	19

16911A0357	2	2	2	3	3	3	1	1	1	1	1	20
16911A0358	2	1	2	3	3	4	1	1	1		1	19
16911A0359	2	2	2	3	3	4	1	1	1	1	1	21
16911A0360	2	2	2	3	3	4	1	1	1	1	1	21
16911A0361	1	2	2	3	3	4	1	1	1		1	19
16911A0362	2	2	2	5	5	4	1	1	1	1	1	25
16911A0363	2	1	2	2	2	2	1	1	1		1	15
16911A0364	2	2	2	4	4	4	1	1	1	1	1	23
16911A0365	2		2	2	2	2	1			1	1	13
16911A0366	2	2	2	3	3	3	1	1	1	1	1	20
16911A0367	2	2	1	2	2	3	1	1	1		1	16
16911A0368	2	2	2	3	3	4	1	1	1	1	1	21
16911A0369	1	2	2	2	2	2	1	1	1		1	15
16911A0370	2	2	2	3	3	3	1	1	1	1	1	20
16911A0371	2	2	2	3	3	3	1	1	1	1	1	20
16911A0372	2	2		2	2	3	1			1	1	14
16911A0373		2	2	1	1	3	1			1	1	12
16911A0374	2	2	2	3	3	3	1	1	1	1	1	20
16911A0375	2	1	2	3	3	4	1	1	1		1	19
16911A0376		2	2	2	2	3	1			1	1	14
16911A0377	2	2	2	5	5	4	1	1	1	1	1	25
16911A0378	2	2	2	4	3	4	1	1	1	1	1	22
16911A0379	2	2	2	3	3	3	1	1	1	1	1	20
16911A0380	1	2	2	2	2	4	1	1	1		1	17
16911A0381	2	2		2	2	3	1			1	1	14
16911A0382	2	2	2	3	3	3	1	1	1	1	1	20
16911A0383	2	2	2	4	3	4	1	1	1	1	1	22
16911A0384	1	2	2	2	2	3	1	1	1		1	16
16911A0385	1	2	2	2	2	4	1	1	1		1	17
16911A0386	1	2	2	2	2	2	1	1	1		1	15
16911A0387	2	2	2	5	5	4	1	1	1	1	1	25
16911A0388	1	2	2	3	3	4	1	1	1		1	19
16911A0389		2	2	1	1	3	1			1	1	12
16911A0390	2	2	2	3	3	4	1	1	1	1	1	21
16911A0391	2	2	1	2	2	4	1	1	1		1	17
16911A0392	2		2	1	1	3	1			1	1	12
16911A0393	2	2	2	5	4	4	1	1	1	1	1	24
16911A0394	2	2	2	4	4	4	1	1	1	1	1	23
16911A0395	2	2	2	4	3	4	1	1	1	1	1	22
16911A0396	2	2	2	5	5	4	1	1	1	1	1	25
16911A0397	2	2	2	4	3	4	1	1	1	1	1	22
16911A0399	2	2	2	4	4	4	1	1	1	1	1	23
16911A03A0	2	2	2	5	4	4	1	1	1	1	1	24
16911A03A1	2	2	2	3	3	3	1	1	1	1	1	20
16911A03A2	1	2	2	2	2	4	1	1	1		1	17
16911A03A3	2	2	2	5	5	4	1	1	1	1	1	25
16911A03A5	2	2	2	5	5	4	1	1	1	1	1	25
16911A03A6	2	2	2	5	4	4	1	1	1	1	1	24
16911A03A7	2		2	2	2	3	1			1	1	14
16911A03A8	1	2	2	2	2	2	1	1	1		1	15
16911A03A9	1	2	2	3	3	3	1	1	1		1	18
16911A03B0	2	2	2	5	5	4	1	1	1	1	1	25
16911A03B1	1	2	2	2	2	4	1	1	1		1	17
16911A03B2	2	2	2	5	4	4	1	1	1	1	1	24
16911A03B3	2	2	2	4	4	4	1	1	1	1	1	23
16911A03B4	2	2	2	5	5	4	1	1	1	1	1	25

16911A03B5	2	2	2	4	4	4	1	1	1	1	1	23
16911A03B6	2	2	2	4	4	4	1	1	1	1	1	23
16911A03B7	1	2	2	2	2	3	1	1	1		1	16
16911A03B8	2	2		1	1	3	1			1	1	12
16911A03B9	2	2	2	3	3	4	1	1	1	1	1	21
16911A03C0	2	1	2	2	2	3	1	1	1		1	16
16911A03C1	2	1	2	3	3	4	1	1	1		1	19
16911A03C2	2	1	2	3	3	4	1	1	1		1	19
16911A03C3	2	1	2	2	2	2	1	1	1		1	15
16911A03C4	2	1	2	2	2	2	1	1	1		1	15
16911A03C5	2	1	2	3	3	4	1	1	1		1	19
16911A03C6	2	2	2	5	5	4	1	1	1	1	1	25
16911A03C7	2		2	2	2	2	1			1	1	13
16911A03C8	2	2	1	3	3	3	1	1	1		1	18
16911A03C9	2	1	2	3	3	3	1	1	1		1	18
16911A03D0		2	2	2	2	3	1			1	1	14
16911A03D1	2	2	2	5	5	4	1	1	1	1	1	25
16911A03D2	2	2	2	5	5	4	1	1	1	1	1	25
16911A03D3	2	2	2	3	3	4	1	1	1	1	1	21
16911A03D4	2	2	1	3	3	3	1	1	1		1	18
16911A03D5	2	2		1	1	1	1			1	1	10
16911A03D6	2	2	2	3	3	3	1	1	1	1	1	20
16911A03D7	2	2	2	3	3	3	1	1	1	1	1	20
16911A03D8	2	2		2	2	2	1			1	1	13
16911A03E0	2	2	2	4	3	4	1	1	1	1	1	22
16911A03E1	2	2	2	5	5	4	1	1	1	1	1	25
16911A03E2	2	2	2	3	3	4	1	1	1	1	1	21
16911A03E3	2	2	2	4	4	4	1	1	1	1	1	23
16911A03E4	2	2	2	3	3	4	1	1	1	1	1	21
16911A03E5	2	2	1	3	3	4	1	1	1		1	19
16911A03E6	2	2	2	3	3	4	1	1	1	1	1	21
16911A03E7	2	2	1	2	2	3	1	1	1		1	16
16911A03E8	2	2	1	2	2	4	1	1	1		1	17
16911A03E9	2	2	1	3	3	3	1	1	1		1	18
16911A03F0	2		2	2	2	2	1			1	1	13
16911A03F1	2	2	2	3	3	4	1	1	1	1	1	21
16911A03F2	2	2	2	5	5	4	1	1	1	1	1	25
16911A03F3	2	2	2	4	3	4	1	1	1	1	1	22
16911A03F5	2	2		1	1	3	1			1	1	12
16911A03F6	1	2	2	3	3	4	1	1	1		1	19
16911A03F7	2	2	2	5	5	4	1	1	1	1	1	25
16911A03F8	2	2	2	3	3	4	1	1	1	1	1	21
16911A03F9	2		2	2	2	3	1			1	1	14
16911A03G0	2		2	1	1	3	1			1	1	12
16911A03G1	2	2	2	3	3	3	1	1	1	1	1	20
16911A03G2	1	2	2	3	3	3	1	1	1		1	18
16911A03G3	2	2	2	3	3	4	1	1	1	1	1	21
16911A03G4	2	2	2	3	3	3	1	1	1	1	1	20
16911A03G5	2	2	2	4	3	4	1	1	1	1	1	22
16911A03G6	1	2	2	3	3	3	1	1	1		1	18
16911A03G7	1	2	2	3	3	4	1	1	1		1	19
16911A03G8	1	2	2	2	2	4	1	1	1		1	17
16911A03G9	2	2	2	3	3	3	1	1	1	1	1	20
16911A03H0	2	2	2	5	4	4	1	1	1	1	1	24
16911A03H1	2	2		2	2	2	1			1	1	13
16911A03H2	2	2	2	4	3	4	1	1	1	1	1	22

16911A03H3	2	2	2	5	5	4	1	1	1	1	1	25
16911A03H4	1	2	2	2	2	2	1	1	1		1	15
16911A03H6	2	1	2	2	2	2	1	1	1		1	15
16911A03H7	2	2	2	3	3	4	1	1	1	1	1	21
16911A03H8	2	1	2	3	3	4	1	1	1		1	19
16911A03H9	2		2	1	1	3	1			1	1	12
16911A03J0	2	2	2	5	4	4	1	1	1	1	1	24
16911A03J1	2	2	2	4	4	4	1	1	1	1	1	23
16911A03J2	2	2	2	3	3	3	1	1	1	1	1	20
16911A03J3	2	2	2	3	3	3	1	1	1	1	1	20
16911A03J4	2	2	2	4	4	4	1	1	1	1	1	23
16911A03J5	2	2		2	2	2	1			1	1	13
16911A03J6		2	2	1	1	3	1			1	1	12
16911A03J7	2	1	2	2	2	3	1	1	1		1	16
16911A03J8	1	2	2	3	3	4	1	1	1		1	19
16911A03J9	2	2	2	4	4	4	1	1	1	1	1	23
16911A03K0		2	2	2	2	2	1			1	1	13
16911A03K1	2	2	1	2	2	2	1	1	1		1	15
16911A03K2	1	2	2	2	2	3	1	1	1		1	16
16911A03K3	1	2	2	2	2	2	1	1	1		1	15
16911A03K4	2	2		2	2	2	1			1	1	13
16911A03K5	1	2	2	2	2	3	1	1	1		1	16
16911A03K8	2	2	2	3	3	3	1	1	1	1	1	20
16911A03K9	2	2	2	3	3	3	1	1	1	1	1	20
16911A03L0	2	2	1	2	2	3	1	1	1		1	16
16911A03L1	2	2	2	3	3	3	1	1	1	1	1	20
16911A03L2	2	2	1	2	2	2	1	1	1		1	15
16911A03L3	2		2	1	1	3	1			1	1	12
16911A03L4	2	2	2	4	3	4	1	1	1	1	1	22
16911A03L5	2	2	1	2	2	3	1	1	1		1	16
16911A03L6	2		2	2	2	2	1			1	1	13
16911A03L7	2		2	2	2	2	1			1	1	13
16911A03L8	2		2	1	1	3	1			1	1	12
16911A03L9	2	1	2	3	3	3	1	1	1		1	18
16911A03M0		2	2	1	1	3	1			1	1	12
16911A03M1	1	2	2	3	3	3	1	1	1		1	18
16911A03M2	1	2	2	3	3	3	1	1	1		1	18
16911A03M3	2	2	2	4	3	4	1	1	1	1	1	22
16911A03M4	2	2	2	4	3	4	1	1	1	1	1	22
16911A03M5	2	2	2	4	3	4	1	1	1	1	1	22
16911A03M6	1	2	2	2	2	4	1	1	1		1	17
16911A03M7	1	2	2	3	3	3	1	1	1		1	18
16911A03M8	2	2	2	3	3	3	1	1	1	1	1	20
16911A03M9	1	2	2	3	3	3	1	1	1		1	18
16911A03N0	1	2	2	2	2	4	1	1	1		1	17
16911A03N1	2	2		2	2	3	1			1	1	14
16911A03N2	2	2		2	2	2	1			1	1	13
16911A03N3	2	1	2	2	2	4	1	1	1		1	17
16911A03N4	2	1	2	3	3	3	1	1	1		1	18
17915A0301	1	2	2	3	3	3	1	1	1		1	18
17915A0302	2	2	2	4	4	4	1	1	1	1	1	23
17915A0303	1	2	2	3	3	3	1	1	1		1	18
17915A0304	1	2	2	2	2	4	1	1	1		1	17
17915A0305	1	2	2	2	2	4	1	1	1		1	17
17915A0306	1	2	2	2	2	4	1	1	1		1	17
17915A0307	2	1	2	3	3	4	1	1	1		1	19

17915A0308	2	2	2	4	4	4	1	1	1	1	1	23
17915A0309	2	2	2	3	3	4	1	1	1	1	1	21
17915A0310	2	2	2	5	5	4	1	1	1	1	1	25
17915A0311	2	2	2	3	3	4	1	1	1	1	1	21
17915A0312	2	2	2	4	3	4	1	1	1	1	1	22
17915A0313	2	1	2	3	3	3	1	1	1		1	18
17915A0314	2	2	2	5	5	4	1	1	1	1	1	25
17915A0316	2	2	2	5	5	4	1	1	1	1	1	25
17915A0317	2	2	2	5	5	4	1	1	1	1	1	25
17915A0318	2	2	2	5	4	4	1	1	1	1	1	24
17915A0320	2	2	2	5	4	4	1	1	1	1	1	24
17915A0321	2	2	2	5	5	4	1	1	1	1	1	25
17915A0322	2	2	2	5	5	4	1	1	1	1	1	25
17915A0323	2	2	2	3	3	3	1	1	1	1	1	20
17915A0324	2	2	2	5	5	4	1	1	1	1	1	25
17915A0325	2	2	2	5	5	4	1	1	1	1	1	25
17915A0326	1	2	2	3	3	3	1	1	1		1	18
17915A0327	2	2	2	5	5	4	1	1	1	1	1	25
17915A0328	2	2	2	4	4	4	1	1	1	1	1	23
17915A0329	1	2	2	2	2	4	1	1	1		1	17
17915A0330	2	2	2	3	3	4	1	1	1	1	1	21
17915A0331	2	2	1	2	2	3	1	1	1		1	16
17915A0332	2	2	1	2	2	2	1	1	1		1	15
17915A0333	2	2	1	2	2	4	1	1	1		1	17
17915A0334	2	2	1	3	3	4	1	1	1		1	19
17915A0335	2		2	2	2	3	1			1	1	14
17915A0336	2	2	1	2	2	2	1	1	1		1	15
17915A0337	2	2	1	3	3	4	1	1	1		1	19
17915A0338	2	2	2	5	4	4	1	1	1	1	1	24
17915A0339	2	2	2	5	4	4	1	1	1	1	1	24
17915A0340	2	2	1	2	2	4	1	1	1		1	17
17915A0341	2	2	1	3	3	4	1	1	1		1	19
17915A0343	2	1	2	2	2	2	1	1	1		1	15
17915A0344	2	1	2	2	2	2	1	1	1		1	15
17915A0345	2	2		2	2	3	1			1	1	14
17915A0346	2	2		2	2	2	1			1	1	13
17915A0347	2	2	2	4	4	4	1	1	1	1	1	23
17915A0348	2	2	2	5	5	4	1	1	1	1	1	25
17915A0349	2	2	2	3	3	3	1	1	1	1	1	20
17915A0350	1	2	2	2	2	4	1	1	1		1	17
17915A0351	2	2	2	3	3	4	1	1	1	1	1	21
17915A0352	2	2	2	3	3	3	1	1	1	1	1	20
17915A0353	2	2	2	3	3	4	1	1	1	1	1	21
No of students attempted	252	248	245	260	260	261	261	261	261	261	261	
No of students who scored >= 60% Marks	206	222	218	168	168	258	261	223	224	162	260	
% of students who scored >= 60% Marks	82	90	89	65	65	99	100	85	86	62	100	
Attainment	3	3	3	2	2	3	3	3	3	2	3	

Mid 2												
MOFHM_M2	Part A			Part B			Assignment					Total Marks
Roll No:	Q1	Q2	Q3	Q4	Q5	Q6	A_Q1	A_Q2	A_Q3	A_Q4	A_Q5	
16911A0301	2	2	2	3	3	4	1	1	1	1	1	21
16911A0303	1	2	2	2	2	4	1	1	1		1	17
16911A0304	1	2	2	2	2	2	1	1	1		1	15
16911A0305	2	2	2	4	5	5	1	1	1	1	1	25
16911A0306	2	1	2	3	3	4	1	1	1		1	19
16911A0307	2	1	2	3	3	3	1	1	1		1	18
16911A0308	2	2	2	4	5	5	1	1	1	1	1	25
16911A0309		1	2	1	1	1	1		1			8
16911A0310		2	2	1	1	3	1			1	1	12
16911A0312	2	2	1	2	2	2	1	1	1		1	15
16911A0313	2	2	2	3	3	3	1	1	1	1	1	20
16911A0314	2	2	2	3	3	3	1	1	1	1	1	20
16911A0315	2	2	2	3	3	4	1	1	1	1	1	21
16911A0317	2	2	2	4	4	4	1	1	1	1	1	23
16911A0318	2	2	2	4	5	5	1	1	1	1	1	25
16911A0319	2	2	2	3	3	4	1	1	1	1	1	21
16911A0321	2	2	2	3	3	3	1	1	1	1	1	20
16911A0322	2	2	2	3	3	3	1	1	1	1	1	20
16911A0323	2	1	2	3	3	4	1	1	1		1	19
16911A0324	2	1	2	3	3	4	1	1	1		1	19
16911A0325	2	2	2	3	3	5	1	1	1	1	1	22
16911A0326	2	2	2	4	4	5	1	1	1	1	1	24
16911A0327	2	2		2	2	2	1			1	1	13
16911A0328	2	2	2	4	5	5	1	1	1	1	1	25
16911A0329	1	2	2	3	3	4	1	1	1		1	19
16911A0330	2	2	2	4	4	5	1	1	1	1	1	24
16911A0331	2	2	2	4	4	5	1	1	1	1	1	24
16911A0332	2		2	2	2	3	1			1	1	14
16911A0333	2	2	2	4	4	4	1	1	1	1	1	23
16911A0334	2	2	1	3	3	3	1	1	1		1	18
16911A0335	2	2	2	3	3	3	1	1	1	1	1	20
16911A0336	2	2	2	4	4	5	1	1	1	1	1	24
16911A0337	2	2	1	2	2	2	1	1	1		1	15
16911A0338	2		2	2	2	2	1			1	1	13
16911A0339	2	2	2	3	3	5	1	1	1	1	1	22
16911A0340	2	2	2	3	3	4	1	1	1	1	1	21
16911A0341	2	2	2	3	3	3	1	1	1	1	1	20
16911A0342	2	2	1	3	3	3	1	1	1		1	18
16911A0343	2	2	2	4	4	4	1	1	1	1	1	23
16911A0345	2	2		2	2	2	1			1	1	13
16911A0346	2	2	2	4	4	4	1	1	1	1	1	23
16911A0347	1	2	2	3	3	3	1	1	1		1	18
16911A0348	2	2	1	3	3	4	1	1	1		1	19
16911A0349	2	2	2	4	5	5	1	1	1	1	1	25
16911A0350	1	2				1	1		1			6
16911A0351	2	2	2	3	3	3	1	1	1	1	1	20
16911A0352	2	2		2	2	3	1			1	1	14
16911A0354	2	1	2	3	3	3	1	1	1		1	18
16911A0355	1	2	2	2	2	4	1	1	1		1	17
16911A0356	2	2	2	3	3	3	1	1	1	1	1	20
16911A0357	2	2	2	3	3	3	1	1	1	1	1	20
16911A0358	2	1	2	2	2	2	1	1	1		1	15
16911A0359	1	2	2	3	3	4	1	1	1		1	19

16911A0360	1	2	2	2	2	4	1	1	1		1	17
16911A0361	2	2	2	4	5	5	1	1	1	1	1	25
16911A0362	2	2	2	4	4	4	1	1	1	1	1	23
16911A0363	2	1	2	2	2	4	1	1	1		1	17
16911A0364	2	2	2	4	4	4	1	1	1	1	1	23
16911A0365	2	2	1	3	3	4	1	1	1		1	19
16911A0366	2	2	2	3	3	5	1	1	1	1	1	22
16911A0367	2		2	2	2	3	1			1	1	14
16911A0368	2	2	1	3	3	4	1	1	1		1	19
16911A0369	2	2	2	3	3	4	1	1	1	1	1	21
16911A0370	2	2	2	4	4	5	1	1	1	1	1	24
16911A0371	1	2	2	2	2	3	1	1	1		1	16
16911A0372	2	2		2	2	3	1			1	1	14
16911A0373		2	2	2	2	3	1			1	1	14
16911A0374	2	2	2	4	4	5	1	1	1	1	1	24
16911A0375	2	1	2	2	2	2	1	1	1		1	15
16911A0376	2	2	2	3	3	3	1	1	1	1	1	20
16911A0377	2	2	2	3	3	4	1	1	1	1	1	21
16911A0378	2	2	2	4	4	5	1	1	1	1	1	24
16911A0379	2	2	2	4	4	5	1	1	1	1	1	24
16911A0380	2	2	2	3	3	4	1	1	1	1	1	21
16911A0381	2	2		1	1	3	1			1	1	12
16911A0382	1	2	2	2	2	3	1	1	1		1	16
16911A0383	2	2	2	3	3	5	1	1	1	1	1	22
16911A0384	1	2	2	3	3	3	1	1	1		1	18
16911A0385	1	2	2	2	2	2	1	1	1		1	15
16911A0386	2	2	2	3	3	4	1	1	1	1	1	21
16911A0387	2	2	2	4	5	5	1	1	1	1	1	25
16911A0388	1	2	2	2	2	2	1	1	1		1	15
16911A0389		2	2	2	2	3	1			1	1	14
16911A0390	2	2	2	4	4	4	1	1	1	1	1	23
16911A0391	2	2	1	3	3	4	1	1	1		1	19
16911A0392	2		2	1	1	1	1			1	1	10
16911A0393	2	2	2	4	4	5	1	1	1	1	1	24
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16911A0395	2	2	2	3	3	5	1	1	1	1	1	22
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16911A0399	2	2	2	4	4	4	1	1	1	1	1	23
16911A03A0	2	2	2	3	3	3	1	1	1	1	1	20
16911A03A1	2	2	2	3	3	5	1	1	1	1	1	22
16911A03A2	1	2	2	2	2	2	1	1	1		1	15
16911A03A3	2	2	2	4	5	5	1	1	1	1	1	25
16911A03A5	2	2	2	4	5	5	1	1	1	1	1	25
16911A03A6	2	2	2	3	3	5	1	1	1	1	1	22
16911A03A7	2	2	1	2	2	3	1	1	1		1	16
16911A03A8	2	2	2	3	3	4	1	1	1	1	1	21
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16911A03B0	2	2	2	4	5	5	1	1	1	1	1	25
16911A03B1	1	2	2	2	2	4	1	1	1		1	17
16911A03B2	2	2	2	3	3	5	1	1	1	1	1	22
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16911A03B4	2	2	2	4	5	5	1	1	1	1	1	25
16911A03B5	2	1	2	3	3	4	1	1	1		1	19
16911A03B6	2	2	2	4	5	5	1	1	1	1	1	25
16911A03B7	1	2	2	3	3	3	1	1	1		1	18

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16911A03C7	2	2	1	2	2	4	1	1	1		1	17
16911A03C8	2	2	1	2	2	3	1	1	1		1	16
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16911A03D0	2	2	2	3	3	3	1	1	1	1	1	20
16911A03D1	2	2	2	4	5	5	1	1	1	1	1	25
16911A03D2	2	2	2	3	3	4	1	1	1	1	1	21
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16911A03D5	2	2		1	1	3	1			1	1	12
16911A03D6	1	2	2	2	2	3	1	1	1		1	16
16911A03D7	1	2	2	3	3	3	1	1	1		1	18
16911A03D8	2	2		2	2	2	1			1	1	13
16911A03E0	2	2	2	3	3	4	1	1	1	1	1	21
16911A03E1	2	2	2	4	5	5	1	1	1	1	1	25
16911A03E2	1	2	2	3	3	4	1	1	1		1	19
16911A03E3	2	2	2	3	3	4	1	1	1	1	1	21
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16911A03E5	2	2	1	3	3	3	1	1	1		1	18
16911A03E6	2	2	1	2	2	4	1	1	1		1	17
16911A03E7	2	2	2	3	3	3	1	1	1	1	1	20
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16911A03E9	2		2	2	2	3	1			1	1	14
16911A03F0	2	2	1	2	2	4	1	1	1		1	17
16911A03F1	2	2	2	3	3	4	1	1	1	1	1	21
16911A03F2	2	2	2	4	5	5	1	1	1	1	1	25
16911A03F3	1	2	2	3	3	3	1	1	1		1	18
16911A03F5	1	2	2	2	2	3	1	1	1		1	16
16911A03F6	2	2	2	4	4	4	1	1	1	1	1	23
16911A03F7	2	2	2	4	5	5	1	1	1	1	1	25
16911A03F8	2	2	1	2	2	4	1	1	1		1	17
16911A03F9	2	2	1	2	2	3	1	1	1		1	16
16911A03G0	2	2	1	3	3	3	1	1	1		1	18
16911A03G1	2	2	2	4	4	5	1	1	1	1	1	24
16911A03G2	2	2	2	3	3	3	1	1	1	1	1	20
16911A03G3	2	2	2	4	4	4	1	1	1	1	1	23
16911A03G4	2	2	2	3	3	5	1	1	1	1	1	22
16911A03G5	2	2	2	3	3	4	1	1	1	1	1	21
16911A03G6	2	2	2	4	4	5	1	1	1	1	1	24
16911A03G7	1	2	2	3	3	4	1	1	1		1	19
16911A03G8	1	2	2	3	3	4	1	1	1		1	19
16911A03G9	2	1	2	3	3	3	1	1	1		1	18
16911A03H0	2	2	2	3	3	5	1	1	1	1	1	22
16911A03H1	1	2	2	2	2	4	1	1	1		1	17
16911A03H2	1	2	2	3	3	3	1	1	1		1	18
16911A03H3	2	2	2	4	5	5	1	1	1	1	1	25
16911A03H4	1	2	2	2	2	4	1	1	1		1	17
16911A03H6	2	1	2	3	3	4	1	1	1		1	19

16911A03H7	2	2	2	4	5	5	1	1	1	1	1	25
16911A03H8	2	2	2	4	4	4	1	1	1	1	1	23
16911A03H9	2		2	2	2	3	1			1	1	14
16911A03J0	2	2	2	4	4	5	1	1	1	1	1	24
16911A03J1	2	2	2	3	3	4	1	1	1	1	1	21
16911A03J2	2	2	2	3	3	3	1	1	1	1	1	20
16911A03J3	2	2	2	3	3	3	1	1	1	1	1	20
16911A03J4	2	2	2	3	3	4	1	1	1	1	1	21
16911A03J5	2	2		2	2	2	1			1	1	13
16911A03J6	2	1	2	2	2	3	1	1	1		1	16
16911A03J7	2	2	2	3	3	3	1	1	1	1	1	20
16911A03J8	2	2	2	4	4	4	1	1	1	1	1	23
16911A03J9	2	2	2	4	4	4	1	1	1	1	1	23
16911A03K0	2	1	2	2	2	2	1	1	1		1	15
16911A03K1	2	2	1	2	2	2	1	1	1		1	15
16911A03K2	2	2		2	2	3	1			1	1	14
16911A03K3	1	2	2	2	2	4	1	1	1		1	17
16911A03K4	1	2	2	2	2	4	1	1	1		1	17
16911A03K5	2	2	2	3	3	3	1	1	1	1	1	20
16911A03K8	1	2	2	2	2	3	1	1	1		1	16
16911A03K9	2	2	1	3	3	4	1	1	1		1	19
16911A03L0	2	2	1	3	3	3	1	1	1		1	18
16911A03L1	2	2	1	3	3	4	1	1	1		1	19
16911A03L2	2		2	1	1	2	1			1	1	11
16911A03L3	2	2	1	2	2	3	1	1	1		1	16
16911A03L4	2	2	2	3	3	3	1	1	1	1	1	20
16911A03L5	2		2	1	1	3	1			1	1	12
16911A03L6	2	2	1	2	2	2	1	1	1		1	15
16911A03L7	2		1	1	1	2	1		1			9
16911A03L8	2	2	1	2	2	3	1	1	1		1	16
16911A03L9	2	1	2	2	2	3	1	1	1		1	16
16911A03M0		2	2	2	2	3	1			1	1	14
16911A03M1	1	2	2	3	3	3	1	1	1		1	18
16911A03M2	2	2	2	4	4	5	1	1	1	1	1	24
16911A03M3	2	2	2	3	3	3	1	1	1	1	1	20
16911A03M4	1	2	2	3	3	3	1	1	1		1	18
16911A03M5	2	2	2	3	3	5	1	1	1	1	1	22
16911A03M6	1	2	2	3	3	4	1	1	1		1	19
16911A03M7	1	2	2	2	2	3	1	1	1		1	16
16911A03M8	2	2	2	3	3	3	1	1	1	1	1	20
16911A03M9	2	2		2	2	3	1			1	1	14
16911A03N0	1	2	2	2	2	4	1	1	1		1	17
16911A03N1	2	2		1	1	3	1			1	1	12
16911A03N2	1	2		1	1	2	1		1			9
16911A03N3	2	1	2	2	2	2	1	1	1		1	15
16911A03N4	2	2	2	4	4	5	1	1	1	1	1	24
17915A0301	2	2	2	3	3	5	1	1	1	1	1	22
17915A0302	2	2	2	3	3	5	1	1	1	1	1	22
17915A0303	2	2	2	3	3	5	1	1	1	1	1	22
17915A0304	2	2	2	4	4	4	1	1	1	1	1	23
17915A0305	1	2	2	3	3	4	1	1	1		1	19
17915A0306	1	2	2	3	3	4	1	1	1		1	19
17915A0307	2	2	2	4	5	5	1	1	1	1	1	25
17915A0308	2	2	2	4	4	4	1	1	1	1	1	23
17915A0309	2	1	2	3	3	4	1	1	1		1	19
17915A0310	2	2	2	4	5	5	1	1	1	1	1	25

17915A0311	2	2	2	4	4	4	1	1	1	1	1	23
17915A0312	2	2	2	3	3	3	1	1	1	1	1	20
17915A0313	2	2	2	3	3	3	1	1	1	1	1	20
17915A0314	2	2	2	4	5	5	1	1	1	1	1	25
17915A0316	2	2	2	4	5	5	1	1	1	1	1	25
17915A0317	2	2	2	4	5	5	1	1	1	1	1	25
17915A0318	2	2	2	4	4	5	1	1	1	1	1	24
17915A0320	2	2	2	4	4	5	1	1	1	1	1	24
17915A0321	2	2	2	4	5	5	1	1	1	1	1	25
17915A0322	2	2	2	4	5	5	1	1	1	1	1	25
17915A0323	2	2	2	4	4	5	1	1	1	1	1	24
17915A0324	2	2	2	3	3	4	1	1	1	1	1	21
17915A0325	2	2	2	4	5	5	1	1	1	1	1	25
17915A0326	2	2	2	4	4	5	1	1	1	1	1	24
17915A0327	2	2	2	4	4	4	1	1	1	1	1	23
17915A0328	2	2	2	4	4	4	1	1	1	1	1	23
17915A0329	2	2	2	3	3	4	1	1	1	1	1	21
17915A0330	2	2	2	4	4	4	1	1	1	1	1	23
17915A0331	2	2	2	3	3	5	1	1	1	1	1	22
17915A0332	2	2	1	2	2	4	1	1	1		1	17
17915A0333	2	2	2	3	3	4	1	1	1	1	1	21
17915A0334	2	2	2	3	3	4	1	1	1	1	1	21
17915A0335	2	2	1	2	2	3	1	1	1		1	16
17915A0336	2	2	1	2	2	2	1	1	1		1	15
17915A0337	2	2	2	4	5	5	1	1	1	1	1	25
17915A0338	2	2	2	4	4	5	1	1	1	1	1	24
17915A0339	2	2	2	4	4	5	1	1	1	1	1	24
17915A0340	2	2	1	3	3	4	1	1	1		1	19
17915A0341	2	2	1	3	3	4	1	1	1		1	19
17915A0343	2	2	2	3	3	4	1	1	1	1	1	21
17915A0344	2	2	2	3	3	4	1	1	1	1	1	21
17915A0345	1	2	2	3	3	3	1	1	1		1	18
17915A0346	2	2		2	2	2	1			1	1	13
17915A0347	2	2	2	4	4	4	1	1	1	1	1	23
17915A0348	2	2	2	4	4	4	1	1	1	1	1	23
17915A0349	2	2	2	4	4	5	1	1	1	1	1	24
17915A0350	1	2	2	2	2	2	1	1	1		1	15
17915A0351	2	2	2	4	4	4	1	1	1	1	1	23
17915A0352	2	2	2	3	3	5	1	1	1	1	1	22
17915A0353	1	2	2	3	3	4	1	1	1		1	19
No of students attempted	254	251	247	260	260	261	261	261	261	261	261	
No of students who scored >= 60% Marks	213	230	216	184	184	258	261	230	234	168	257	
% of students who scored >= 60% Marks	84	92	87	71	71	99	100	88	90	64	98	
Attainment	3	3	3	3	3	3	3	3	3	2	3	

External	
Roll No:	External Marks
16911A0301	40
16911A0303	49
16911A0304	37
16911A0305	68
16911A0306	54
16911A0307	54
16911A0308	73
16911A0309	AB
16911A0310	42
16911A0312	50
16911A0313	27
16911A0314	70
16911A0315	41
16911A0317	34
16911A0318	65
16911A0319	67
16911A0321	46
16911A0322	71
16911A0323	28
16911A0324	8
16911A0325	72
16911A0326	56
16911A0327	34
16911A0328	74
16911A0329	47
16911A0330	40
16911A0331	58
16911A0332	31
16911A0333	74
16911A0334	28
16911A0335	49
16911A0336	61
16911A0337	36
16911A0338	52
16911A0339	49
16911A0340	70
16911A0341	45
16911A0342	59
16911A0343	57
16911A0345	14
16911A0346	61
16911A0347	53
16911A0348	52
16911A0349	66
16911A0350	13
16911A0351	38
16911A0352	32
16911A0354	31
16911A0355	49
16911A0356	47
16911A0357	69
16911A0358	51
16911A0359	68
16911A0360	74

16911A0361	51
16911A0362	64
16911A0363	29
16911A0364	54
16911A0365	32
16911A0366	26
16911A0367	54
16911A0368	42
16911A0369	49
16911A0370	30
16911A0371	44
16911A0372	26
16911A0373	27
16911A0374	54
16911A0375	31
16911A0376	45
16911A0377	66
16911A0378	67
16911A0379	34
16911A0380	26
16911A0381	15
16911A0382	27
16911A0383	57
16911A0384	56
16911A0385	34
16911A0386	45
16911A0387	57
16911A0388	45
16911A0389	27
16911A0390	54
16911A0391	43
16911A0392	29
16911A0393	51
16911A0394	52
16911A0395	46
16911A0396	57
16911A0397	41
16911A0399	60
16911A03A0	29
16911A03A1	47
16911A03A2	52
16911A03A3	71
16911A03A5	58
16911A03A6	58
16911A03A7	14
16911A03A8	28
16911A03A9	43
16911A03B0	71
16911A03B1	42
16911A03B2	61
16911A03B3	74
16911A03B4	63
16911A03B5	40
16911A03B6	57
16911A03B7	35
16911A03B8	26

16911A03B9	20
16911A03C0	46
16911A03C1	26
16911A03C2	26
16911A03C3	66
16911A03C4	32
16911A03C5	51
16911A03C6	58
16911A03C7	54
16911A03C8	54
16911A03C9	54
16911A03D0	50
16911A03D1	72
16911A03D2	63
16911A03D3	65
16911A03D4	70
16911A03D5	20
16911A03D6	29
16911A03D7	40
16911A03D8	50
16911A03E0	8
16911A03E1	65
16911A03E2	32
16911A03E3	74
16911A03E4	26
16911A03E5	2
16911A03E6	50
16911A03E7	47
16911A03E8	13
16911A03E9	43
16911A03F0	28
16911A03F1	38
16911A03F2	57
16911A03F3	38
16911A03F5	51
16911A03F6	41
16911A03F7	59
16911A03F8	41
16911A03F9	28
16911A03G0	41
16911A03G1	60
16911A03G2	38
16911A03G3	71
16911A03G4	28
16911A03G5	40
16911A03G6	62
16911A03G7	72
16911A03G8	16
16911A03G9	62
16911A03H0	66
16911A03H1	10
16911A03H2	72
16911A03H3	71
16911A03H4	57
16911A03H6	28
16911A03H7	47

16911A03H8	71
16911A03H9	5
16911A03J0	74
16911A03J1	62
16911A03J2	44
16911A03J3	60
16911A03J4	65
16911A03J5	51
16911A03J6	42
16911A03J7	41
16911A03J8	66
16911A03J9	61
16911A03K0	26
16911A03K1	51
16911A03K2	27
16911A03K3	62
16911A03K4	64
16911A03K5	74
16911A03K8	49
16911A03K9	42
16911A03L0	18
16911A03L1	30
16911A03L2	43
16911A03L3	51
16911A03L4	72
16911A03L5	36
16911A03L6	49
16911A03L7	57
16911A03L8	37
16911A03L9	42
16911A03M0	27
16911A03M1	57
16911A03M2	66
16911A03M3	16
16911A03M4	65
16911A03M5	74
16911A03M6	67
16911A03M7	56
16911A03M8	57
16911A03M9	64
16911A03N0	47
16911A03N1	4
16911A03N2	49
16911A03N3	52
16911A03N4	74
17915A0301	15
17915A0302	2
17915A0303	69
17915A0304	50
17915A0305	37
17915A0306	26
17915A0307	74
17915A0308	44
17915A0309	73
17915A0310	59
17915A0311	60

17915A0312	58
17915A0313	69
17915A0314	46
17915A0316	70
17915A0317	72
17915A0318	63
17915A0320	72
17915A0321	66
17915A0322	40
17915A0323	63
17915A0324	65
17915A0325	61
17915A0326	57
17915A0327	61
17915A0328	51
17915A0329	65
17915A0330	29
17915A0331	38
17915A0332	67
17915A0333	53
17915A0334	67
17915A0335	44
17915A0336	17
17915A0337	70
17915A0338	58
17915A0339	59
17915A0340	26
17915A0341	73
17915A0343	69
17915A0344	57
17915A0345	45
17915A0346	53
17915A0347	49
17915A0348	68
17915A0349	69
17915A0350	18
17915A0351	74
17915A0352	68
17915A0353	67
No of students attempted	260
No: of students who scored more than 60%	162
% of students who scored more than 60%	62
Attainment	2

CO	Method	Value	Average	Attainment Level	Attainment Level	CO Direct Attainment

				(Internal)	(External)	(25%Int+75%Ext)
CO1	M1_D_Q1	3	2.75	2.80	2.00	**2.20**
	M1_D_Q4	2				
	M1_A_Q1	3				
	M1_A_Q2	3				
CO2	M1_D_Q2	3	2.50			
	M1_D_Q5	2				
	M1_A_Q3	3				
	M1_A_Q4	2				
CO3	M1_D_Q3	3	3.00			
	M1_D_Q6	3				
	M1_A_Q5	3				
	M2_D_Q1	3				
	M2_D_Q4	3				
	M2_A_Q1	3				
CO4	M2_D_Q2	3	3.00			
	M2_D_Q5	3				
	M2_A_Q2	3				
	M2_A_Q3	3				
CO5	M2_D_Q3	3	2.75			
	M2_D_Q6	3				
	M2_A_Q4	2				
	M2_A_Q5	3				

Direct CO Attainment	2.20
Indirect CO Attainment	2.80
Overall CO Attainment (0.8 * Direct Attainment+ 0.2 * Indirect Attainment)	2.32

17. COURSE END SURVEY FORM

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE INDIRECT ATTAINMENT REPORT

Batch: 2017-21
Year-Sem: II-II
Course: MOFHM (C212)

Course Indirect Attainment: 2.58

Students Participated: 205 **Total Students:** 256 **Survey Date:** 20-04-2019

Roll Number	CO1	CO2	CO3	CO4	CO5
Anonymous	2	3	3	3	3
Anonymous	3	3	2	2	3
Anonymous	3	2	2	3	3
Anonymous	2	2	2	2	3
Anonymous	2	2	2	2	3
Anonymous	2	3	2	2	3
Anonymous	3	2	2	2	3
Anonymous	3	3	2	2	3

COURSE (OUTCOME) END SURVEY FORM (THEORY/ LABORATORY)

Faculty Name:		Designation / Department	
Course Code:	A24311	Course Name:	MOFHM
Student Name (Optional):		Roll No./Reg. No. (Optional):	
Programme:	B.Tech (Mechnaical Engineering)	Semester:	II/II
Academic Year:	2020-21	Batch:	2019-23

[Please tick (√) appropriately]

CO's	To what extent do you have learnt and will be able to do the following (which of the CO's of the course)	Poor	Average	Good
		1	3	5
CO 1	Understand the basics of Mechanics of fluid Statics and Fluid kinematics.			√
CO 2	Able to quantify the flow of fluid in venturimeter, orifice meter, flow nozzles, pitot static tubes.			√
CO 3	Analyze the losses in pipe flow, boundary layer, separation of flows, forces on different vanes.		√	
CO 4	Understand the working of hydraulic machinery and analyze their characteristic curves.			√
CO 5	Appreciate the working principles of pumps and their applications.		√	

Any other feed back / suggestions:

CALCULATION OF INDIRECT ATTAINMENT

Average of indirect CO attainment from course end survey of all the students for MOFHM = **2.58**

CCV

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE INDIRECT ATTAINMENT REPORT

Batch: 2016-20
Year-Sem: II-II
Course: MOFHM (C212)

Back

Course Indirect Attainment: 2.80

Students Participated: 205 **Total Students:** 261 **Survey Date:** 24-04-2018

Roll Number	CO1	CO2	CO3	CO4	CO5
Anonymous	3	2	3	3	3
Anonymous	3	3	3	3	3
Anonymous	3	3	3	3	3
Anonymous	3	3	3	2	3
Anonymous	3	3	3	3	2
Anonymous	3	3	3	2	2
Anonymous	3	3	2	2	2
Anonymous	2	2	2	2	3

COURSE (OUTCOME) END SURVEY FORM (THEORY/ LABORATORY)

Faculty Name:		Designation / Department	
Course Code:	A24311	Course Name:	MOFHM
Student Name (Optional):		Roll No./Reg. No. (Optional):	
Programme:	B.Tech (Mechnaical Engineering)	Semester:	II/II
Academic Year:	2019-20	Batch:	2018-22

[Please tick (√) appropriately]				
CO's	**To what extent do you have learnt and will be able to do the following (which of the CO's of the course)**	**Poor**	**Average**	**Good**
		1	**3**	**5**
CO 1	Understand the basics of Mechanics of fluid Statics and Fluid kinematics.			√
CO 2	Able to quantify the flow of fluid in venturimeter, orifice meter, flow nozzles, pitot static tubes.			√
CO 3	Analyze the losses in pipe flow, boundary layer, separation of flows, forces on different vanes.		√	
CO 4	Understand the working of hydraulic machinery and analyze their characteristic curves.			√
CO 5	Appreciate the working principles of pumps and their applications.		√	

Any other feed back / suggestions:

CALCULATION OF INDIRECT ATTAINMENT

Average of indirect CO attainment from course end survey of all the students for MOFHM = **2.80**

VIDYA JYOTHI INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE INDIRECT ATTAINMENT REPORT

Batch: 2015-19
Year-Sem: II-II
Course: MOFHM (C212)

Back

Course Indirect Attainment: 2.71

Students Participated: 205 **Total Students:** 248 **Survey Date:** 10-05-2017

Roll Number	CO1	CO2	CO3	CO4	CO5
Anonymous	3	3	3	3	3
Anonymous	3	3	3	3	3
Anonymous	3	3	3	3	3
Anonymous	3	2	3	2	3
Anonymous	3	3	3	2	3
Anonymous	3	2	3	2	3
Anonymous	3	2	3	2	2
Anonymous	3	2	2	2	2

Student Name (Optional):		Roll No./Reg. No. (Optional):	
Programme:	B.Tech (Mechnaical Engineering)	Semester:	II/II
Academic Year:	2018-19	Batch:	2017-21

[Please tick (√) appropriately]				
CO's	**To what extent do you have learnt and will be able to do the following (which of the CO's of the course)**	**Poor**	**Average**	**Good**
		1	**3**	**5**
CO 1	Understand the basics of Mechanics of fluid Statics and Fluid kinematics.			√
CO 2	Able to quantify the flow of fluid in venturimeter, orifice meter, flow nozzles, pitot static tubes.			√
CO 3	Analyze the losses in pipe flow, boundary layer, separation of flows, forces on different vanes.		√	
CO 4	Understand the working of hydraulic machinery and analyze their characteristic curves.			√
CO 5	Appreciate the working principles of pumps and their applications.		√	

Any other feed back / suggestions:

CALCULATION OF INDIRECT ATTAINMENT

Average of indirect CO attainment from course end survey of all the students for MOFHM = **2.71**

18. TOPICS COVERED UNDER CONTENT BEYOND SYLLABUS (GAP ANALYSIS)

JET PROPULSION

Jet propulsion means the propulsion or movement of the bodies such as ships, aircrafts, rocket etc., with the help of jet. The reaction of the jet coming out from the orifice provided in the bodies is used to move the bodies. This is explained as given below.

A jet of fluid coming out from an orifice or nozzle, when strikes a plate, exerts a force on the plate. The magnitude of the force exerted on the plate can be determined depending upon whether plate is flat, inclined, curved, stationary or moving. This force exerted by the jet on the plate is called as '*action of the jet*'. But according to Newtons third law of motion, every action is accompanied by an equal and opposite reaction. Hence the jet while coming out of the orifice or nozzle, exerts a force on the orifice or nozzle in the opposite direction in which jet is coming out. The magnitude of the force exerted is equal to the 'action of the jet'. This force which is acting on the orifice or nozzle in the opposite direction is called the 'reaction of the jet'. If the body in which orifice or nozzle is fitted, is free to move, the body will start moving in the direction opposite to the jet. The following cases are important where this principle is used :

(*a*) Jet propulsion of a tank to which orifice is fitted, and

(*b*) Jet propulsion of ships.

Jet Propulsion of a Tank with an Orifice. Consider a large tank fitted with an orifice in one of its sides as shown in Fig.

Let H = Constant head of water in tank from the centre of orifice,

a = Area of orifice,

V = Velocity of the jet of water,

C_v = Co-efficient of the velocity of orifice.

Then $V = C_v \sqrt{2gH}$

And mass of water coming out from the orifice per second

$$= \rho \times \text{Volume per second} = \rho \times (\text{Area} \times \text{Velocity})$$

$$= \rho \times a \times V$$

Force acting on the water is equal to the rate of change of momentum.

or F = Mass per second × [Change of velocity]

= Mass per second × [Final velocity – Initial velocity].

Note. Here change of velocity is to be taken as final minus initial as we are finding force on water and not force exerted by water.

Initial velocity of water in the tank is zero and final velocity of water when it comes out in the form of jet is equal to V.

$\therefore$ $$F = \rho a V\,[V - 0] = \rho a V^2$$

Thus, F is the force exerted on the jet of water. This jet of water will exert a force on the tank which is equal to F but opposite in direction as shown in Fig. The force will be acting at A, the point on the tank in the horizontal line of the centre of the orifice. If the tank is free to move or the tank is fitted with frictionless wheel, it will start moving with some velocity say, 'u' in the direction opposite to the direction of the jet. When the tank starts moving, the velocity of the jet with which it comes out of the orifice will not be equal to V but it will be equal to the relative velocity of the jet with respect to tank.

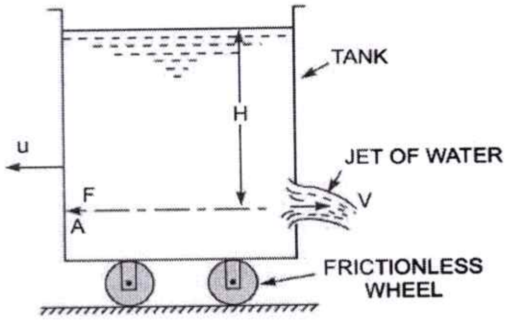


Fig. *Jet propulsion of a tank*

Hence if V = Absolute velocity of jet,

u = Velocity of tank,

V_r = Velocity of jet with respect to tank

Then V_r = Vectorial difference of absolute velocity (V) and velocity of tank (u)

$= V - (-u)$ (as u is in opposite direction to V hence velocity of tank is taken as $-u$)

$= V + u$

Hence when the tank is moving, the velocity with which jet comes out from the orifice is $(V + u)$.

Mass of water coming out from the orifice per sec

$= \rho \times a \times$ Velocity with which water comes out

$= \rho \times a \times (V_r) = \rho a\,(V + u)$

∴ Force exerted on the tank is given as

F_x = Mass of water coming out from orifice per second × [Change of velocity]

$= \rho a(V + u) \times [(V + u) - u] = \rho a\,[V + u]\,[V]$

$= \rho a[V + u] \times V$

Thus, the force given by equation (17.30) is used for propelling the tank.

∴ Work done on the moving tank by jet per second

$= F_x \times u = \rho a(V + u) \times V \times u$

∴ Efficiency of propulsion is given as,

$$\eta = \frac{\text{Work done per second}}{\text{Kinetic energy of the issuing jet per second}}$$

$$= \frac{\rho a(V+u) \times V \times u}{\frac{1}{2}(\text{Mass of water issuing per second}) \times (\text{Velocity of issuing jet})}$$

$$= \frac{\rho a(V+u) \times V \times u}{\frac{1}{2}[\rho a(V+u)] \times (V+u)^2} = \frac{2Vu}{(V+u)^2}$$

Condition for Maximum Efficiency and Expression for Maximum η. For a given value of V, the efficiency will be maximum when $\frac{d\eta}{du} = 0$

or $$\frac{d}{du}\left[\frac{2Vu}{(V+u)^2}\right] = 0 \quad \text{or} \quad \frac{d}{du}\left[2Vu \times (V+u)^{-2}\right] = 0$$

or $$2Vu \times (-2)(V+u)^{-3} + (V+u)^{-2} \times 2V = 0$$

or $$\frac{-4Vu}{(V+u)^3} + \frac{2V}{(V+u)^2} = 0 \quad \text{or} \quad -4Vu + 2V(V+u) = 0$$

Dividing by $2V$, $-2u + (V + u) = 0$ or $-u + V = 0$ or $u = V$

Equation (17.32) is the condition for maximum efficiency. Substituting equation in equation the value of maximum efficiency is obtained as

$$\eta_{max} = \frac{2 \times u \times u}{(u+u)^2} = \frac{2u^2}{4u^2} = \frac{1}{2} = 0.5 \text{ or } 50\%.$$

Jet Propulsion of Ships. By the application of the jet propulsion principle, a ship is driven through water. A jet of water which is discharged at the back (also called stern) of the ship, exerts a propulsive force on the ship. The ship carries centrifugal pumps which draw water from the surrounding sea. This water is discharged through the orifice provided at the back of the ship in the form of a jet. The reaction of the jet coming out at the back of the ship propels the ship in the opposite direction of the jet. The water from the surrounding sea by the centrifugal pump is taken by the following two ways :

1. Through inlet orifices which are at right angles to the direction of the motion of the ship, and
2. Through the inlet orifices, which are facing the direction of motion of the ship.

1st Case. Jet propulsion of the ship when the inlet orifices are at right angles to the direction of the motion of the ship.

Fig. shows a ship which is having the inlet orifices at right angles to its direction.

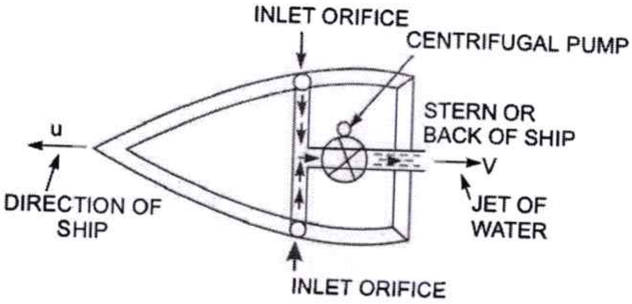


Fig. *Inlet orifices are at right angles.*

Let

V = Absolute velocity of jet of water coming at the back of the ship,

u = Velocity of the ship,

V_r = Relative velocity of jet with respect to ship
$= (V + u)$.

As the velocity V and u are in opposite direction and hence relative velocity will be equal to the sum of these two velocities.

Mass of water issuing from the orifice at the back of the ship $= \rho a V_r = \rho a(V + u)$,
where a = Area of the jet of water

$\therefore$ Propulsive force exerted on the ship

F = Mass of water issuing per sec × Change of velocity*

$= \rho a(V + u)\ [V_r - u] = \rho a(V + u)\ [(V + u) - u] = \rho a(V + u) \times V$

Work done per second $= F \times u = \rho a\ (V + u) \times V \times u$

19. INNOVATIONS IN TEACHING

A case study on Micro Hydro Power Turbine

Introduction: Water is clean, cheap and environment friendly source of power generation which is important from ecological point of view.[1] Hydropower is utilized from last hundreds of years which is resourceful and consistent source of renewable energy. The scope of project work is to design and develop small size turbine concept to utilize the natural resource of energy in remote areas where it is not possible to construct power transmission line for providing electrification. A total of 32,227 villages of India are until now to be provided with electricity access, as per report on 31st August 2013. As per the 2001 census, as on 31st August 2013, a total of 561505 villages were electrified, out of a total of 593,732 colonized villages [2]. For hydropower development there is significant potential in the country. From such plants at more than 15,000 MW, power can be generated in India as per the Ministry of New and Renewable Energy (MNRE). The 11th Five Year Plan completed its term in March 2012. For improving the overall energy picture of the countryside particularly in remote and unreachable areas, mini, micro, and pico hydropower projects can play a significant role. As per ministry's plan at least half of the hydro potential of the country is harnessed upto the further ten years and that will be the installed capacity of small hydro facilities, it should be about 7,000 MW at the end of the 2017. For the next (12th) Five Year Plan period, MNRE is targeting a capacity n of 30,000 MW power generation from different renewable energy sources An cumulative capacity of 3,632 MW had been installed in India, by announcing a policy in 24 states to invite private sector bodies to set up projects, by means of 967 small hydro projects, by the end of April 2013. An additional thing is that , 281 small hydro projects with a capacity of 1,061 MW are under progress.

For the Small Hydro Power (SHP) schemes, INR1.6 billion of grant was released, from 2012 to 2013. The largest amounts going to states such as Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir and Uttarakhand. As expected, most of the hydro-potential of power generation is from river-based projects in Himalayan states, and on irrigation canals in other states. To focus mainly on SHP program, and to minimise the cost of equipment, increase reliability and arrange projects in areas that give the maximum advantage in terms of capacity utilization.
According to MNRE, its SHP program is now essentially being driven by private investment, and it finds that projects are usually economically feasible. The private sector taking lot of interest in investing in SHP projects. Number of peoples studying on the installation of SHP in India. From the overall study they closing that there is"assured future of small hydropower in India."[3].

1. Motivation in designing different turbine: In 1976 Mohammd Durali [4], designed the turbine for farmers who having little technical knowledge, so completed structure design is avoided. These turbines are designed with simple structure so that they can be used in a period of years when plenty of water is available. Design should be cheap so that machine can be built locally in each farming area as well as can be manufactured in simple workshop having enough facilities. In July-1999, Alastair Gill, ESD, Neston Paul Mosley, [5] To help rural people to improve their financial condition and get better life-style, micro-hydro power designed, which has proved as a very successful tool. In a village areas which are away from the grid, to reduce the hard work of food processing and to offer a ways of generating electric power, MHP provides required energy. In Dec' 2007 Miyoshi Nakijama, Shishnu University, Japan,[6] developed environmentally friendly nano hydraulic

turbine, in which two bucket savonius type turbine is constructed and tested in water channel with an optimal installation condition. This turbine can be used efficiently as a nano hydro turbine & dispersed power system. These types of turbines are suitable for rivers or canals in which net head is not sufficient while the flow-rate is enough. In July 2009 Toshihiko Ikedo, Jio, Kenji-Shishnu University Japan, [7]focused on development of environmentally friendly nano-hydraulic turbine using waterfalls. Sebastian Hermann,[8] Battery charging potential using small hydropower resources in rural areas with respect to its efficient and technical feasibility were investigated and explored. In April 2012, Bryn Patrick HO-Yan,[9] Pico hydropower (≥5KW) has been identified as promising means for rural electrification.

2. Hydro Power Basics: In this section basic fundamentals terminology regarding design of MHP turbine is discussed. Further in the next section design of various turbine will be discussed.

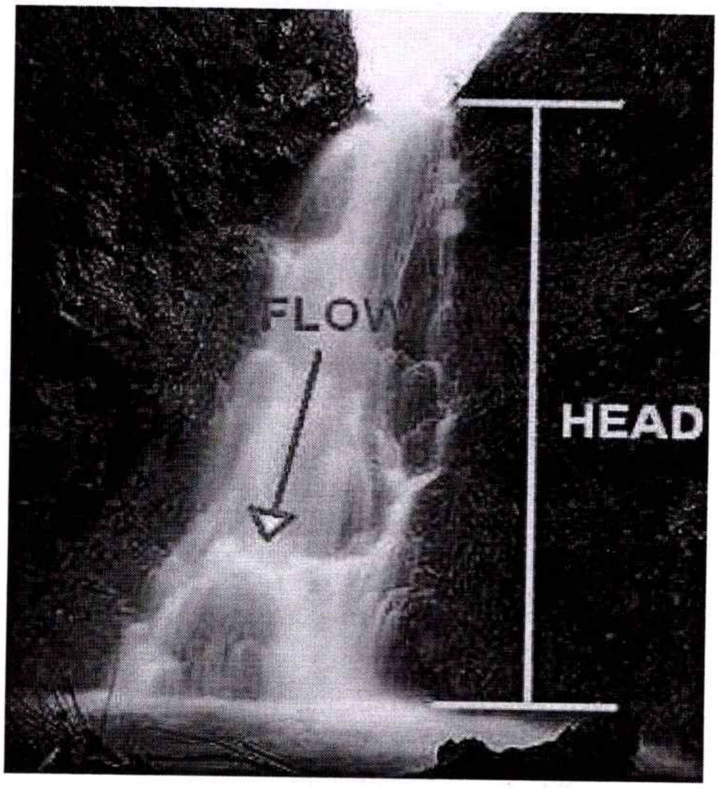


Fig1: Waterfall showing its flow and head measured .(Source: Mini-hydro power plant)

Head and Flow: "Head", the vertical fall of the water, necessary for generation of hydropower. A water discharge **Q**, and a net Head $\mathbf{H_n}$, two quantities are required. To keeps the machinery smaller, it is better to have more head than more flow,

The Gross Head: (H_g) Vertical fall of water, from the top level to the bottom level, is the gross head.

Flow Rate (Q) in, is the volume of water passing through river per second, measured in m^3/sec.

Power and Energy: Energy converted per second, is nothing but power, measured in watts (where, 1000 watts=1 kilowatt).

Initially stored energy of the water is converted to equal amount of kinetic energy, in a hydro power plant. To calculate its P.E., the height of the water is utilized and utilized to speed up the water at the entrance of the turbine by balancing both energies of water.

Potential energy of water $E_{pe} = m*g*Z$ (Z is nothing but H) Equation(1)

Kinetic energy of water $E_{ke} = ½ * m *c^2$ Equation (2)

For any hydro system's power is given by the general formula

P= $\eta_h \rho g Q H$ Equation (3)

Where,

- m = Water mass (kg),
- **g**= gravitational acceleration. (9.81 m/s^2),
- **H** = pressure head of water. (m).
- **c**= water jet velocity (m/s), Thus, $c = \sqrt{(2gH)}$
- **P** =power (mechanical) produced (Watts),
- η_h= hydraulic efficiency.
- ρ = water density (1000 kg/m^3),
- **Q** = volume of water passing through the turbine (m^3/s),
- Hydraulic efficiencies of best turbines vary 80 to 90%, which reduce with size. Micro-hydro schemes having power generation capacity <100KW are 0.6 to 0.8.

Capacity Factor: The 'Capacity factor' of turbine is expressed as, how reliably a turbine is working.

Capacity factor (%) =Energy generated/year (kWh/year) / {Installed capacity (kW) x 8760 hours/year}

Energy Output: Work done in a certain time,is the'**Energy**', measured in Joules.

Energy (kWh/year) = **P** (kW) × **CF** × 8760. [10]. Equation (4)

Turbine selection criteria: An appropriate turbine Selection mostly depends on the available water head and to a less extent on the available flow rate. [12]

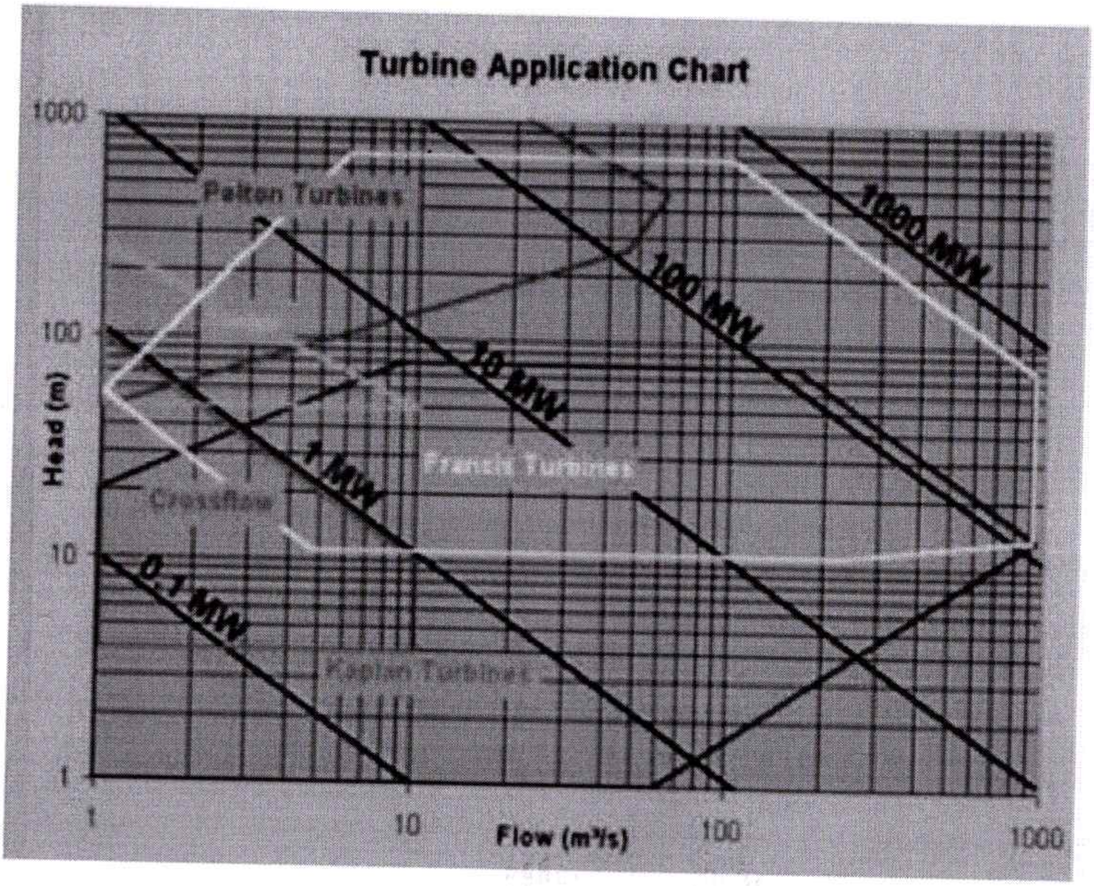


Fig:2 Source: Micro Hydro Power, Resource Assessment Handbook Prepared for APCTT

Above turbine application chart is useful for selection of turbine to be design for power generation, as per availability of head and water discharge. Power generation ranges of different turbines is shown on a chart in MWatt.

3. Design Work:

3.1 Design A (Reaction turbine)[31]

In April 2011, Sir Robert Simpson & Arthur Williams, For this design procedure they used the following equation:

Specific speed $=nq=N\sqrt{Q}H0.75$ Equation(5)

Where, N is in (rpm), Q in(m^3/s) and H in (m), all above parameters were founded by standard method available, and calculated'nq' . From the range of specific speed type of turbine to be designed is decided. If'nq' is correct, from 'sizing sheet' for diameter for hub and tip of runner is choosen. For further calculation actual size & no. of blades are are used as input. From this standard runner sheet gives flow velocities. For this if $vw2$was correct, runner sheet provides blade design data. Further if possible to manufacture then standard spiral sheet provides scroll dimensions. If difficulties to manufacture then again change values blade parameters and also hub tip ratio.

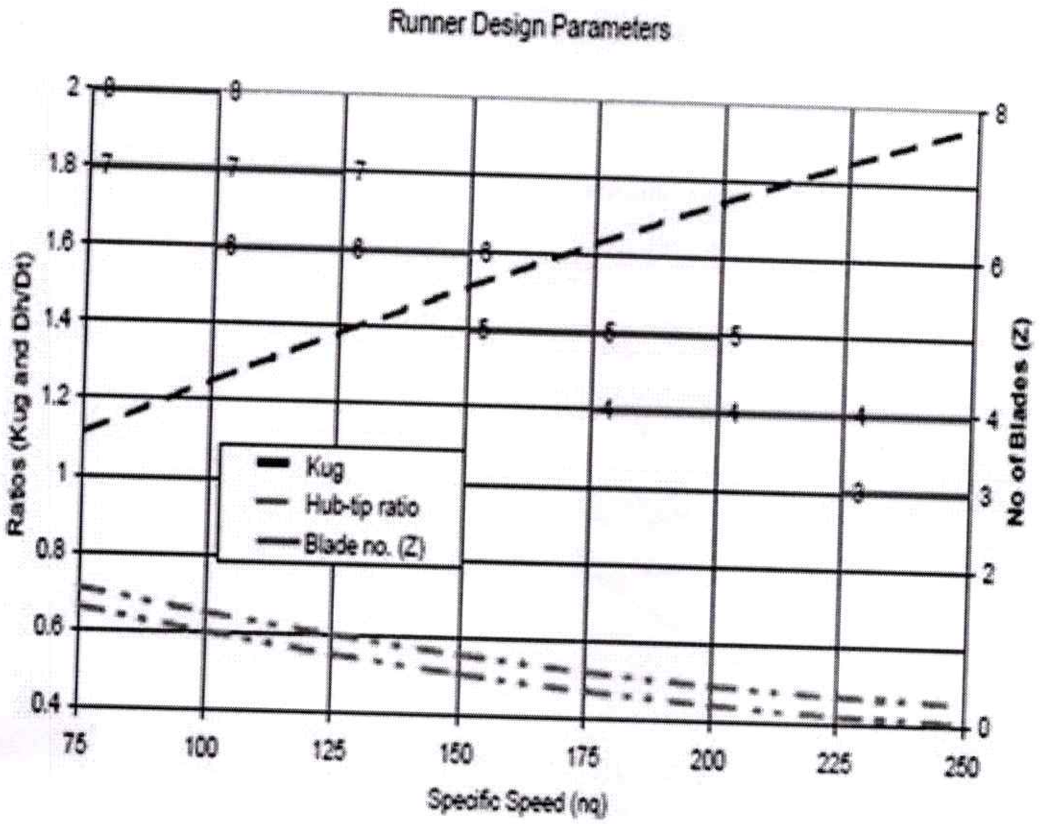


Fig 3: Design parameters for 'sizing' sheet.

$k_{ug} = r_{tip} \times \omega \sqrt{2gH}$ Equation (6)

r_{tip} = D/2 , is r_{tip} the blade tip radius, and ω in in rad/s, is the angular velocity of the turbine runner, i.e. ω = 2πN/60. In the spread sheet the specific speed(k_{ug}) is calculated, as shown in above graph. In "Sizing" sheet.there are two other parameters which are input by the designer, as shown in graph. Those are the the number of runner blades (Z), and diameter ratio of runner hub:tip The values on the graph are for guidance. The values of the number of blades are customized because ,it is better to have fewer blades on the runnerfor small turbines. [12]. This is *pico hydro* turbine design, range of power generated is less than 5Kw.

[14] To obtain the runner blade shape and characteristics CFD-based design method was used. With the provided parameters for a specific power plant, the design of the runner blade starts. Those parameters areQ (Discharge or flow rate), H (Head) and Ns (Specific Speed). Simple runner angles of leading and trailing edges are determined, by using in-house codes. By using a CFD software for meshing and for simulations using the grid generation module of the same software, runner blade shape is designed. CFD with k-ε turbulence model was used to simulate the geometric design

By changing the runner shape the procedure is repeated, to obtain accurate results. The CAD model of the blades is generated when the designed shape with the necessary conditions of head, efficiency, outlet flow angle (alpha) and minimum pressure value for cavitation free operation. As a part of the developed runner design methodology, mechanical analysis of the design was also performed. For the parametric, CFD aided design and manufacturing of hydro turbine runners, a collaborative design methodology was developed.The design and manufacturing methodology for ***Francis water turbine and its runner*** is developed by using a specific power plant.

For runner design,

From Fig 4 of flow velocities,using following Euler's equation:

$gnhH=u1vw1-u2vw2$ Equation (7)

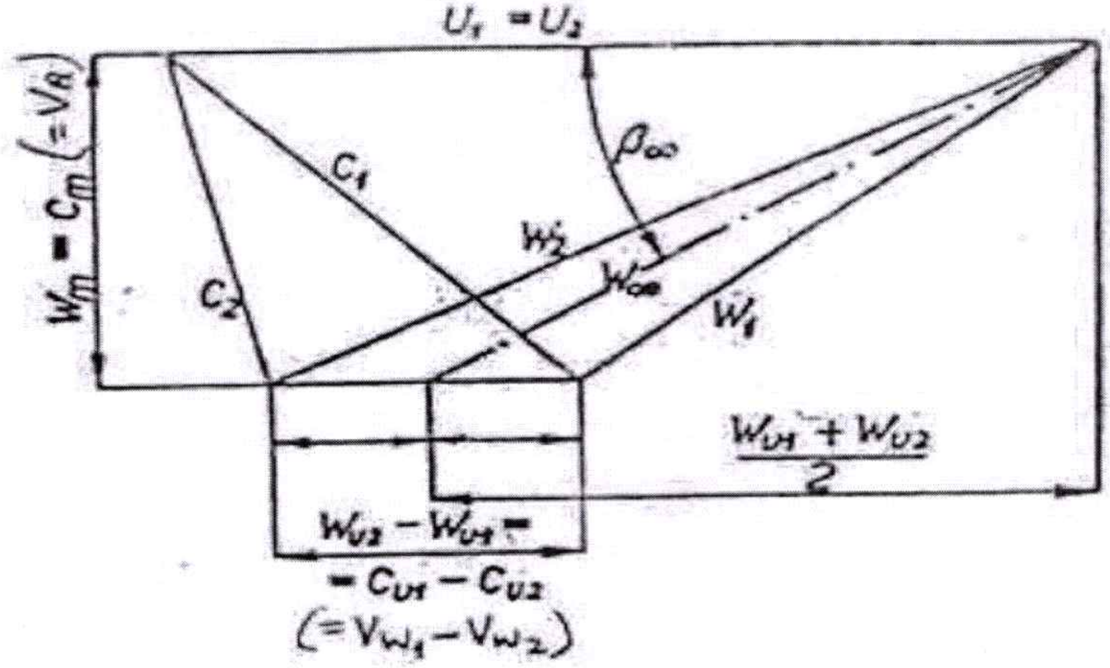


Fig 4: Diagram of flow velocities, with w2 = u

Where, u= the runner peripheral speed (1 at entrance and 2 at exit) and

v_w = the water velocity tangential component.

For an axial flow turbine, $u_1=u_2$.

The axial flow velocity through the runner or rotor is calculated from:

$va=Q\pi rt2-rh2=4Q\pi Dt2-Dh2$ Equation (8)
Where, r_t= the runner outside radius (tip radius), and

r_h= the runner blade inside edge radius (hub radius).The value of v_{wl} as a variable for the designer to choose, is used as input.

The speed (N in r.p.m) of turbine can be calculated as:

N=60×w2π (rpm), Equation (17)

N= speed of turbine

The specific speed is defined as:

Ns=N×√$PtHn$5/4 (rpm) Equation (18)

Where,

Pt= power of turbine in (Kw).

h). Turbine powerPt=ρ×g×Hn×Q×nt (watt) Equation (3)

Thus, by Matlab Simulink design steps of MHP plant was applied after introducing the site measurement and calculations as input data to the machine control unit- program through which all above parameters are determined. Following designs for different turbine was given,

4.2.1 Design of pelton turbine: The sizes of the Pelton turbine can be estimated from the following equations: if the runner speed (N_r), the net head and water flow rate (Q) are known,
D1=40.8×√HnN Buckets center line describing diameter of circle (m) Equation (19)
B2=1.68×√QK×1√Hnwidth of bucket (m). Equation (20)

Where, K= number of nozzles.

De=1.178×√QK×1√Hn×$g$diameter of nozzle (m). Equation (21)

Dj=0.54□Q/√Hndiameter of jet (m). Equation (22)

$Vjet$=0.97×√2×g×Hnvelocity of jet (m/s). Equation (23)

The ratio $D1/B2$ must be >2.7 If the case is other than this, fresh calculations with additional no of nozzle has to be carried out. For the same power of Pelton turbine, if the turbine is Turgo, specific speed is double anddiameter is halfedof the Pelton.

4.2.2.Design of Francis turbine: A broad range of specific speed from 50(low head) to 350(high head) is covered . the major sizes evaluated as :
D3=84.5(0.31+2.49Ns995)√HnN diameter in (m) Equation (24)

D1=(0.4+94.5Ns)×D3 Runner inlet diameter in (m) Equation (25)

D2=D30.96+3.8×10−4×NsRunner inlet diameter in (m) Equation (26)

If, Ns<163 $thenD$1=D2

4.2.3 Design for Kaplan turbine: De=84.5(0.79+1.6×10−3Ns))√HnNExit(outer) diameter of runner in (m)Equation(27)

Di=(0.25+94.5Ns)×De Hub (inlet) diameter of runner in (m) Equation(28)

4.2.4 Design for cross flow turbine: Dr=40√HnN Diameter ofrunnerin (m) Equation (29)

Lr=0.81×QDr√Hn length of runner in (m) Equation(30)

In some cases – e.g. For an existing casing where a new runner is being designed is already set by the scroll design. But by changing the values of v_{w2} and w_2 normally it can be adjusted. An initial guess for v_{wl} is given in the spreadsheet, based on the Euler Equation and assuming that v_{w2} is positive and is 10% of v_{wl}.(shown in above Fig 4)

$vw2=vw1-gnhHu$ Equation (9)

$w12=u-vw12+va2$; $w22=u-vw22+va2$ Equation (10)

4.2 Design (B):

[15] Bilal Nasir,put some design considerations in his paper,

a). Discharge data organization is nothing but 'Flow duration curve'. By using the FDC, the river or stream, highest flow capacity of the turbine can be determined.

b). Flow rate measurement, Measuring the cross sectional area (*Ar*):

$Ar=a+b2\times h1+h2+h3+\cdots.hk(m^2)$ Equation (11)

Where,

\a = Top river-width (*m*), b = Bottom river-width(m)

average height of water in the river or stream (*m*). Equation (12)

c). The velocity-measurement (*Vr*):

Surface speed is, $Vrs=Lt$ (*m/s*) Equation (13)

$Vr=0.75\times Vrs$ (*m/s*) Equation (14)

d). Flow rate/discharge of river or of stream can be calculated as:-

$Q=Ar\times Vr$ (*m3/s*) Equation (15)

d). Gates and valves in MHP: For the intake small and micro-hydro systems, a descending gates of steel , plastic or timber , and cast iron, are suited

e). Meaning of Vorticity: Uneven flow form of water introduces air into the stream with bad results on the turbine and draw debris at the entrance is nothing but Vorticity

f).Meaning of trash rack, to avoid the debris to enter into the entrance. The coefficient (*Ktr) of* trash rack depends on the block shape and it is changeable between 0.8 to 2.4.

The minimum value of submersion (*hs*) is given by:

$hs\geq Dh\times[1+2.3Ven\sqrt{g}\times Dh]$ Equation (16)

where, $D_{h=}$ diameter of thehydraulic downstream channel (*m*).

V_{en} = velocity at entrance (*m/s*).

g = Gravitational acceleration constant (9.8 *m/s2*)

$tj=0.233*QLr\sqrt{Hn}$ Jet thickness orwidth nozzle in (m) Equation (31)

Thus, micro hydro power plant turbine design –*pelton, francis, Kaplan and cross flow turbine* was explained.

[16] Finnemore, E.J. and Franzini, explained essentials of hydraulic turbine design and analysis, wherein,

specific speed $=Ns=ne\sqrt{gpmh3/4}$ Equation(32)

Where, n_e is the rpm (optimum operating efficiency), h is in feet.

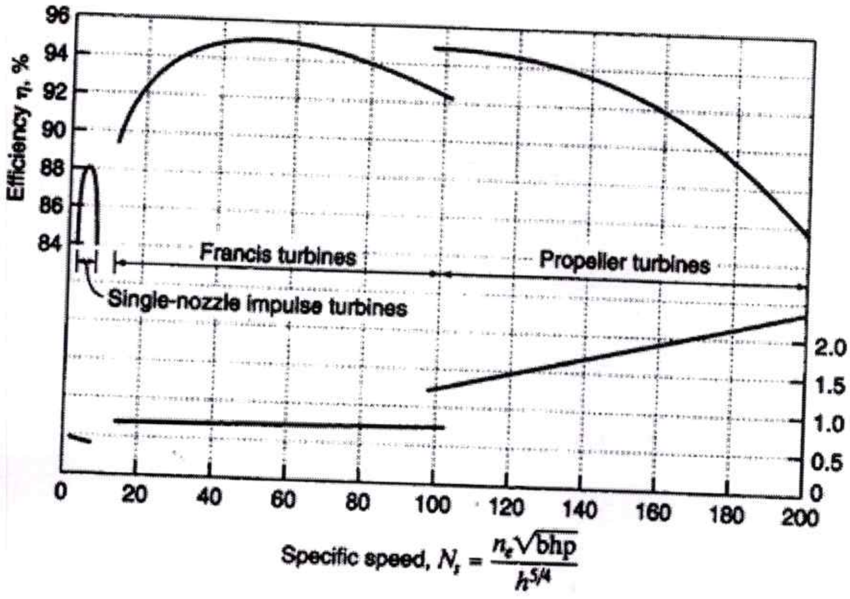


Fig 5 : maximum turbine efficiency and typical values Φc as a function of specific speed.[2]

a. Nozzle Design:

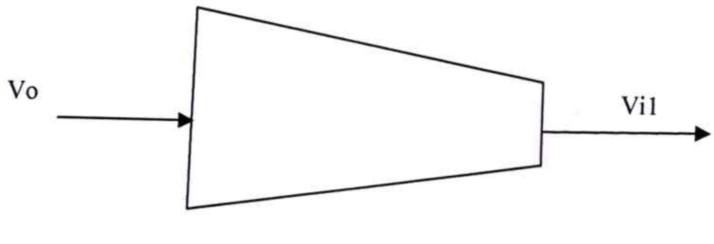


Fig: 6 Nozzle Design[2]

V_{i1}(the ideal exit velocity),is determined From the following equation:

Equation (33) 22001101 22*iPVVPzzggγλ*++=++ Equation (33)

Velocity at entrance is the product of ideal velocity and a velocity coefficient, 11*viVCV*=

Conservation of mass directs to:Equation (34) 11*dQCAV*=

Where Cd=CcCv

b. Nozzle Dimensions: The criteria for diameter of nozzle should be 20% greater than the calculated diameter of the jet at discharge.

c. Rotational Velocity:

Head (ft) Specific Speed (n_s)

1000 5.0 – 5.5
2000 4.0 – 5.0

$$n_s = \frac{n\sqrt{P_{shaft}}}{H^{5/4}}$$

Equation (35)
Where: *n* = rpm; = shaft horsepower; *H* = turbine head, (feet). *shaftW*

Rotational velocity=, Where: *f* = frequency (60 cycles/ sec),*p* = no of poles. 120*fnp*=

d. Runner Diameter: (DEquation(36) $_p$):1840*pHDn*φ=

e. Absolute Bucket Entering Velocity: Equation(37) 1,2*idealVU*=

Where: *U* = peripheral velocity of a point on the pitch dia. of the bucket.

f. Bucket Shape and Dimensions: The shape of bucket is semi-ellipsoidal on both “splitter”, a sharp-edge of bucket divides the flow, into one-half, going to both side.

Estimation of bucketsizeas follows:

Width - B = 3d Depth - D = 0.85d Length -L = 2.6d

Where: *d*=diameter of jet

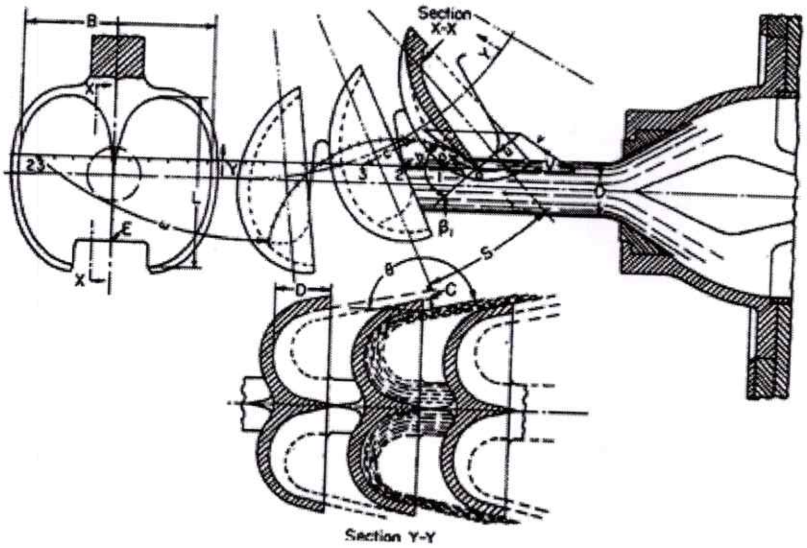
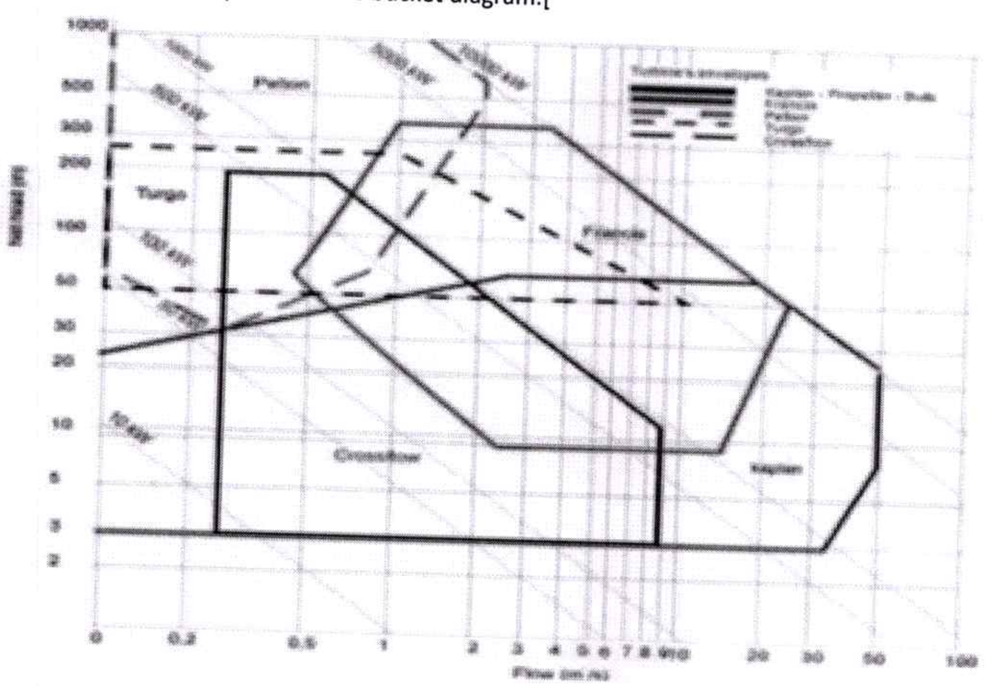


Fig7: Impulse turbine bucket diagram.[



2]

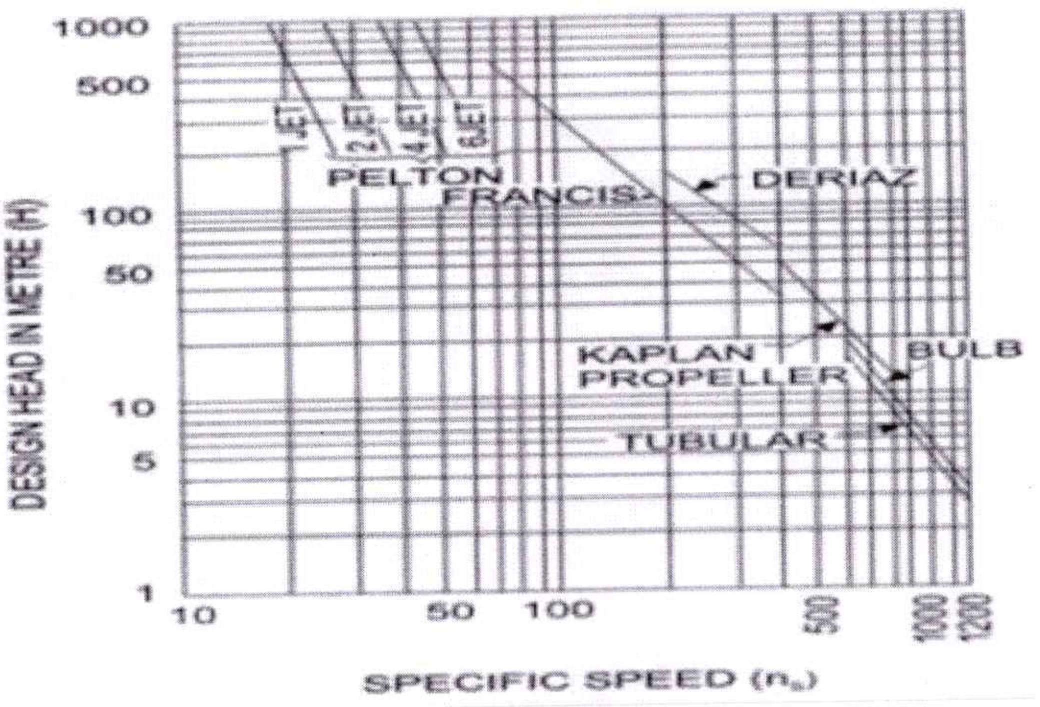


Fig 9: Chart for determining the selection of turbine.[17]

By knowing head, discharge and assuming efficiency, power can be calculated.

b. Speed of the turbine:

Specific speed= $nQE=n\times\sqrt{QE}3/4$, Equation (38)

Where:

E=Machine specific hydraulic energy [J/kg]

n =The turbine rational speed [s-1]

A machine specific hydraulic energy can be proven as below:

$E=Hn\times g$ [J/kg] Equation (39)

Where, H_n = net head of flow [m]

$Hn=H\times$[m] Equation(40)

For Kaplan turbines correlation between the specific speed and the net head is given by:

$nQE=2.294Hn0.486$ [-] Equation (41)

As, the rational speed is unknown, the specific speed can be calculated with the above formula. Hence, a resulting specific speed can be calculated.

c. Rational speed: The rational speed can be calculated by putting equation (39) in equation (38). To obtain rational speed of the turbine, the resulting equation has to be re-arranged . This value of the rational speed is optimal because it is synchronous to the generator speed. Thus, the turbine can be directly coupled to following.

Table1: Generator synchronization speed/1/

Number of poles	50 Hz	60 Hz	Number of poles	50 Hz	60 Hz
2	3000	3600	16	375	450
4	1500	1800	18	333	400
6	1000	1200	20	300	360
8	750	900	22	272	327
10	600	720	24	250	300
12	500	600	26	231	277
14	428	540	28	214	257

d. Diameter of runner :

Diameter of Runner 'De' can be determined as below:

$De=84.5\times(0.79+1.602\times nQE)\times\sqrt{}Hn60\times n$ (m) Equation (42)

e. Diameter of Hub:

Diameter of hub 'Di' can be determined as below:

$Di=[0.25+0.0951nQE]\times Do$ Equation (43)

Thus, this is basic design procedure for Kaplan turbine. Also design of blade and forces acting on blade are explained.

5.Economy of micro hydro power plants:

5.1 Economic evolution: The capital cost was minimized and revenue from energy produced was maximized. The intake, penstock and discharge pipe work at water treatment works may already exists which reduces the capital cost of the scheme. To maximize the returns from energy cells, the plants must be operated at maximum capacity for the longest possible periods of time.

5.2 Actions to reduce the costs:

1. To save civil-work cost, building cost, hydro-Mechanical equipments cost, control system duplication, electric wiring etc. the number of components should be limited to 2-3.

2 Simpler edition of water level controllers to be used, rather than going for complete Kaplan turbine, semi Kaplan where guide blades are unchanging.

3. Civil engineering cost can be minimized, by minimizing the sizes of Power house, control panels, instrumentation panels plan can be simplified.

4. To make the scheme economical, sizing with subsystems should be carefully decided.

5. Synchronous generators with associated subsystems, are more costlier than Induction Generator

6. With objective of reducing cost standardization of Hydraulic turbine is important. Turbines can be standardized by simple design of parts and keeping its sizes standard, which reduces the production cost and time of delivery.

7. Standardizing the Hydro-Mechanical equipments should continue , by manufacturers.

8. Implementation of electronic load controller devices and removal of guide vanes may reduce the cost.

9. In irrigation system low head falls harnessing is wanted by standardize design.

10. Particular funding and abundant term loan is given, to explore MHP generation which will be highly inexpensive for countryside industry and remote areas.

In this two plants one is dam toe and second is canal based are studied in M.P., of which dam toe plant is more beneficial in terms of returns of revenue. Though, the Cost/ KW is high as compared to Large Hydro Projects and Micro/Pico Hydro Plant supplies power to very limited locality, a villagers can have their own micro Hydro Power Plant (HPP). Thus if energy of canal drops is tapped effectively, the small remote villages can become self reliant in power. Micro hydro power is most cost effective renewable energy approach than solar or wind energy, as long as water is flowing

20. COURSE CLOSURE REPORT

Regulation: R18

Academic Year: 2020 - 2021

Program: B.Tech (Mechanical Engineering)

Year/Sem: II /II

Course Name: MECHANICS OF FLUIDS & HYDRAULIC MACHINERY

Course Code: A24311

Contact Hours: 4Lectures/1Tutorial/4Credits

No. of Students: 231

No. of lecture classes taken	**54**
No. of tutorial classes taken	**10**
Course delivery modes	Lectures, Demonstration
Technology utilization	Power Point / OHP Slides
Assessment Tools	Internal Mid Examinations, Assignments, Autonomous End Exam

OVERALL ATTAINMENT (80% DIRECT + 20% INDIRECT)	
DIRECT	2.18
INDIRECT	2.58
OVERALL ATTAINMENT	2.26

Regulation: R18

Academic Year: 2020 - 2021

Program: B.Tech (Mechanical Engineering)

Year/Sem: II /II

Course Name: MECHANICS OF FLUIDS & HYDRAULIC MACHINERY

Course Code: A24311

Contact Hours: 4Lectures/1Tutorial/4Credits

No. of Students: 254

No. of lecture classes taken	**62**
No. of tutorial classes taken	**10**
Course delivery modes	Lectures, Demonstration
Technology utilization	Power Point / OHP Slides
Assessment Tools	Internal Mid Examinations, Assignments, Autonomous End Exam

OVERALL ATTAINMENT (80% DIRECT + 20% INDIRECT)	
DIRECT	2.20
INDIRECT	2.80
OVERALL ATTAINMENT	2.32

Regulation: R15

Academic Year: 2018 - 2019

Program: B.Tech (Mechanical Engineering)

Year/Sem: II /II

Course Name: MECHANICS OF FLUIDS & HYDRAULIC MACHINERY

Course Code: A14311

Contact Hours: 4Lectures/1Tutorial/4Credits

No. of Students: 238

No. of lecture classes taken	**64**
No. of tutorial classes taken	**10**
Course delivery modes	Lectures, Demonstration
Technology utilization	Power Point / OHP Slides
Assessment Tools	Internal Mid Examinations, Assignments, Autonomous End Exam

OVERALL ATTAINMENT (80% DIRECT + 20% INDIRECT)	
DIRECT	2.08
INDIRECT	2.71
OVERALL ATTAINMENT	2.21