THEORY COURSE CONTENT

1. **Vision and Mission statements of the Institute and Department.**
2. **PEOs, PSOs and PO statements.**
3. **VTU, College and Department Calendar.**
4. **Time Table. (Department and Individual time table)**
5. **Syllabus copy**
6. **COs, CO-PO and CO-PSO Mapping and Justification.**
7. **Students List (Students Attendance Register).**
8. **Course Plan**
9. **Course Execution Summary**
10. **Course Assessment and Evaluation scheme.**
11. **Assignment Questions-I, II, III**
12. **Internal Assessment Test –I, II, III (Question Papers)**
13. **Internal Assessment Test – I, II, III – Scheme of Evaluation.**
14. **Internal Assessment Test I, II, III Performance Analysis.**
15. **Remedial and Tutorial Classes information (If any)**
16. **Final Internal (IA) - CIE and External –SEE Marks.**
17. **VTU Question papers.**
18. **Course Exit Survey.**
19. **Course Self Assessment Report.**
20. **Final Result Analysis**
21. **Direct and Indirect Attainment of COs, POs and PSOs.**
22. **CO Attainment Gap Analysis.**
23. **Action taken report (ATR) on Gap Analysis.**
24. **Content beyond syllabus.**
25. **Instructor report (Innovative Practices)**
26. **Any other related documents.**

VISION AND MISSION OF THE INSTITUTE AND DEPARTMENT

VISION OF THE INSTITUTION

To Produce Professionally Excellent, Knowledgeable, Globally Competitive and Socially Responsible Engineers and Entrepreneurs.

MISSION OF THE INSTITUTION

M1 To Provide Quality Education in Engineering and Management.

M2 To Establish a Continuous Industry-Institute Interaction, Participation and Collaboration to Contribute Skilled Engineers.

M3 To Develop Human Values, Social Values, Entrepreneurship Skills and Professional Ethics among the Technocrats.

M4 To Focus on Innovation and Development of Technologies by Engaging in Cutting Edge Research areas.

VISION OF THE DEPARTMENT

To Produce Professionally Excellent, Knowledgeable, Globally Competitive, Socially Responsible Mechanical Engineers and Entrepreneurs.

MISSION OF THE DEPARTMENT

M1 To provide quality education in Mechanical Engineering and Management.

M2 To establish a continuous industry - institute interaction, participation and collaboration to contribute skilled Mechanical Engineers.

M3 To develop human values, socio-ethical values, entrepreneur skills and professional ethics among Mechanical Engineers.

M4 To focus on Research & Development (R & D) and Innovative Technologies by engaging in cutting edge research areas of Mechanical Engineering.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates of Mechanical Engineering shall Develop Strong Academic Foundation for Successful Professional Career

PEO2 Graduates of Mechanical Engineering Acquires skills to excel in the area of Mechanical Engineering both in Industries and Academics

PEO3 Graduates of Mechanical Engineering Possess awareness towards Higher Education, R & D and Socio-Ethical values

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1	Graduates are able to Design, Analyze and Develop Mechanical Systems.
PSO 2	Graduates are Capable of Developing Research Skills in Self Sustainable Energy sources and Composite Materials.

PROGRAM OUTCOMES (PO)

PO 1	Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	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.
PO 3	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.
PO 4	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.
PO 5	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.
PO 6	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.
PO 7	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.
PO 9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	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.
PO 11	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 a team, to manage projects and in multidisciplinary environments.
PO 12	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.

VTU,DEPARTMENT CALENDAR 2019-20 Odd Sem

Academic Calendar of VTU, Belagavi for ODD Semester of 2019-2020 (Jul 2019 – Jan 2020)

	I Sem B. E. / B. Tech. / B. Arch. (Tentative)	III, V & VII Sem B. E. /B. Tech. III, V,VII & IX Sem B. Arch.	III & V Sem MCA	III Sem MBA	III Sem M. Tech.	III Sem M. Arch.
Commencement of ODD Semester	01.08.2019	29.07.2019	29.07.2019	08.08.2019	26.08.2019	08.09.2019
Last Working day of ODD Semester	29.11.2019	30.11.2019	30.11.2019	05.12.2019	23.12.2019	06.01.2020
Practical Examinations	03.12.2019 To 13.12.2019	03.12.2019 To 13.12.2019	03.12.2019 To 07.12.2019	-	-	-
Theory Examinations	16.12.2019 To 04.01.2020	16.12.2019 To 07.02.2020	09.12.2019 To 28.12.2019	09.12.2019 To 04.01.2020	27.12.2019 To 10.01.2020	08.01.2020 To 22.01.2020
Internship Viva-Voce	-	-	-	-	12.01.2020 To 19.01.2020	-
Professional training / Organization study	-	-	-	-	-	-
Commencement of EVEN Semester	27.01.2020	10.02.2020	27.01.2020	27.01.2020	27.01.2020	01.02.2020

NOTE

- **VII Semester B. E / B. Tech** students shall have to undergo **Internship** for a period of four Weeks.
- **I Semester B. E/ B. Tech / B. Arch** Students shall compulsorily undergo **Induction Program** for a period of 3 Weeks (two phases) as per the schedule given by VTU. First phase 11 days in first semester and second phase 10 days in second semester.

1. **College Time Table shall be arranged for five and a half week days and planned to accommodate EDUSAT transmission slots, the schedule of which will be notified separately.**
2. **The faculty/staff shall be available to undertake any work assigned by the university.**
3. **If any of the above date is declared to be a holiday then the corresponding event will come into effect on the next working day.**
4. **Notification regarding Calendar of Events relating to the conduct of University Examination will be issued by the Registrar (Evaluation) from time to time.**

28/6/19
REGISTRAR

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

V. V. SANGHA'S

RAO BAHADUR Y MAHABALESHWARAPPA ENGG COLLEGE, BALLARI – 583104.

(Formerly VIJAYANAGARA ENGINEERING COLLEGE)

CANTONMENT, BALLARI-583 104 (KARNATAKA).

DEPARTMENT OF MECHANICAL ENGINEERING

CALENDER OF EVENTS

ACADEMIC YEAR 2019 – 20 [(ODD SEMESTER) AUG 2019 – JAN 2020].

Week (Session)	Mon	Tue	Wed	Thu	Fri	Sat	Sun	EVENTS	VTU Events Holidays
	August 2019								
1ST				1	2	3	4	29th.07.2019 commencement of BE Higher Sem 1st HOD Meeting.	1st Commencement of Semester for both UG (I Semester).
2ND	5	6	7	8	9	10	11		
3RD	12	13	14	15	16	17	18	12th Commencement of P G (III Semester).	15th Independence Day
4TH	19	20	21	22	23	24	25	24th HOD Meeting.	
5TH	26	27	28	29	30	31			
	September 2019								
							1		
6TH	2	3	4	5	6	7	8		
7TH	9	10	11	12	13	14	15	12th, 13th & 14th IA Test-I.	9th Ganesh Chathurthi
8TH	16	17	18	19	20	21	22	19th SMS IA-1 Marks & Attendance to Parents.	
9TH	23	24	25	26	27	28	29	23rd HOD Meeting.	
10TH	30								
	October 2019								
		1	2	3	4	5	6		2nd Gandhi Jayanthi
11TH	7	8	9	10	11	12	13	10th, 11th & 12th IA Test-II.	13th Vijaya Dashami
12TH	14	15	16	**17**	18	19	20	17th SMS IA Marks & Attendance to Parents	16th Bakrid
13TH	21	**22**	23	24	25	26	27		
14TH	28	29	30	31				28th HOD Meeting.	
	November 2019								
					1	2	3		1st Rajyotsava 3rd Deepavali
15TH	4	5	6	7	8	9	10		
16TH	**11**	12	13	14	15	16	17	11th, 12th & 13th IA Test-III.	15th Moharram
17TH	18	19	20	21	22	23	24	21st SMS Final IA Marks & Attendance to parents. 18th HOD Meeting.	
18TH	25	26	27	28	29	30		29th Last Working Day of I-Semester UG.	30th Last Working Day of UG Higher Semesters.

03rd Dec – 13th Dec 2019 VTU **Practical** Examinations (B. E., III, V & VII Semesters).
03rd Dec – 13th Dec 2019 VTU **Practical** Examinations (B. E., I Semesters).
16th Dec 2019 – 07th Feb 2020 VTU **Theory** Examinations (B. E., III, V & VII Semesters).
16th Dec 2019 – 4th Jan 2020 VTU **Theory** Examinations (B. E., I Semesters).
27th Dec 2019 – 10th Jan 2020 VTU **Theory** Examinations (M. Tech, III Semester).
12 Jan – 19 Jan 2020 VTU internship viva voce (M. Tech, III Semester)

Head of the Department,
Dept. of Mechanical Engg.

TIME TABLE 2019-20

V V SANGHA'S
RAO BAHADUR Y MAHABALESWARAPPA ENGINEERING COLLEGE, BELLARY
ACADEMIC YEAR 2019-2020(ODD)
DEPARTMENT OF MECHANICAL ENGINEERING
TIME TABLE

CLASS : 5th SEM- A SECTION | W.E.F :29 JULY 2019 | ROOM No : LH-10

DAYS	09:00 AM to 09:55 AM	09:55 AM to 10:50 AM	10:50 AM to 11:00 AM	11:00 AM to 11:55 AM	11:55 AM to 12:50 PM	12:50 PM to 02:15 PM	02:15 PM to 03:10 PM	03:10 PM to 04:05 PM	04:05 PM to 05:00 PM
MONDAY	M&EE	DOM	B R	DME-1	E & E/AR	L U	EC LAB A1/FM LAB A2		
TUESDAY	DOM	NTM	E A	M&EE	E & E/AR	N C	DME-1	TM	TM
WEDNESDAY	E & E/AR	M&EE		DOM	TM	H	EC LAB A2/FM LAB A3		
THURSDAY	NTM	TM	B R	DME-1	M&EE	B R	TM	DOM	DOM
FRIDAY	DME-1	DME-1	E A	TM	DOM	E A	EC LAB A3/FM LAB A1		
SATURDAY	E & E/AR	DME-1	K	NTM	NTM	K			

BATCH LIST: B1 = ROLL No. 1-25, B2 = ROLL No. 26-50, B3 = ROLL No. 51-TILL END.

SL. No.	SUBJECT CODE	SUBJECT	STAFF	SL. No.	EVENTS	DATE
1	17ME51	M & EE	N SWAMY		COMMENCEMENT OF 5th SEM	
2	17ME52	DOM	S G DESAI		1ST IA TEST	
3	17ME53	TM	Dr. K MANJUNATH		2ND IA TEST	
4	17ME54	DME-1	DUDA NAIK		3RD IA TEST	
5	17ME554	NTM	K G PRAKASH		LAST WORKING DAY	
6	17ME562	E & E	B BASAVA PRAKASH		COMMENCEMENT OF PRACTICAL EXAM	
7	17MEL57	FM LAB	Dr. K MANJUNATH/ M R INDHUDHAR		COMMENCEMENT OF THEORY EXAM	
8	17MEL58	EC LAB	B BASAVA PRAKASH/ Dr. SHIVA KUMAR MODI			
9	17ME563	AR	DEEPAK C/ K SURESH KUMAR			
10						

CO-ORDINATOR | HOD | PRINCIPAL

Head of the Department,
Mechanical Engineering Department,
R.Y.M. Engineering Collage,
Cantonment, BELLARY-583 104

PRINCIPAL
R.Y.M. Engineering College
(Formerly Vijayanagar Engg. College)
Cantonment, BELLARY-583 104

TURBO MACHINES

Subject Code: 17ME53 **I.A. Marks : 40**
Hours/Week : 05 **Exam Hours: 03**
Total Hours : 50 **Exam Marks: 60**

Module - I

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies.

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process 10 Hours

Module –II

Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor,Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles,Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head –capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems 10 Hours

Module –III

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of
compounding, Multi-stage impulse turbine, expression for maximum utilization factor.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.10 Hours

Module –IV

Hydraulic Turbines: Classification, various efficiencies.**Pelton turbine** – velocity triangles, design parameters, Maximum efficiency.

Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions. **Kaplan and**
Propeller turbines - velocity triangles, design parameters. Problems 10 Hours

Module –V

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting
the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and
problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.10 Hours

TEXT BOOKS:

T/R BOOK	TITLE/AUTHORS/PUBLICATION
T1	An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers, reprint 2008.
T2	Turbo Machines ,B.U.Pai , 1st Editions, Wiley India Pvt, Ltd.
T3	Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002
R1	Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964).
R2	Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005).
R3	Text Book of Turbo machines, M. S. Govindegouda and A. M. Nagaraj, M. M. Publications, 4Th Ed, 2008
	T- Text Book. R-Reference Book, AR – Additional Reference

QUESTION PAPER FORMAT:

1. One question from each module carrying 16 marks.
2. Attempt: Answer Any One Question Compulsorily from Each Module.

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

COURSE OUTCOMES

Staff Name: Dr Manjunatha Kondekal	**Sem: V**	**Sec: A**
Course Name: TURBO MACHINE	**Course Code: 17ME53**	**Total Contact Hours:50**
Course outcome author: Dr Manjunatha Kondekal	**Checked by: S K Modi**	

CO Index	**Course Outcome**
At the end of the course completion student will be able to:	
17C303.1	Understand the basic quantities related to power absorbing and generating machines.
17C303.2	Comprehend thermodynamic relations applied to turbo machines.
17C303.3	Analyse the performance of steam turbines.
17C303.4	Evaluate the work interactions and characterstics of hydraulic turbines.
17C303.5	Intrepret the working of pumps and compressors.

CO-PO mapping Matrix

PO's / CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
17C303.1	3	3		2								1
17C303.2	3	3		2								1
17C303.3	3	3	3	2								1
17C303.4	3	3	3	2								1
17C303.5	3	3	3	2								1

Signature of Staff **Stream Coordinator** **Course Coordinator**

Justification for the CO with the PO (1-12)

PO1: CO 1 to CO 5 has been given higher weightage for this PO as knowledge on fundamentals of science and mathematics are very much required to understand this course.

PO2: As problem analysis is carried out for all the Cos mentioned, hence higher weightage is given for the COs 1 to 5.

PO3: Design/development of solutions are moderate w.r.t CO3 to CO5, hence higher weightage is assigned, but for the other COs this PO is not applicable.

PO4: As we come across complex problems moderately w.r.t all the COs, hence moderate weightage is given.

PO5 to PO11 are not mapped to any of the Cos as they are not applicable for this course.

PO12: All Cos are mapped with less weightage as they may be required for future with less preference.

CO-PSO Mapping Matrix

PSO's / CO's	PSO1	PSO2
17C303.1		
17C303.2		
17C303.3		2
17C303.4		2
17C303.5		2

***Note: - 1.Slight (Low) 2.Modarate (Medium) 3.Substanial (High).**

Justification for the CO with the PSO (1-2)

PSO1: None of the Cos will justify PSO1, hence no weightage is given.

PSO2: As CO1 & CO2 are not related no weghtage is given and not mapped, remaining Cos are mapped moderately as they are related to working of the machines

Signature of Staff **Stream Coordinator** **Course Coordinator**

PAC

Head of the Department,
Mechanical Engineering Department,
R.Y.M. Engineering College,
Cantonment, BELLARY-583 104

STUDENTS LIST

Sl.No	USN	NAME
A-1	3VC16ME007	ABHISHEK SINHA
A-2	3VC17ME001	AJAY REDDY N
A-3	3VC17ME002	AKASHA GOUDA H
A-4	3VC17ME003	ANIL KITTUR
A-5	3VC17ME004	BHARATHISHA A B
A-6	3VC17ME005	BHARGHAV R
A-7	3VC17ME006	C ESHWAR
A-8	3VC17ME007	DEEPAK PATIL S R
A-9	3VC17ME008	DODDA BASAVA B
A-10	3VC17ME009	DURJAYA K B
A-11	3VC17ME010	EARESH VARMA C
A-12	3VC17ME012	ERANAGOUDA K M
A-13	3VC17ME014	G RANJITH
A-14	3VC17ME016	G S SREE HARSHA
A-15	3VC17ME018	GANESH GOWDA M
A-16	3VC17ME019	GANESH J
A-17	3VC17ME020	GURUSIDDANA GOUDA B
A-18	3VC17ME021	HAMPANNA
A-19	3VC17ME022	HANUMESH
A-20	3VC17ME023	JAFERSADIQ M ABDUL KHADER BASHA
A-21	3VC17ME024	JAGADEESH
A-22	3VC17ME025	JEFFREY SUJAN KUMAR K
A-23	3VC17ME027	KADUBURU MATH PARIKSHITH
A-24	3VC17ME028	KAISARAHMED D
A-25	3VC17ME029	KARTHIK KUMAR D
A-26	3VC17ME030	KARTHIK R B

A-27	3VC17ME031	KIRAN MATH
A-28	3VC17ME032	LOKESHA NAIK
A-29	3VC17ME033	M CHAITANYA
A-30	3VC17ME041	MOHAMMED AZAM J
A-31	3VC17ME043	MOHAN E
A-32	3VC17ME046	NAVEEN SURAGOUNI
A-33	3VC17ME049	PAVAN KUMAR B
A-34	3VC17ME054	PAVITHRA R
A-35	3VC17ME081	VINAY KUMAR S
A-36	3VC18ME401	ANAND K R
A-37	3VC18ME402	ANIL KUMAR V
A-38	3VC18ME411	H M UDAY KUMAR
A-39	3VC18ME413	IMRAN ABDUL WAHEED BELGUMI
A-40	3VC18ME415	K VINAY KUMAR
A-41	3VC18ME418	KIRAN KUMAR D
A-42	3VC18ME420	KUMAR K
A-43	3VC18ME423	MADHUSUDHAN B
A-44	3VC18ME424	MAHANTESH H M
A-45	3VC18ME425	MANIKANTA K
A-46	3VC18ME431	MULLA ALTAF HUSSAIN
A-47	3VC18ME433	NISAR AHAMED K M
A-48	3VC18ME434	G PAVAN KALYAN
A-49	3VC18ME435	PAVITHRA K
A-50	3VC18ME441	SAGAR MP
A-51	3VC18ME443	SAMPATH KUMAR Y M
A-52	3VC18ME444	SANTOSH G
A-53	3VC18ME446	K SHIVA KUMAR
A-54	3VC18ME449	SHIVA SHANKAR ADUR
A-55	3VC18ME454	THIPPESWAMY B

A-56	3VC18ME455	THIPPESWAMY R
A-57	3VC18ME457	V SIDDHI VINAYAKA
A-58	3VC18ME459	VINOD KUMAR B
A-59	3VC18ME460	VISHWANATH H
A-60	3VC18ME461	VISHWANATH GOWDA K
A-61	3VC18ME462	VYSHNAVI
A-62	3VC18ME464	YESHWANTH D
A-63	3VC17ME425	S MUSHTAQ AHMED

Staff Name: Dr Manjunatha Kondekal	**Course Type: Core**	**Sem / Sec: V/A**
Course Name: Turbo Machine	**Course Code: 17ME53**	**Total Number of Lecture Hours:50**
Max marks: 40	**Prerequisites: BTD and ATD**	

Sl.No	Module Name	Lecture Hours Required
01	**Introduction, Thermodynamics of fluid flow**	10 Hours
02	**Energy exchange in Turbo machines, General Analysis of Turbo machines**	10 Hours
03	**Steam Turbines, Reaction turbine**	10 Hours
04	**Hydraulic Turbines, Francis turbine, Propeller turbines**	10 Hours
05	**Centrifugal Pumps, Centrifugal Compressors**	10 Hours

Sl.No	Topic to be Covered
1.	Module - I Introduction: Definition of turbo machine, parts of turbo machines
2.	Comparison with positive displacement machines, Classification,
3.	Dimensionless parameters and their significance
4.	Effect of Reynolds number
5.	Unit and specific quantities, model studies.
6.	Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines
7.	Static and Stagnation states
8.	Incompressible fluids and perfect gases, overall isentropic efficiency
9.	stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes.
10.	Reheat factor for expansion process
11.	Module –II Energy exchange in Turbo machines: Euler’s turbine equation, Alternate form of Euler’s turbine equation,
12.	Velocity triangles for different values of degree of reaction
13.	Components of energy transfer
14.	Degree of Reaction, utilization factor
15.	Relation between degree of reaction and Utilization factor,Problems
16.	General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction,
17.	velocity triangles,Effect of blade discharge angle on energy transfer and degree of reaction
18.	Effect of blade discharge angle on performance
19.	Theoretical head –capacity relationship, General analysis of axial flow pumps and compressors

20.	degree of reaction, velocity triangles, Problems
21.	Module –III Steam Turbines: Classification
22.	Single stage impulse turbine
23.	condition for maximum blade efficiency
24.	stage efficiency
25.	Need and methods ofcompounding,.
26.	Multi-stage impulse turbine, expression for maximum utilization factor
27.	Reaction turbine – Parsons's turbine
28.	condition for maximum utilization factor
29.	reaction staging
30.	Problems.
31.	Module –IV Hydraulic Turbines: Classification, various efficiencies.
32.	Pelton turbine – velocity triangles, design parameters,
33.	Maximum efficiency.
34.	Francis turbine - velocity triangles
35.	design parameters
36.	runner shapes for different blade speeds
37.	Draft tubes- Types and functions.
38.	Kaplan and Propeller turbines - velocity triangles
39.	design parameters
40.	Problems
41.	Module –V Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump,
42.	Minimum speed for starting the flow, Maximum suction lift,
43.	Net positive suction head, Cavitation, Need for priming
44.	Pumps in series and parallel
45.	Problems
46.	Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed,
47.	stage efficiency and surging and problems. Axial flow Compressors:,.
48.	Expression for pressure ratio developed in a stage, work done factor
49.	efficiencies and stalling
50.	Problems.

Teaching and Learning Tools: Blackboard/PowerPoint presentation/webinar/lab

Text Books:

T1	Thermodynamics an engineering approach, by Yunus A. Cenegal and Michael A. Boles. Tata McGraw hill Pub. Sixth edition,2008.
T2	Basic and Turbo Machines" by P .K. Nag, Tata McGraw Hill, 2nd Edi. 2009
T3	Fundamentals of Thermodynamics by G.J. Van Wylen and R.E. Sonntag, Wiley Eastern.

Fourth edition 19993.

Reference Books:

R1	Thermodynamics for engineers, Kenneth A. Kroos and Merle C. Potter, Cengage Learning, 2016
R2	Principles of Engineering Thermodynamics, Michael J,Moran, Howard N. Shapiro, Wiley, 8th Edition
R3	An Introduction to Thermo Dynamics by Y.V.C.Rao, Wiley Eastern Ltd, 2003.
R4	Thermodynamics by Radhakrishnan. PHI, 2nd revised edition.
R5	I.C Engines by Ganeshan.V. Tata McGraw Hill, 4rth Edi. 2012.
R6	I.C.Engines by M.L.Mathur & Sharma. Dhanpat Rai& sons- India

Note: Planning of syllabus is done as per VTU curriculum

Staff Signature **HOD**

Head of the Department,
Mechanical Engineering Department,
R.Y.M. Engineering College,
Cantonment, BELLARY-583 104

COURSE EXECUTION SUMMARY 2019-20

Staff Name: **Dr Manjunatha Kondekal**	**Course Type: Core**	**Sem / Sec: V/A**
Course Name: Turbo Machines	**Course Code: 17ME53**	**Total Number of Lecture Hours:50**

Sl.No	Date	Topic to be Covered
1.	05/08/2019 To 17/08/2019	Module - I Introduction: Definition of turbo machine, parts of turbo machines
2.		Comparison with positive displacement machines, Classification,
3.		Dimensionless parameters and their significance
4.		Effect of Reynolds number
5.		Unit and specific quantities, model studies.
6.		Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines
7.		Static and Stagnation states
8.		Incompressible fluids and perfect gases, overall isentropic efficiency
9.		stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes.
10.		Reheat factor for expansion process
11.	19/08/2019 To 31/08/2019	Module –II Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation,
12.		Velocity triangles for different values of degree of reaction
13.		Components of energy transfer
14.		Degree of Reaction, utilization factor
15.		Relation between degree of reaction and Utilization factor,Problems
16.		General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction,
17.		velocity triangles,Effect of blade discharge angle on energy transfer and degree of reaction
18.		Effect of blade discharge angle on performance
19.		Theoretical head –capacity relationship, General analysis of axial flow pumps and compressors
20.		degree of reaction, velocity triangles, Problems
21.	02/09/2019 To 14/09/2019	Module –III Steam Turbines: Classification
22.		Single stage impulse turbine
23.		condition for maximum blade efficiency
24.		stage efficiency
25.		Need and methods ofcompounding,.
26.		Multi-stage impulse turbine, expression for maximum utilization factor
27.		Reaction turbine – Parsons's turbine
28.		condition for maximum utilization factor
29.		reaction staging
30.		Problems.

31.	16/09/2019 To 28/09/2019	Module –IV Hydraulic Turbines: Classification, various efficiencies.
32.		Pelton turbine – velocity triangles, design parameters,
33.		Maximum efficiency.
34.		Francis turbine - velocity triangles
35.		design parameters
36.		runner shapes for different blade speeds
37.		Draft tubes- Types and functions.
38.		Kaplan and Propeller turbines - velocity triangles
39.		design parameters
40.		Problems
41.	01/10/2019 To 30/11/2019	Module –V Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump,
42.		Minimum speed for starting the flow, Maximum suction lift,
43.		Net positive suction head, Cavitation, Need for priming
44.		Pumps in series and parallel
45.		Problems
46.		Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed,
47.		stage efficiency and surging and problems. Axial flow Compressors:,.
48.		Expression for pressure ratio developed in a stage, work done factor
49.		efficiencies and stalling
50.		Problems.

Staff Signature **HOD**

Head of the Department,
Mechanical Engineering Department,
R.Y.M. Engineering College,
Cantonment. BELLARY-583 104

COURSE EVALUATION AND ASSESSMENT SCHEME-2019-20

		What	To Whom	When/ Where (Frequency in the course)	Max Marks	Evidence Collected
Direct Assessment Methods	IA	Internal Assessment Tests	Students	Thrice(Average of the best two will be computed)	30	Blue Books
		Assignment		One(During Semester)	10	Assignment Books
		Practical Assessment		Once	40	Practical evaluation
	FE	Final Examination		End of Course (Answering One of two questions from five Modules)	60	Result sheet
		Practical Examination		One question from lot	60	Result sheet
Indirect Assessment Methods	Students Feedback		Students	End of the course	-	Questionnaire
	Course Exit Survey					

Questions for IA and FE will be designed to evaluate the various educational components (Bloom's taxonomy)

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

ASSIGNMENT-I (2019-20 Odd Sem)

Staff Name : Dr Manjunatha Kondekal	Sem/Sec: V/A	Max Marks:20
Course Name : Turbo Machines	Course Code : 17ME53	

Q No	QUESTIONS	CO	BTL
1	Define a Turbo Machine. Illustrate the parts of turbo machines with neat sketch,Expain the difference between Turbo Machine and a Positive Displacement Machine. ?	1	2
2	A 1:10 reduced scale model of a submarine of is tested in a wind tunnel.The design speed of the submarine is 15x1.852kmph.The specific gravity of sea water is 1.026 and kinematic viscosity is 0.014 stoke.The densityof air in the wind tunnel is 1.22 kg/m3 and its kinematic viscosity is 0.046 stoke.Calculate the velocity of air.If the drag measured on the model is 1133 N,predict the power required to drive the prototype submarine.	1	4
3	Expain the Effect of Reynolds number , Unit specific quantities and the Application of first and second law of thermodynamics to turbo machines?	1	2
4	The quantity of water available for a hydel station is 310 cumecs under a head of 1.8m.Assuming speed of each turbine is 60 RPM and efficiency of 85% find the no of turbines and power produced by each turbine .Each turbine has a specific speed of 800	1	4
5	Expain the Velocity triangles for different values of degree of reaction?	2	2
6	A model of a turbine built to a scale of 1:4 is tested under a head of 10m.The prototype has to work under a head of 50m at 450 RPM (a) what speed should the model run be if it develops 60 kw using 0.9cumecs at this speed (b) what power will be obtained from the prototype assuming that its efficiency is 3% better than that of model.	1	4
7	Expain the significance of Pi terms and laws of similitude ?	1	2
8	At a stage of an Impulse turbine the mean blade dia is 0.75m,its rotational speed being 3500 RPM.The absolute velocity of fluid discharging from a nozzle inclined at 200 to the plane of the wheel is 275 m/sec.If the utilization factor is 0.9 and the relative velocityat rotor exit is 0.9 times that at the inlet,find at the inlet,find the inlet and exit rotor angle.	2	4
9	Expain the following a) static state b) stagnation state c) stagnation enthalpy .Derive the equations for degree of rection and utilization factor for 50% reaction.	2	2,3

10	In a mixed flow turbo machine the fluid enters such that the absolute velocity is axial at inlet and at outlet relative velocity is radial.What is the degree of rection and energy input to the fluid,If relative velocity at outlet is same as tangential blade speed at inlet.The following data may be a) Inlet dia. is 16 cm b) exit dia. is 50cm c) speed is 3000 RPM d)Blade angle at inlet is 450.	2	4

IA C0-0rdinator **Faculty Incharge**

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

INTERNAL ASSESSMENT TEST-I (2019-20 Odd Sem)

Staff Name : Dr Manjunatha Kondekal	**Sem/Sec: V/A**	**Date:14-09-2019** **Time : 09:15 – 10:45am**
Course Name : Turbo Machines	**Course Code : 17ME53**	
Prerequisites: BTD and ATD		

NOTE : Answer five questions, each carrying 6 marks **Max Marks : 30**

Q No	QUESTIONS	Marks	CO	BTL
1	Define a Turbo Machine. Illustrate the parts of turbo machines with neat sketch,Expain the difference between Turbo Machine and a Positive Displacement Machine. ?	10	1	2
	OR			
2	A 1:10 reduced scale model of a submarine of is tested in a wind tunnel.The design speed of the submarine is 15x1.852kmph.The specific gravity of sea water is 1.026 and kinematic viscosity is 0.014 stoke.The densityof air in the wind tunnel is 1.22 kg/m^3 and its kinematic viscosity is 0.046 stoke.Calculate the velocity of air.If the drag measured on the model is 1133 N,predict the power required to drive the prototype submarine.	10	1	4
3	Expain the Effect of Reynolds number , Unit specific quantities and the Application of first and second law of thermodynamics to turbo machines?	10	1	2
	OR			
4	The quantity of water available for a hydel station is 310 cumecs under a head of 1.8m.Assuming speed of each turbine is 60 RPM and efficiency of 85% find the no of turbines and power produced by each turbine .Each turbine has a specific speed of 800.	10	1	4
5	Expain the Velocity triangles for different values of degree of reaction?	10	2	2
	OR			
6	A model of a turbine built to a scale of 1:4 is tested under a head of 10m.The prototype has to work under a head of 50m at 450 RPM (a) what speed should the model run be if it develops 60 kw using 0.9cumecs at this speed (b) what power will be obtained from the prototype assuming that its efficiency is 3% better than that of model.	10	1	4
7	Expain the significance of Pi terms and laws of similitude ? **OR** At a stage of an Impulse turbine the mean blade dia is 0.75m,its rotational speed being 3500 RPM.The absolute velocity of fluid discharging from a nozzle inclined at 20^0 to the plane of the	10	1	2

8	wheel is 275 m/sec.If the utilization factor is 0.9 and the relative velocityat rotor exit is 0.9 times that at the inlet,find at the inlet,find the inlet and exit rotor angle.	10	2	4
9	Expain the following a) static state b) stagnation state c) stagnation enthalpy .Derive the equations for degree of rection and utilization factor for 50% reaction.	10	2	2,3
	OR			
10	In a mixed flow turbo machine the fluid enters such that the absolute velocity is axial at inlet and at outlet relative velocity is radial.What is the degree of rection and energy input to the fluid,If relative velocity at outlet is same as tangential blade speed at inlet.The following data may be a) Inlet dia. is 16 cm b) exit dia. is 50cm c) speed is 3000 RPM d)Blade angle at inlet is 45^0.	10	2	4

Note: BTL (Blooms Taxonomy Level) CO (Course Outcome) PO (Program Outcome)

IA Coordinator **Signature of faculty**

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

Scheme of Evaluation-IA I (2019-20 Odd Sem)

Staff Name : Dr Manjunatha Kondekal	**Sem/Sec: V/A**	**Date: 12/03/2019**
Course Name : Turbo Machines	**Course Code : 17ME53**	
Prerequisites: BTD and ATD		

NOTE : Answer five questions, each carrying 6 marks **Max Marks : 30**

Q No	QUESTIONS	Marks	CO	BTL
1	Diagram (05) Explanation (05)	10	1	2
	OR			
2	predict the power required to drive the prototype submarine. (10)	10	1	4
3	Explanation for Effect of Reynolds number (05) Unit specific quantities and the Application of first and second law of thermodynamics to turbo machines (05)	10	1	2
	OR			
4	no of turbines and power produced by each turbine . (05+05)	10	1	4
5	Explanation for Velocity triangles for different values of degree of reaction (10)	10	2	2
	OR			
6	(a) what speed should the model run be if it develops 60 kw using 0.9cumecs at this speed (b) what power will be obtained from the prototype (05+05)	10	1	4
7	Explanation for significance of Pi terms and laws of similitude?(10)	10	1	2
	OR			
8	Find the inlet and exit rotor angle. (05+05)	10	2	4
9	Explanation for following a) static state b) stagnation state c) stagnation enthalpy . (05) Derive the equations for degree of rection and utilization factor for 50% reaction. (05)	10	2	2,3
	OR			
10	Find the degree of rection and energy input to the fluid (10)	10	2	4

Note: BTL (Blooms Taxonomy Level) **CO (Course Outcome)** **PO (Program Outcome)**

IA Coordinator **Signature of faculty**

IA-I PERFORMANCE ANALYSIS

Internal Assessment I

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
CO mapping	1	1	1	1	2	1	1	2	2	2
Max Marks /Question	10	10	10	10	10	10	10	10	10	10
Total marks of class /question	273	190	212	187	290	95	361	100	172	248
No. of students attended	35	27	35	28	48	15	48	15	27	35
No of students scored > 60% of marks/Question	35	27	35	28	48	15	48	15	27	35
Percentage of students scored>60% of marks/Question	35	27	35	28	48	15	48	15	27	35

Note: 2017 & 2018 Scheme Format

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
Department of Mechanical Engineering

ASSIGNMENT-II (2019-20 Odd Sem)

Staff Name : Dr Manjunatha Kondekal	Sem/Sec: V/A	Max Marks:10
Course Name : Turbo Machines	Course Code : 17ME53	

Q No	QUESTIONS	CO	BTL
1	Explain the Impulse and Rection Turbine with neat sketch?	2	3
2	The following particulars refer to a single impulse turbine .Mean diameter of blade ring 2.5 m,speed 3000rpm,nozzle angle 20_0 ,ratio of blade velocity to steam 0.4,blade friction factor 0.8,blade angle at exit is 3_0 less than that at the inlet.Steam flow rate 36000 kg/h.Draw the velocity diagram for moving blade and estimate (a) the power developed (b) the blade efficiency.	4	3
3	Explain the methods of compounding of steam turbine with neat sketch?	2	3
4	Steam issues from a nozzle to a De Laval turbine at a velocity of 1000m/s.The nozzle angle is 20_0 .The mean blade velocity is 400m/s.The blades are symmetrical.The mass flow rate is 1000 kg/h,friction factor is 0.8,nozzle efficiency is 0.95 calculate (a) Blade angle (b) Axial thrust (c) WD/kg (d) Power developed (e) Blade efficiency (f) Stage efficiency	4	3
5	Explain the Pelton wheel with its main components with neat sketch?	2	4
6	A pelton wheel develops 5800 kw under a net head of 180m at a speed of 195 rpm.Find the discharge through the turbine ,the wheel diameter,the number of jets required and specific speed.use the following assumptions overall efficiency 86%,D/d=12, =0.45 and Cv=0.985.	4	4
7	Expain the Francis Turbine with its main components with neat sketch?	2	4
8	The external and internal diamters of an inward flow rection turbine are 2.0 m and 1.0 m respectively.The head on the turbine is 60 m.The width of the vane at inlet and oulet are same and equal to 0.25 m.The runner vanes are radial at inlet and the discharge is radil at outlet.The speed is 200 rpm and the discharge is 6 m_3/s.Determine (a) The vane angle at outlet and inlet of the runner. (b) The hydraulic efficiency.	4	4
9	A double jet pelton wheel is required to generate 7500 kW when the available head at the base of the nozzle is 400 m.The jet is deflected through 165_0 and the relative velocity of the jet is reduced by 15 in passing over the buckets.Determine (a) the dismeter of the jet (b) the total flow (c) the force exerted by the jets in tangential direction.Assume generator efficiency of 95%,overall efficiency of 80%,blade speed ratio of 0.47 and nozzle coefficient of 0.98.	4	4

10	The following data pertains to Francis turbine.Shaft power 1000 kw,head 200m,overall efficiency 85%,speed 540 rpm,velocity of flow at inlet 9 m/s,The ratioof width to diameter of wheel at inlet 1/10,hydraulic efficiency 87%,area occupied by thickness of blades 7.5%,Find (a) the area of flow (b) the angle of entry (c)the tangential velocity and (d) the velocity of whirl at the inlet if the discharge is radil.	4	4

IA Co-0rdinator **Faculty Incharge**

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

INTERNAL ASSESSMENT TEST-II (2019-20 Odd Sem)

Staff Name : Dr Manjunatha Kondekal	**Sem/Sec: A**	**Date: 20/10/2019** **Time : 9:15 TO 10:45 AM**
Course Name : Turbo Machines	**Course Code : 17ME53**	
Prerequisites: BTD and ATD		

NOTE : Answer five questions, each carrying 6 marks **Max Marks : 30**

Q No	QUESTIONS	Marks	CO	BTL
1	Explain the Impulse and Rection Turbine with neat sketch? **OR**	10	2	3
2	The following particulars refer to a single impulse turbine .Mean diameter of blade ring 2.5 m,speed 3000rpm,nozzle angle 20_0 ,ratio of blade velocity to steam 0.4,blade friction factor 0.8,blade angle at exit is 3_0 less than that at the inlet.Steam flow rate 36000 kg/h.Draw the velocity diagram for moving blade and estimate (a) the power developed (b) the blade efficiency.	10	4	3
3	Explain the methods of compounding of steam turbine with neat sketch? **OR**	10	2	3
4	Steam issues from a nozzle to a De Laval turbine at a velocity of 1000m/s.The nozzle angle is 20_0 .The mean blade velocity is 400m/s.The blades are symmetrical.The mass flow rate is 1000 kg/h,friction factor is 0.8,nozzle efficiency is 0.95 calculate (a) Blade angle (b) Axial thrust (c) WD/kg (d) Power developed (e) Blade efficiency (f) Stage efficiency	10	4	3
5	Explain the Pelton wheel with its main components with neat sketch? **OR**	10	2	4
6	A pelton wheel develops 5800 kw under a net head of 180m at a speed of 195 rpm.Find the discharge through the turbine ,the wheel diameter,the number of jets required and specific speed.use the following assumptions overall efficiency 86%,D/d=12, =0.45 and Cv=0.985.	10	4	4
7	Expain the Francis Turbine with its main components with neat sketch? **OR**	10	2	4
8	The external and internal diamters of an inward flow rection turbine are 2.0 m and 1.0 m respectively.The head on the turbine is 60 m.The width of the vane at inlet and oulet are same and equal to 0.25 m.The runner vanes are radial at inlet and the discharge is radil at outlet.The speed is 200 rpm and the discharge is 6 m_3/s.Determine (a) The vane angle at outlet and inlet of the runner. (b) The hydraulic efficiency.	10	4	4
9	A double jet pelton wheel is required to generate 7500 kW when the available head at the base of the nozzle is 400 m.The jet is deflected through 165_0 and the relative velocity of the jet	10	4	4

10	is reduced by 15 in passing over the buckets.Determine (a) the dismeter of the jet (b) the total flow (c) the force exerted by the jets in tangential direction.Assume generator efficiency of 95%,overall efficiency of 80%,blade speed ratio of 0.47 and nozzle coefficient of 0.98. **OR** The following data pertains to Francis turbine.Shaft power 1000 kw,head 200m,overall efficiency 85%,speed 540 rpm,velocity of flow at inlet 9 m/s,The ratioof width to diameter of wheel at inlet 1/10,hydraulic efficiency 87%,area occupied by thickness of blades 7.5%,Find (a) the area of flow (b) the angle of entry (c)the tangential velocity and (d) the velocity of whirl at the inlet if the discharge is radil.	10	4	4

Note: BTL (Blooms Taxonomy Level) CO (Course Outcome) PO (Program Outcome)

IA Coordinator

Signature of faculty

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

Scheme of Evaluation-IA II (2019-20 Odd Sem)

Staff Name : Dr Manjunatha Kondekal	**Sem/Sec: A**	**Date: 20/10/2019**
Course Name : Turbo Machines	**Course Code : 17ME53**	
Prerequisites: BTD and ATD		

NOTE : Answer five questions, each carrying 6 marks **Max Marks : 30**

Q No	QUESTIONS	Marks	CO	BTL
1	Explanation for Impulse and Rection Turbine with neat sketch (05+05)	10	2	3
2	Estimate (a) the power developed (b) the blade efficiency. (05+05)	10	4	3
3	Explanation for methods of compounding of steam turbine with neat sketch (10)	10	2	3
4	(a)Blade angle (b) Axial thrust (c) WD/kg (d) Power developed (e) Blade efficiency (f) Stage efficiency (2x5=10)	10	4	3
5	Explanation for Pelton wheel with its main components with neat Sketch (10)	10	2	4
6	Find the discharge through the turbine ,the wheel diameter,the number of jets required (10)	10	4	4
7	Explanation for Francis Turbine with its main components with neat Sketch (10)	10	2	4
8	Determine (a) The vane angle at outlet and inlet of the runner. (b) The hydraulic efficiency. (5x5=10)	10	4	4
9	Determine (a) the dismeter of the jet (b) the total flow (c) the force exerted by the jets in tangential direction. (10)	10	4	4
10	Find (a) the area of flow(b) the angle of entry (c)the tangential velocity and (d) thevelocity of whirl at the inlet if the discharge is radil. (10)	10	4	4

Note: BTL (Blooms Taxonomy Level) **CO (Course Outcome)** **PO (Program Outcome)**

IA Coordinator **Signature of faculty**

IA-II PERFORMANCE ANALYSIS

Internal Assessment II

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
CO mapping	2	4	2	4	2	4	2	4	4	4
Max Marks /Question	10	10	10	10	10	10	10	10	10	10
Total marks of class /question	304	133	237	155	260	142	309	181	137	309
No. of students attended	42	20	43	23	42	21	42	25	20	43
No of students scored > 60% of marks/Question	42	20	43	23	42	21	42	25	20	43
Percentage of students scored>60% of marks/Question	42	20	43	23	42	21	42	25	20	43

Note: 2017 & 2018 Scheme Format

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

ASSIGNMENT-III (2019-20 Odd Sem)

Staff Name : Dr Manjunatha Kondekal	**Sem/Sec: A**	**Max Marks:10**
Course Name : Turbo Machines	**Course Code : 17ME53**	

Q No	QUESTIONS	CO	BTL
1	Explain the Classification and parts of centrifugal pump with neat sketch?	2	5
2	A centrifugal pump delivers 1800 lit/min against a total height of 20m.its speed is 1450 rpm,Inner and outer diameters of impeller are 120mm and 240mm respectively and the diameter of suction and delivery pipes are both 100mm.Detrimine the blade angles 1 and 2 of the impeller vane if the water enters radially.neglect friction and other losses	4	5
3	Explain the different heads and efficiencies of centrifugal pump and Minimum speed for starting the flow?	2	5
4	A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000rpm works against a total head of 40m.the The velocity of flow through the impeller is constant and equal to 2.5m/sec. vanes are set back at an angle of 40_0 at outlet.If the outer diameter of the impeller is 50cm and width at outlet is 5cm.determine a) the vane angle at the inlet b) the work done per second by the impeller on water and c) the manometric efficiency.	4	5
5	Explain the Centrifugal Compressors with Stage velocity triangles and slip factor?	2	5
6	Air at a temperature of 290K,flows in a centrifugal compressor running at 20,000rpm,slip factor =0.8,Total to total efficiency=80%,d_2=0.60m.Assume that the absolute velocities at the inlet and outlet are same.Calculate a) the temperature rise of air passing through the compressor b)the stage pressure ratio.	4	5
7	Explain the power input factor, Stage work, Pressure developed, stage efficiency and surging and problems in Centrifugal Compressors?	2	5
8	Free air delivered by a compressor is 20kg/min.The inlet conditions are 1bar and 20_0C static.The velocity of air at the inlet is 60 m/sec.The isentropic efficiency of the compressor is 0.7.The total head pressure ratio is 3.Find a) the total head temperature at the exit b) the power required by the compressor if the mechanical efficiency is 95%.	4	5

9	Explain the Axial flow Compressors with neat sketch and efficiencies and stalling?	2	5
10	Derive an expression for pressure ratio developed in a stage and work done factor in Axial flow Compressors?	2	5

IA C0-0rdinator **Faculty Incharge**

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

INTERNAL ASSESSMENT TEST-III (2019-20 Odd Sem)

Staff Name : Dr Manjunatha Kondekal	**Sem/Sec: A**	**Date: 19/05/2019** **Time : 9:15 TO 11:00 AM**
Course Name : Turbo Machines	**Course Code : 17ME53**	
Prerequisites: BTD and ATD		

NOTE : Answer five questions, each carrying 6 marks **Max Marks : 30**

Q No	QUESTIONS	Marks	CO	BTL
1	Explain the Classification and parts of centrifugal pump with neat sketch?	10	2	5
	OR			
2	A centrifugal pump delivers 1800 lit/min against a total height of 20m.its speed is 1450 rpm,Inner and outer diameters of impeller are 120mm and 240mm respectively and the diameter of suction and delivery pipes are both 100mm.Detrimine the blade angles 1 and 2 of the impeller vane if the water enters radially.neglect friction and other losses	10	4	5
3	Explain the different heads and efficiencies of centrifugal pump and Minimum speed for starting the flow?	10	2	5
	OR			
4	A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000rpm works against a total head of 40m.the The velocity of flow through the impeller is constant and equal to 2.5m/sec. vanes are set back at an angle of 40^0 at outlet.If the outer diameter of the impeller is 50cm and width at outlet is 5cm.determine a) the vane angle at the inlet b) the work done per second by the impeller on water and c) the manometric efficiency.	10	4	5
5	Explain the Centrifugal Compressors with Stage velocity triangles and slip factor?	10	2	5
	OR			
6	Air at a temperature of 290K,flows in a centrifugal compressor running at 20,000rpm,slip factor =0.8,Total to total efficiency=80%,d_2=0.60m.Assume that the absolute velocities at the inlet and outlet are same.Calculate a) the temperature rise of air passing through the compressor b)the stage pressure ratio.	10	4	5
7	Explain the power input factor, Stage work, Pressure developed, stage efficiency and surging and problems in Centrifugal Compressors?	10	2	5
	OR			
8	Free air delivered by a compressor is 20kg/min.The inlet conditions are 1bar and 20^0C static.The velocity of air at the inlet is 60 m/sec.The isentropic efficiency of the	10	4	5

	compressor is 0.7.The total head pressure ratio is 3.Find a) the total head temperature at the exit b) the power required by the compressor if the mechanical efficiency is 95%.			
9	Explain the Axial flow Compressors with neat sketch and efficiencies and stalling? **OR**	10	2	5
10	Derive an expression for pressure ratio developed in a stage and work done factor in Axial flow Compressors?	10	2	5

Note: BTL (Blooms Taxonomy Level) CO (Course Outcome) PO (Program Outcome)

IA Coordinator **Signature of faculty**

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

Scheme of Evaluation-IA III (2019-20 Odd Sem)

Staff Name : Dr Manjunatha Kondekal	**Sem/Sec: A**	**Date: 27/04/2017**
Course Name : Turbo Machines	**Course Code : 17ME53**	
Prerequisites: BTD and ATD		

NOTE : Answer five questions, each carrying 6 marks **Max Marks : 30**

Q No	QUESTIONS	Marks	CO	BTL
1	Explanation for Classification and parts of centrifugal pump with neat sketch (5+5=10)	10	2	5
2	Determine the blade angles of the impeller vane if the water enters radially.neglect friction and other losses (5+5=10)	10	4	5
3	Explanation for different heads and efficiencies of centrifugal pump and Minimum speed for starting the flow (05+05=10)	10	2	5
4	Determine a) the vane angle at the inlet b) the work done per second by the impeller on water and c) the manometric efficiency. (10)	10	4	5
5	Explanation for the Centrifugal Compressors with Stage velocity triangles and slip factor (05+05=10)	10	2	5
6	Calculate a) the temperature rise of air passing through the compressor b)the stage pressure ratio.(05+05=10)	10	4	5
7	Explanation for the power input factor, Stage work, Pressure developed, stage efficiency and surging and problems in Centrifugal Compressors (10)	10	2	5
8	Find a) the total head temperature at the exit b) the power required by the compressor (05+05=10)	10	4	5
9	Explanation for the Axial flow Compressors with neat sketch and efficiencies and stalling (05+05=10)	10	2	5
10	Derive an expression for pressure ratio developed in a stage and work done factor in Axial flow Compressors (05+05=10)	10	2	5

Note: BTL (Blooms Taxonomy Level) **CO (Course Outcome)** **PO (Program Outcome)**

IA Coordinator **Signature of faculty**

IA-3 PERFORMANCE ANALYSIS

Internal Assessment 3

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
CO mapping	2	4	**2**	4	2	4	2	4	2	2
Max Marks /Question	10	10	10	10	10	10	10	10	10	10
Total marks of class /question	144	306	314	99	218	237	293	117	155	265
No. of students attended	21	41	46	15	33	31	41	17	25	35
No of students scored > 60% of marks/Question	21	41	46	15	33	31	41	17	25	35
Percentage of students scored>60% of marks/Question	21	41	46	15	33	31	41	17	25	35

Note: 2017 & 2018 Scheme Format

REMEDIAL AND TUTORIAL CLASSES INFORMATION

Sl.No	Topic Covered
01	Introduction: Definition of turbo machine, parts of turbo machines
02	Comparison with positive displacement machines, Classification,
03	Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation,
04	Velocity triangles for different values of degree of reaction
05	Components of energy transfer
06	Degree of Reaction, utilization factor
07	Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation,
08	Velocity triangles for different values of degree of reaction
09	Components of energy transfer
10	Degree of Reaction, utilization factor
11	Hydraulic Turbines: Classification, various efficiencies.
12	Pelton turbine – velocity triangles, design parameters,
13	Maximum efficiency.
14	Francis turbine - velocity triangles
15	Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump,
16	Minimum speed for starting the flow, Maximum suction lift,
17	Net positive suction head, Cavitation, Need for priming
18	Expression for pressure ratio developed in a stage, work done factor

Signature of faculty

HOD

Head of the Department,
Mechanical Engineering Department,
R.Y.M. Engineering College,
Cantonment, BELLARY-583 104

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

FINAL CIE, AND SEE MARKS

	Faculty:	**DR MANJUNATHA KONDEKAL**			
	Subject:	**TURBOMACHINES**			
	Code:	**17C303**			
	SEM:	**V**		**SEC:**	**A**
CAY 2019-20					

Sl. No	USN NO	NAME	17C303		
			Internal marks	Assignment Marks	External marks
			30	10	60
A-1	3VC16ME007	ABHISHEK SINHA	23	10	14
A-2	3VC17ME001	AJAY REDDY N	36	10	31
A-3	3VC17ME002	AKASHA GOUDA H	40	10	55
A-4	3VC17ME003	ANIL KITTUR	38	10	53
A-5	3VC17ME004	BHARATHISHA A B	35	10	48
A-6	3VC17ME005	BHARGHAV R	29	10	18
A-7	3VC17ME006	C ESHWAR	32	10	14
A-8	3VC17ME007	DEEPAK PATIL S R	23	10	21
A-9	3VC17ME008	DODDA BASAVA B	30	10	23
A-10	3VC17ME009	DURJAYA K B	29	10	21
A-11	3VC17ME010	EARESH VARMA C	34	10	21
A-12	3VC17ME012	ERANAGOUDA K M	34	10	25
A-13	3VC17ME014	G RANJITH	37	10	21
A-14	3VC17ME016	G S SREE HARSHA	30	10	16
A-15	3VC17ME018	GANESH GOWDA M	37	10	24
A-16	3VC17ME019	GANESH J	29	10	23
A-17	3VC17ME020	GURUSIDDANA GOUDA B	27	10	24
A-18	3VC17ME021	HAMPANNA	32	10	21
A-19	3VC17ME022	HANUMESH	28	10	14
A-20	3VC17ME023	JAFERSADIQ M ABDUL KHADER BASHA	30	10	21
A-21	3VC17ME024	JAGADEESH	30	10	21
A-22	3VC17ME025	JEFFREY SUJAN KUMAR K	25	10	11
A-23	3VC17ME027	KADUBURU MATH PARIKSHITH	34	10	21
A-24	3VC17ME028	KAISARAHMED D	31	10	23

A-25	3VC17ME029	KARTHIK KUMAR D	24	10	26
A-26	3VC17ME030	KARTHIK R B	36	10	27
A-27	3VC17ME031	KIRAN MATH	31	10	35
A-28	3VC17ME032	LOKESHA NAIK	37	10	23
A-29	3VC17ME033	M CHAITANYA	37	10	24
A-30	3VC17ME041	MOHAMMED AZAM J	25	10	14
A-31	3VC17ME043	MOHAN E	20	10	11
A-32	3VC17ME046	NAVEEN SURAGOUNI	29	10	13
A-33	3VC17ME049	PAVAN KUMAR B	34	10	21
A-34	3VC17ME054	PAVITHRA R	37	10	21
A-35	3VC17ME081	VINAY KUMAR S	21	10	21
A-36	3VC18ME401	ANAND K R	34	10	21
A-37	3VC18ME402	ANIL KUMAR V	30	10	8
A-38	3VC18ME411	H M UDAY KUMAR	21	10	21
A-39	3VC18ME413	IMRAN ABDUL WAHEED BELGUMI	23	10	7
A-40	3VC18ME415	K VINAY KUMAR	30	10	21
A-41	3VC18ME418	KIRAN KUMAR D	37	10	40
A-42	3VC18ME420	KUMAR K	30	10	21
A-43	3VC18ME423	MADHUSUDHAN B	30	10	23
A-44	3VC18ME424	MAHANTESH H M	29	10	32
A-45	3VC18ME425	MANIKANTA K	46	10	46
A-46	3VC18ME431	MULLA ALTAF HUSSAIN	30	10	11
A-47	3VC18ME433	NISAR AHAMED K M	40	10	40
A-48	3VC18ME434	G PAVAN KALYAN	27	10	9
A-49	3VC18ME435	PAVITHRA K	37	10	33
A-50	3VC18ME441	SAGAR MP	22	10	21
A-51	3VC18ME443	SAMPATH KUMAR Y M	28	10	22
A-52	3VC18ME444	SANTOSH G	29	10	21
A-53	3VC18ME446	K SHIVA KUMAR	25	10	3
A-54	3VC18ME449	SHIVA SHANKAR ADUR	33	10	21
A-55	3VC18ME454	THIPPESWAMY B	30	10	24
A-56	3VC18ME455	THIPPESWAMY R	35	10	33
A-57	3VC18ME457	V SIDDHI VINAYAKA	28	10	11

A-58	3VC18ME459	VINOD KUMAR B	26	10	10
A-59	3VC18ME460	VISHWANATH H	26	10	27
A-60	3VC18ME461	VISHWANATH GOWDA K	23	10	14
A-61	3VC18ME462	VYSHNAVI	32	10	13
A-62	3VC18ME464	YESHWANTH D	25	10	15
A-63	3VC17ME425	S MUSHTAQ AHMED	35	10	21

HOD

Head of the Department,
Mechanical Engineering Department,
R.Y.M. Engineering College,
Cantonment, BELLARY-583 104

Signature of faculty

VTU QUESTION PAPER

CBCS SCHEME

USN | | | | | | | | | | | 17ME53

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Turbomachines

Time: 3 hrs.   Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define specific speed of turbine and hence derive an expression for specific speed of turbine. **(06 Marks)**

b. A Pelton wheel is running at a speed of 200rpm and develops 5200KW when working under a heat of 220m with an overall efficiency of 80%. Determine its unit speed, unit flow, unit power and specific speed. Find the speed, flow and power when its operating condition changes to a head of 140m. **(08 Marks)**

c. A full scale centrifugal pump running at 500rpm delivers $5m^3/s$ against a head of 100m. A model of the pump delivers $0.3m^3/s$ with a power input of 100KW at an efficiency of 90%. Calculate the speed of the model and scale ratio. **(06 Marks)**

OR

2 a. Applying First law of thermodynamics to turbomachines, prove that the work transfer is numerically equal to the change in total enthalpy between inlet and outlet of the machine. **(06 Marks)**

b. With the help of h-s diagram define the following with respect to turbines :
i) Total–to–total efficiency
ii) Total–to–static efficiency. **(06 Marks)**

c. Liquid water flows through pump from an elevation of 1m at the inlet to an elevation of 2m at the exit from the centre of the pump respectively. The static pressure increases from 10cm to 150cm of mercury between the inlet and exit. The inlet and exit velocities are 5m/s and 10m/s respectively. Evaluate the isentropic enthalpy increase across the pump. Also find the power required to drive the pump and the actual change in enthalpy if the total – to – total isentropic efficiency of the pump is 75%. The mass flow rate of water in pump is 100kg/min. **(08 Marks)**

Module-2

3 a. Define degree of reaction and utilization factor. Obtain the general equation for utilization factor in terms of degree of reaction, absolute velocities at inlet and outlet of the turbine. **(08 Marks)**

b. At a stage of an impulse turbine, the mean blade diameter is 0.75m, its rotational speed being 3500rpm. The absolute velocity of fluid exiting from a nozzle inclined at 20° to the wheel tangent is 275m/s. If the utilization factor is 0.9 and the relative velocity at rotor exit is 0.9 times that at inlet, find the inlet and exit rotor angles. Also find the power output from the stage for a mass flow rate of 2 kg/s and axial thrust on the shaft. **(12 Marks)**

OR

4 a. Prove that the degree of reaction for an axial flow compressor is given by

$$R = \frac{V_a}{2U}\left[\frac{\tan\beta_2 + \tan\beta_1}{\tan\beta_1 + \tan\beta_2}\right]$$

Where V_a = Axial component or flow velocity, U = tangential velocity of rotor, β_1 and β_2 are the rotor angles at inlet and exit measured with reference to tangential direction. **(10 Marks)**

b. A single stage axial flow blower with no inlet guide vanes, operates at 3600rpm. The tip and hub diameters of the rotor are 20cm and 12.5cm respectively. The air flow through the stage is 0.45kg/s. The air turned through an angle of 20° towards the axial direction during the passage through the rotor at the mean diameter. Assuming the inlet conditions of pressure of 1 bar and 25°C, constant axial velocity and no losses in the rotor, compute :
i) The power input in KW ii) degree of reaction. **(10 Marks)**

Module-3

5 a. Derive the condition for maximum blade efficiency with equip-angular blades in an impulse steam turbine. **(08 Marks)**

b. In a Curtis stage with two rows of moving blades, the rotors are equiangular. The first rotor has angle of 29° each while second rotor has angle of 32° each. The velocity of steam at the exit of nozzle is 530m/s and blade coefficients are 0.9 in the first moving row, 0.95 in the stator and in the second moving row. If the absolute velocity at the stage exit should be axial, find :
i) Mean blade speed
ii) The rotor efficiency
iii) The power output for a steam flow rate of 1kg/s. **(12 Marks)**

OR

6 a. Prove that the maximum blade efficiency in a Parason's reaction steam turbine is given by :

$$\eta_{b,max} = \frac{2\cos^2\alpha_1}{1+\cos^2\alpha_1}.$$ **(08 Marks)**

b. At a stage of a turbine with Parasons's blading deliver dry saturated steam at 2.7 bar form fixed blades at 90m/s. The mean blade height is 40mm, and the moving blade exit angle is 20°. The axial velocity of steam is ¾ times the blade velocity at the mean radius. Steam is supplied to the stage at the rate of 9000kg/h. The effect of blade tip thickness on the annulus area can be neglected calculate : i) the wheel speed in RPM ii) the diagram efficiency iii) the diagram power iv) the enthalpy drop of the steam in this stage. **(12 Marks)**

Module-4

7 a. With the necessary velocity triangles, show that the maximum hydraulic efficiency of a Pelton wheel is given by $\eta_{H,max} = \frac{1+c_b\cos\beta_2}{2}$, where $c_b = V_{r2}/V_{r1}$ and β_2 is bucket tip angle. **(08 Marks)**

b. A double jet Pelton wheel is required to generate 7500KW when the available head at the base of the nozzle is 400m. The jet is deflected through 165° and the relative velocity of the jet is reduced by 15% in passing over the buckets. Determine : i) The diameter of each jet ii) total flow iii) force exerted by the jets in the tangential direction. Assume generator efficiency is 95%, overall efficiency is 80% and speed ratio = 0.47. **(12 Marks)**

OR

8 a. For Francis turbine, show that the hydraulic efficiency = $\frac{2}{2+\tan^2\alpha_1}$ for the following conditions : i) the component of velocity normal to the tangential direction is constant from inlet to outlet ii) relative velocity at the inlet is radial iii) absolute velocity at the outlet is radial. Where α_1 = flow angle at inlet. Sketch the velocity triangles at inlet and outlet. **(08 Marks)**

b. An inward flow reaction turbine has a runner 0.5m diameter an d7.5cm wide. The inner diameter is 0.35m. The effective area of flow is 93% of the gross area and the flow velocity is constant. The guide vane angle is 23° inlet moving vane angle is 97° and the outlet vane angle is 30°. Assuming radial discharge at the exit, calculate the speed of the wheel so that the water enters without shock and the supply head of 60m. Assume hydraulic friction losses of 10% and mechanical efficiency as 94%. What is the specific speed of the machine? **(12 Marks)**

Module-5

9 a. Show that the pressure rise in the impeller of a centrifugal pump, when the frictional and other losses in the impeller are neglected, is given by

$$\frac{1}{2g}\left[V_{f1}^2 + u_2^2 - V_{f2}^2 \operatorname{cosec}^2\beta_2\right].$$

Where V_{f1} and V_{f2} are the flow velocities at inlet and out let of the impeller, u_2 = tangential velocity of the impeller at exit and β_2 = exit blade angle. **(08 Marks)**

b. Derive an expression for minimum speed of CF pump to start the flow. **(04 Marks)**

c. Find the power required to drive the CF pomp which delivers $0.04m^3/p$ of water t a height of 20m through a 15cm diameter of pipe and 100m long. The overall efficiency of the pump is 70% and the friction factor is assumed to be 0.015. **(08 Marks)**

OR

10 a. Explain the phenomena of :
Surging
Stalling and
Choking in a centrifugal compressor stage. **(06 Marks)**

b. Show that the H-Q characteristic equation for centrifugal blower is given by

$$H = K_1 - K_2 Q$$

Where $K_1 = u_2^2/g$, $K_2 = \frac{u_2 \cot\beta_2}{g \cdot \pi D_2 \cdot b_2}$. **(06 Marks)**

c. An axial flow compressor of 50% reaction design has blades with inlet and outlet angle with reference to axial direction of 45° and 10° respectively. The compressor is to produce a pressure ratio of 6 : 1 with an isentropic efficiency of 0.85 when inlet static temperature is 37°C. The blade speed and axial velocity are constant throughout the compressor. Assuming a blade speed of 200m/s, find the number of stages required if the work done factor is i) unity ii) 0.87 for all stages. **(08 Marks)**

* * * * *

CBCS SCHEME

USN

15ME53

Fifth Semester B.E. Degree Examination, June/July 2019
Turbo Machines

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. List the difference between positive displacement machine and turbo machine. **(08 Marks)**

b. Two geometrically similar pumps are running at same speed of 1000 rpm. One pump has an impeller diameter of 0.3 m and lifts water at the rate of 20 litres/sec against a head of 15 m. Determine the head and impeller diameter of the other pump to deliver half the discharge. **(08 Marks)**

OR

2 a. Derive the equation of efficiency η_p for compression process

$$\eta_{cs-s} = \frac{(Pr)^{\frac{\gamma-1}{\gamma}} - 1}{(Pr)^{\frac{\epsilon}{\eta_p}} - 1}$$

(08 Marks)

b. A turbine has four stages and each stage pressure ratio is 2. The inlet static temperature is 630°C. The mass flow rate is 30 kg/s. the overall efficiency is 0.8. Calculate: (i) the polytropic efficiency (ii) stage efficiency (iii) the power developed (iv) the reheat factor. **(08 Marks)**

Module-2

3 a. Derive the alternate forms of Euler's turbine equation and explain the significance of each energy component. **(08 Marks)**

b. In an axial flow turbine discharge blade angles are 20° each for both stator and rotor. The steam speed at the exit of fixed blade is 150 m/s. The ration $\frac{V_m}{U} = 0.75$ at exit of rotor. Find the inlet blade rotor angle, power developed and degree of reaction for a flow rate of 3.5 kg/s. **(08 Marks)**

OR

4 a. Derive an expression of theoretical head capacity relationship of radial outward flow devices for different values of discharge angles (centrifugal machines). **(08 Marks)**

b. An inward flow reaction turbine has outer and inner diameter wheels as 1 m and 0.5 m respectively. The vanes are radial at inlet and discharge is radial at outlet and fluid enters the vanes at an angle of 10°. Assuming the velocity of flow to be constant and equal to 3 m/s. Find: (i) speed of wheel (ii) vane angle at outlet (iii) degree of reaction. **(08 Marks)**

Module-3

5 a. What is the necessity for compounding steam turbines? Name the different compounding methods and explain any one. **(08 Marks)**

b. In a single stage impulse turbine the mean diameter of the blades is 1m. It runs at 3000 rpm. The steam is supplied from a nozzle at a velocity of 350 m/s and nozzle angle is 20°. The rotor blades are equiangular. The blade friction factor is 0.86. Draw the velocity diagram and calculate the power developed if the axial thrust is 117.72 Newton's. **(08 Marks)**

OR

6 a. For a 50% reaction steam turbine, show that $\alpha_1 = \beta_2$ and $\alpha_2 = \beta_1$, where α_1 and β_1 are the inlet angles of fixed and moving blades, α_2 and β_2 are the outlet blade angles of fixed and moving blade angles. **(08 Marks)**

b. In a reaction turbine, the inlet and outlet blade angles are 50° and 20° respectively. Steam enters at 18° to the plane of the rotor wheel and leaves at 40°. The rotor speed is 260 m/s. Calculate the speed ratio, specific work and degree of reaction. **(08 Marks)**

Module-4

7 a. Show that the maximum hydraulic efficiency of a Pelton wheel turbine is given by $(\eta_h)_{max} = \frac{1 + c_b \cos\beta_2}{2}$. Also draw the inlet and exit velocity triangles, c_b is bucket velocity coefficient and β_2 is exit blade angle. **(08 Marks)**

b. The penstock supplies water from a reservoir to the Pelton wheel with a gross head of 500 m. 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 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 c_v = 1.0. **(08 Marks)**

OR

8 a. The following data are given for a Francis turbine net head = 70 m, speed = 600 rpm, power at the shaft = 367.5 KW, overall efficiency = 85%, hydraulic efficiency = 95%, flow ratio = 0.25, width ratio = 0.1, outer dia to inner dia ratio = 2. The thickness of the vanes occupy 10% of the circumferential area of the runner. Velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine: (i) Guide blade angle (ii) Runner vane angles (iii) Diameter of runner at inlet and outlet (iv) Width of wheel at inlet. **(08 Marks)**

b. With a neat sketch, explain the working of Kaplan turbine. Mention the functions of draft tube. **(08 Marks)**

Module-5

9 a. Explain the following with reference to centrifugal pump:
i) Manometric efficiency with expression
ii) Cavitation in pump
iii) Need of priming
iv) Pumps in series **(08 Marks)**

b. A centrifugal pump is designed to run at 1450 rpm with maximum discharge of 1800 litres/min against a total read of 20 m. The suction and delivery pipes are designed such that they are equal in size of 100 mm. If the inner and outer diameter of the impeller are 12 cm and 24 cm respectively, determine the blade angles β_1 and β_2 for radial entry. Neglect friction and other losses. **(08 Marks)**

OR

10 a. Explain the phenomena of slip factor, surging, stalling and chocking in centrifugal compressor. **(08 Marks)**

b. Air enters a three stage axial flow compressor at 1 bar and 300 K. the energy input is 25 kJ/kg per stage. The stage efficiency is 0.86. Calculate: (i) the exit static temperature (ii) the compressor efficiency (iii) the static pressure ratio. **(08 Marks)**

* * * * *

CBCS Scheme

USN | | | | | | | | | | | **15ME53**

Fifth Semester B.E. Degree Examination, June/July 2018

Turbo Machines

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define with appropriate expressions: i) flow coefficient ii) head coefficient iii) power coefficient iv) specific speed. **(08 Marks)**

b. A model of a centrifugal pump absorbs 5 KW at a speed of 1500 rpm, pumping water against a head of 6m. The large prototype pump is required to pump water to a head of 30 m. The scale ratio of diameter is 4. Assume same efficiency and similarities. Find: (i) Speed (ii) Power of prototype (iii) The ratio of discharge of prototype and model. **(08 Marks)**

OR

2 a. Show that polytropic efficiency for compressor is given by $\eta_p = \left(\frac{\gamma-1}{\gamma}\right)\times\left(\frac{n}{n-1}\right)$. **(08 Marks)**

b. Air enters a compressor at a static pressure of 1.5 bar, a static temperature of 15°C and a flow velocity of 15 m/s. At the exit the static pressure is 3 bar the static temperature is 100°C and the flow velocity is 100 m/s. The outlet is 1 m above the inlet. Evaluate :

i) The isentropic change in enthalpy

ii) The actual change in enthalpy and efficiency of the compressor. **(08 Marks)**

Module-2

3 a. Define utilization factor and write the expression. Derive relation between degree of reaction and utilization factor. **(08 Marks)**

b. The following data refers to a turbomachine. Inlet velocity of whirl = 16 m/s, velocity of flow = 10 m/s, blade speed = 33 m/s, outlet blade speed = 8 m/s. Discharge is radial with an absolute velocity of 16 m/s. If water is the working fluid flowing at the rate of 1 m^3/s. Calculate the following:

i) Power in KW

ii) Change in total pressure in kN/m^2

iii) Degree of reaction

iv) Utilization factor **(08 Marks)**

OR

4 a. Derive theoretical head capacity relation in case of centrifugal pumps.

$$H = \frac{u_2^2}{g_c} - \frac{u_2^2 Q \cot\beta_2}{A_2 g_c}$$

where β_2 discharge blade angle with respect to tangential direction. **(08 Marks)**

b. A hydraulic reaction turbine of the radial inward flow type works under a head of 160 m of water. At the point of fluid entry, the rotor blade angle is 119° and diameter of the runner is 3.65 m. At the exit, the runner diameter is 2.45 m. If the absolute velocity of the wheel outlet is radially directed with a magnitude of 15.5 m/s and the radial component of velocity at the inlet is 10.3 m/s. Find the power developed by the machine, assuming that the 88% of the available head of the machine is converted into work and the flow rate is 110 m^3/s. Find also the degree of reaction and the utilization factor. **(08 Marks)**

Module-3

5 a. Define compounding. List different types of compounding. Explain any one method of compounding with neat sketch showing variations of pressure and velocity of steam. **(08 Marks)**

b. The following particulars refer to a stage of a parsons steam turbine. Mean diameter of blade ring = 70 cm, steam velocity at inlet of moving blades = 160 m/s, outlet blade angles of moving blade $\beta_2 = 20°$. Steam flow through the blades = 7 kg/s and speed 1500 rpm, $\eta = 0.8$. Draw the velocity diagram and find the following: i) Blade inlet angle ii) Power developed in the stage iii) Available isentropic enthalpy drop. **(08 Marks)**

OR

6 a. Derive the condition for maximum efficiency of an impulse steam turbine and show that the maximum efficiency is $\cos^2\alpha_1$. **(08 Marks)**

b. In a stage of an impulse turbine provided with single row wheel, the mean diameter of the blade ring is 80 cm and speed of rotation is 3000 rpm. The steam issues from the nozzles with a velocity of 300 m/s and the nozzle angle is 20°. The rotor blades are equiangular and blade velocity coefficient is 0.85. What is the power developed in the blades when the axial thrust on the blade is 140 N. **(08 Marks)**

Module-4

7 a. Show that for a maximum efficiency of peltan wheel, the bucket velocity is equal to half of the jet velocity. **(08 Marks)**

b. A double over hung peltan wheel unit is to produce 30000 KW at the generator under an effective head of 300 m at base of the nozzle. Find the size of the jet, mean diameter of the runner, speed and specific speed of the each peltan turbine. Assume generator efficiency = 93%, peltan wheel efficiency = 0.85, speed ratio = 0.46, jet velocity coefficient = 0.97 and jet ratio 12. **(08 Marks)**

OR

8 a. Show that pressure at the exit of the reaction turbine with draft tube is less than atmospheric pressure. **(08 Marks)**

b. A Kaplan turbine produces 30000 KW under a head of 9.6 m, while running at 65.2 rpm. The discharge through the turbine is 350 m^3/s. The tip diameter of the runner is 7.4 m. The hub diameter is 0.432 times the tip diameter. Calculate: i) Turbine efficiency ii) Specific speed of the turbine iii) Speed ratio (based on tip diameter) iv) Flow ratio. **(08 Marks)**

Module-5

9 a. Show that pressure rise in impeller of a centrifugal pump when the frictional and other losses in impeller are neglected is given by $\frac{1}{2g}\left[v_{f_1}^2 + u_2^2 - v_{f_2}^2 \operatorname{cosec}^2\beta_2\right]$ where v_{f_1} and v_{f_2} are flow velocities at inlet and outlet of the impeller. u_2 = tangential speed of impeller at exit, β_2 = exit blade angle. **(08 Marks)**

b. A centrifugal pump has its impeller diameter 30 cm and a constant area of flow 210 cm^2. The pump runs at 1440 rpm and delivers 90 LPS against a head of 25 m. If there is no whirl velocity at entry, compute the rise in pressure head across the impeller and hydraulic efficiency of pump. **(08 Marks)**

OR

10 a. Explain the working principle of the axial flow compressor along with a neat sketch of compressor with inlet guide vane. **(08 Marks)**

b. A 4 stage centrifugal pump has 4 identical impellers keyed to the same shaft. Speed of the shaft is 500 rpm. Total manometric head developed from 4 impellers is 50 m. The width at exit is 5 cm and diameter at exit is 60 cm. Whirl velocity at exit is 10 m/s, radial flow velocity at exit is 2 m/s. Calculate: i) Discharge ii) Exit vane angle iii) Manometric efficiency. **(08 Marks)**

CBCS SCHEME

USN

15ME53

Fifth Semester B.E. Degree Examination, July/August 2021
Turbo Machines

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer any FIVE full questions.*
2. *Use of Thermodynamics Data Hand Book, Steam tables and Mollier chart permitted.*

1 a. Define a turbo machine. Mention any five differences between a turbo machine and a positive displacement machine. **(06 Marks)**

b. Define specific speed of a turbine. Explain its significance. **(03 Marks)**

c. A Francis turbine model is built to a scale of 1 : 5. The data for the model is P = 6 kW, N = 350 rpm, H = 3 m and for prototype H = 9 m. Assuming the overall efficiency of the model as 75%, calculate :
(i) Speed of the prototype (ii) Power of the prototype.
Use Moody's equation. **(07 Marks)**

2 a. Show that the polytropic efficiency for a compression process is given by $\eta_P = \left(\frac{n}{n-1}\right)\left(\frac{\gamma-1}{\gamma}\right)$ where γ is the ratio of specific heats and n is the index of compression. **(08 Marks)**

b. Air flows through an air turbine where its stagnation pressure is decreased in the ratio 5 : 1. Total-to-Total efficiency is 0.8. The air flow rate is 5 kg/s. If the total power output is 500 kW, find : (i) Inlet total temperature (ii) Actual exit total temperature (iii) Actual exit static temperature if the flow velocity is 100 m/s. (iv) Total-to-static efficiency. **(08 Marks)**

3 a. Define degree of reaction. Show that the relationship between the utilization factor $\in$ and the degree of Reaction R for an axial flow turbine is given by $\in = \frac{V_1^2 - V_2^2}{V_1^2 - RV_2^2}$ where V_1 and V_2 are the absolute velocity of fluid at inlet and outlet respectively. **(08 Marks)**

b. At a stage in a 50% degree of reaction axial flow turbine running at 3000 rpm, the blade mean diameter is 68.5 cm. If the maximum utilization factor for the stage is 0.915, calculate the inlet and outlet absolute velocities for the rotor assuming the velocity triangles at inlet and outlet to be symmetric. Find also the power output for a flow rate of 15 kg/s. **(08 Marks)**

4 a. Draw the velocity triangles for an axial flow compressor and show that for an axial flow compressor with no axial thrust, the degree of reaction is given by $R = \frac{V_a}{2u}\left[\frac{\tan\beta_1 + \tan\beta_2}{\tan\beta_1 \tan\beta_2}\right]$ where V_a = Axial flow velocity, u = Blade speed, β_1 and β_2 = Inlet and Outlet blade angles with respect to tangential direction. **(10 Marks)**

b. In a mixed flow compressor handling air at 16000 rpm, the stagnation temperature of air at compressor inlet and outlet are respectively 27°C and 215°C. The absolute velocity of air at the rotor inlet is axial while at the exit, the tangential component of absolute velocity is 0.93 times the tangential impeller speed. If the mass flow rate of air through the impeller is 15 kg/s and specific heat is assumed to be constant, find the impeller diameter and total power input. **(06 Marks)**

5 a. What do you mean by compounding of steam turbine? Explain with the help of a schematic diagram, a two row velocity compounded turbine stage. **(06 Marks)**

b. A single stage impulse wheel is supplied with super heated steam at 15 bar and 250°C, expands to 0.5 bar condenser pressure. The rotors are fitted with equi angular blades moving at 450 m/s. If the nozzle angle at the rotor inlet is 16° to the wheel plane, find the specific power output, blade efficiency, grass stage efficiency and direction of exit steam velocity. Assume nozzle efficiency as 94% and assume the relative velocities as equal. **(10 Marks)**

6 a. Show that the maximum blade efficiency of a Parson's reaction turbine is,

$$(\eta_b)_{max} = \frac{2\cos^2\alpha_1}{1+\cos^2\alpha_1}$$

where α_1 = nozzle angle at inlet. **(09 Marks)**

b. The following particulars refer to a Parson's reaction turbine consisting of one ring of fixed blades and one ring of moving blades. The mean diameter of the blade ring is 90 cm and its speed is 3000 rpm. The inlet absolute velocity to the blades is 350 m/s. The blade outlet angle is 20°. The steam flow rate is 7.2 kg/s. Calculate (i) The blade inlet angle (ii) Tangential force (iii) Power developed. **(07 Marks)**

7 a. With suitable velocity triangles, derive an expression for the maximum hydraulic efficiency of a Pelton wheel in terms of blade velocity co-efficient and outlet blade angle. **(08 Marks)**

b. A 137 mm diameter jet of water issuing from a nozzle impinges on the buckets of a Pelton wheel and the jet is deflected through an angle of 165° by the buckets. The head available at the nozzle is 400 m. Assuming coefficient of velocity as 0.97, speed ratio as 0.46 and reduction in the relative velocity while passing through the buckets as 15%, find (i) Force exerted by the jet on the buckets in the tangential direction (ii) theoretical power developed. **(08 Marks)**

8 a. List the functions of a draft tube in a reaction hydraulic turbine. Using Bernoulli's equation, show that the pressure head at the inlet of the draft tube is less than the atmospheric pressure head. **(06 Marks)**

b. The following data is given for a Francis turbine : Net head = 70 m, Speed = 600 rpm, Shaft power = 368 kW, Overall efficiency = 85%, hydraulic efficiency = 95%, Flow ratio = 0.25, Breadth ratio = 0.1, Outer diameter of the runner = 2 × inner diameter of the runner. Velocity of flow is constant at inlet and outlet. The thickness of the vanes occupies 10% of the circumferential area of the runner and the discharge is radial at outlet. Determine : (i) Guide blade angle (ii) Runner vane angles at inlet and outlet. (iii) Diameter of runner at inlet and outlet (iv) Width of the runner at inlet. **(10 Marks)**

9 a. What is Priming? Why priming is required in centrifugal pumps? **(03 Marks)**

b. Derive an expression for minimum starting speed of a centrifugal pump. **(06 Marks)**

c. A 4-stage centrifugal pump has impellers each of 38 cm diameter and 1.9 cm wide at outlet. The outlet vane angle is 45° and the vanes occupy 8% of the outlet area. The manometric efficiency is 84% and overall efficiency is 75%. Determine the head generated by the pump when running at 900 rpm discharging 59 litres/s of water. Also determine the power required. **(07 Marks)**

10 a. Explain the following with appropriate sketches :
(i) Surging (ii) Choking (iii) Pre-rotation. **(09 Marks)**

b. A centrifugal compressor runs at a speed of 15000 rpm and delivers 30 kg/s of air. The exit diameter is 70 cm. The relative velocity at exit is 100 m/s at an exit blade angle of 75°. Assume radial inlet. The inlet total temperature and pressure are 300 K and 1 bar respectively. Determine :
(i) Power required to drive the compressor (ii) Ideal head developed
(iii) Total exit pressure. **(07 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

15ME53

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Turbo Machines

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Distinguish between a Turbo Machine and a positive displacement machine. **(06 Marks)**

b. Define the specific speed of a turbine. **(02 Marks)**

c. A one-fifth scale model of a pump was tested in a laboratory at 1000rpm. The head developed and the power input at the best efficiency point were found to be 8m and 30kW respectively. If the prototype pump has to work against a head of 25m, determine its working speed, the power required to drive it and the ratio of the flow rates handled by the two pumps. **(08 Marks)**

OR

2 a. Define Mach number and explain with neat sketch: i) The subsonic flow ii) Sonic flow of a compressible fluid. **(08 Marks)**

b. An air compressor has eight stages of equal pressure ratio 1.3. The flow rate through the compressor and its overall efficiency are 45kg/s and 80% respectively. If the conditions of air at entry are 1 bar and 35°C determine: i) State of air at compressor exit ii) Polytropic efficiency iii) Stage efficiency. **(08 Marks)**

Module-2

3 a. Derive head-capacity relationship for centrifugal pump and explain the effect of discharge angle on it. **(08 Marks)**

b. At a 50% reaction stage axial flow turbine, the mean blade diameter is 60cm. The maximum utilization factor is 0.9, steam flow rate is 10kg/s. Calculate the inlet and outlet absolute velocities and power developed if the speed is 2000 rpm. **(08 Marks)**

OR

4 a. Show that ϵ_{max} of an axial flow turbine with degree of reaction = 1/4, the relationship of blades speed 'U' to absolute velocity at rotor inlet 'V_1' should be $\frac{U}{V_1} = \frac{2}{3}\cos\alpha$. Where '$\alpha$' is nozzle angle at inlet. **(08 Marks)**

b. A single stage axial flow blower with no inlet guide vanes, operates at 3600RPM. The tip and hub diameters of the rotors are 20cm and 12.5cm respectively. The air flow through the stage is 0.45kg/s. The air turned through an angle of 20° towards the axial direction during the passage through the rotor at the mean diameter. Assuming standard atmospheric conditions, constant axial velocity and no losses in the rotor. Compare i) The power input in kW ii) Degree of reaction. **(08 Marks)**

Module-3

5 a. Define degree of reaction. Prove that moving blades and final blades should have the same shape for a 50% reaction. **(08 Marks)**

b. Following data refers to a De Laval steam turbine having equiangular blades;
Blade speed = 20m/s, Blade velocity co-efficient = 0.85, Mass flow rate of steam = 3kg/s, Absolute velocity of steam at exit from stage = 90m/s, Angle of absolute velocity of steam at exit from stage with tangent of wheel = 75°, Determine i) The blade angle ii) The nozzle angle iii) Absolute velocity of steam at inlet iv) Power developed. **(08 Marks)**

OR

6 a. What is compounding of steam turbine? Explain pressure compounding of steam turbine with a neat sketch. **(08 Marks)**

b. In a 50% reaction turbine, the blade tips are inclined at 35° and 20° in the direction of motion. At a certain place in the turbine, the drum diameter is 1 meter and the blades are 10cm high. At this place the steam having specific volume of $0.938 m^3/kg$, passes through the blades without shock. Find the mass of steam flow and power developed of the speed of the turbine is 250rpm. **(08 Marks)**

Module-4

7 a. Explain the working of Francis turbine with a neat sketch. **(08 Marks)**

b. Determine the power given by the jet of water to the runner of a pelton wheel which is having tangential velocity as 20m/s. The net head on the turbine is 50m and discharge through the jet water is $0.03 m^3/s$. The side clearance angle is 15° and take $C_V = 0.975$. Find also the manometric efficiency. **(08 Marks)**

OR

8 a. Derive an expression for maximum efficiency of the pelton wheel giving the relationship between the jet speed and bucket speed. **(08 Marks)**

b. The external and internal diameters of an inward flow reaction turbine are 1.2m and 0.6m respectively. The head on the turbine is 22m and velocity of flow through the runner is constant and equal to 2.5m/s. The guide blade angle is given as 10° and the runner vanes are radial at inlet. If the discharge at outlet is radial determine : i) The speed of the turbine ii) The vane angle at outlet of the runner iii) Hydraulic efficiency. **(08 Marks)**

Module-5

9 a. Derive an expression for the minimum speed for starting a centrifugal pump. **(08 Marks)**

b. A three stage centrifugal pump has impellers 40cm in diameter and 2cm wide at outlet. The vanes area curved back at the outlet at 45° and reduce the circumferential area by 10%. The manometric efficiency is 90% and the overall efficiency is 80%. Determine the head generated by the pump when running at 1000rpm, delivering 50 litres per second. What should be the shaft power? **(08 Marks)**

OR

10 a. With neat sketch, explain slip, slip coefficient and slip factor. **(06 Marks)**

b. Explain phenomenon of surging. **(02 Marks)**

c. An axial flow compressor has the following data:
Entry conditions : 1 bar and 20°C
Degree of reaction : 50%
Mean blade ring diameter : 36cm
Rotational speed : 18000rpm
Blade angle at rotor and stator exit : 65°
Axial velocity : 180m/s
Mechanical efficient : 96.7%
Find: i) Blade angle at rotor and stator inlet ii) Power required. **(08 Marks)**

* * * * *

COURSE EXIT SURVEY

R NO.	USN	STUDENT NAME	17C303.1	17C303.2	17C303.3	17C303.4	17C303.5
A-1	3VC16ME007	ABHISHEK SINHA	5	5	5	5	5
A-2	3VC17ME001	AJAY REDDY N	5	5	5	5	5
A-3	3VC17ME002	AKASHA GOUDA H	5	5	5	5	5
A-4	3VC17ME003	ANIL KITTUR	5	5	5	5	5
A-5	3VC17ME004	BHARATHISHA A B	5	5	5	5	5
A-6	3VC17ME005	BHARGHAV R	5	5	5	5	5
A-7	3VC17ME006	C ESHWAR	5	5	5	5	5
A-8	3VC17ME007	DEEPAK PATIL S R	5	5	4	4	5
A-9	3VC17ME008	DODDA BASAVA B	5	5	5	5	5
A-10	3VC17ME009	DURJAYA K B	5	5	5	5	5
A-11	3VC17ME010	EARESH VARMA C	5	5	5	5	5
A-12	3VC17ME012	ERANAGOUDA K M	5	4	5	5	5
A-13	3VC17ME014	G RANJITH	5	5	4	5	5
A-14	3VC17ME016	G S SREE HARSHA	5	5	5	5	5
A-15	3VC17ME018	GANESH GOWDA M	5	5	5	5	5
A-16	3VC17ME019	GANESH J	5	4	5	5	5
A-17	3VC17ME020	GURUSIDDANA GOUDA B	4	5	4	5	5
A-18	3VC17ME021	HAMPANNA	5	5	5	5	5
A-19	3VC17ME022	HANUMESH	5	5	5	5	4
A-20	3VC17ME023	JAFERSADIQ M ABDUL KHADER BASHA	5	5	5	5	5
A-21	3VC17ME024	JAGADEESH	5	5	5	5	5
A-22	3VC17ME025	JEFFREY SUJAN KUMAR K	5	5	5	5	5
A-23	3VC17ME027	KADUBURU MATH PARIKSHITH	5	5	5	5	5
A-24	3VC17ME028	KAISARAHMED D	5	5	5	5	5
A-25	3VC17ME029	KARTHIK KUMAR D	5	5	4	4	5
A-26	3VC17ME030	KARTHIK R B	5	5	5	5	5
A-27	3VC17ME031	KIRAN MATH	5	5	5	5	5
A-28	3VC17ME032	LOKESHA NAIK	5	5	5	5	5
A-29	3VC17ME033	M CHAITANYA	5	5	5	5	4
A-30	3VC17ME041	MOHAMMED AZAM J	4	4	4	5	5
A-31	3VC17ME043	MOHAN E	5	5	5	5	5
A-32	3VC17ME046	NAVEEN SURAGOUNI	4	4	5	5	4
A-33	3VC17ME049	PAVAN KUMAR B	4	5	5	5	5
A-34	3VC17ME054	PAVITHRA R	5	4	5	4	4
A-35	3VC17ME081	VINAY KUMAR S	5	4	4	5	5
A-36	3VC18ME401	ANAND K R	5	5	5	4	4
A-37	3VC18ME402	ANIL KUMAR V	4	4	4	5	5
A-38	3VC18ME411	H M UDAY KUMAR	5	5	5	4	5
A-39	3VC18ME413	IMRAN ABDUL WAHEED BELGUMI	5	5	5	5	5

A-40	3VC18ME415	K VINAY KUMAR	4	5	5	5	5
A-41	3VC18ME418	KIRAN KUMAR D	4	5	4	5	5
A-42	3VC18ME420	KUMAR K	5	4	5	4	4
A-43	3VC18ME423	MADHUSUDHAN B	4	5	5	4	4
A-44	3VC18ME424	MAHANTESH H M	5	4	5	4	4
A-45	3VC18ME425	MANIKANTA K	4	5	4	4	5
A-46	3VC18ME431	MULLA ALTAF HUSSAIN	5	5	5	5	5
A-47	3VC18ME433	NISAR AHAMED K M	5	4	5	5	5
A-48	3VC18ME434	G PAVAN KALYAN	4	5	5	4	4
A-49	3VC18ME435	PAVITHRA K	4	4	5	5	4
A-50	3VC18ME441	SAGAR MP	4	5	4	4	5
A-51	3VC18ME443	SAMPATH KUMAR Y M	5	4	5	5	4
A-52	3VC18ME444	SANTOSH G	4	4	5	5	5
A-53	3VC18ME446	K SHIVA KUMAR	5	5	4	4	4
A-54	3VC18ME449	SHIVA SHANKAR ADUR	5	5	5	5	5
A-55	3VC18ME454	THIPPESWAMY B	5	5	5	4	4
A-56	3VC18ME455	THIPPESWAMY R	5	5	5	5	4
A-57	3VC18ME457	V SIDDHI VINAYAKA	5	5	5	5	5
A-58	3VC18ME459	VINOD KUMAR B	5	5	5	5	4
A-59	3VC18ME460	VISHWANATH H	4	5	4	4	5
A-60	3VC18ME461	VISHWANATH GOWDA K	5	5	5	4	4
A-61	3VC18ME462	VYSHNAVI	5	5	5	5	4
A-62	3VC18ME464	YESHWANTH D	5	5	5	5	5
A-63	3VC17ME425	S MUSHTAQ AHMED	5	5	5	5	4

RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

Department of Mechanical Engineering

COURSE SELF ASSESSMENT REPORT

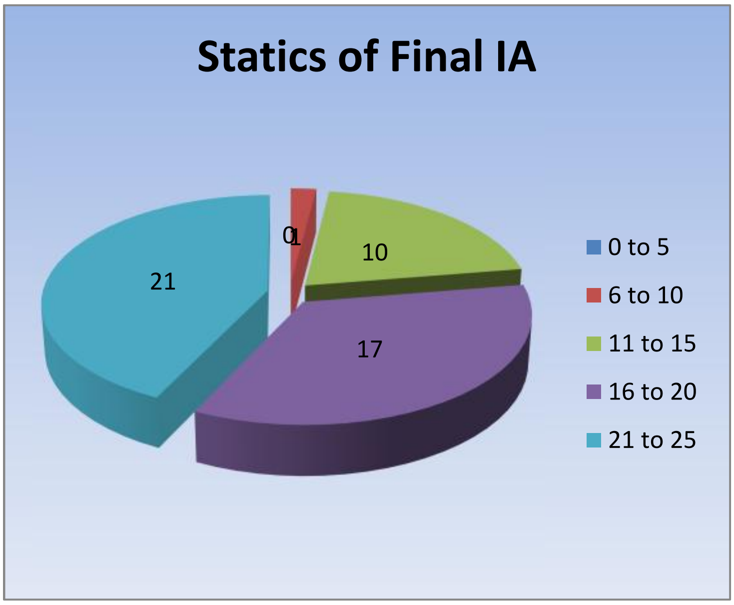
R NO.	USN	STUDENT NAME	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
A-1	3VC16ME007	ABHISHEK SINHA	5	5	5	5	5	5	5	5	5	5
A-2	3VC17ME001	AJAY REDDY N	5	5	5	5	5	5	5	5	5	5
A-3	3VC17ME002	AKASHA GOUDA H	5	5	5	5	5	5	5	5	5	5
A-4	3VC17ME003	ANIL KITTUR	5	5	5	5	5	5	5	5	5	5
A-5	3VC17ME004	BHARATHISHA A B	5	5	5	5	5	5	5	5	5	5
A-6	3VC17ME005	BHARGHAV R	5	5	5	5	5	4	5	5	5	5
A-7	3VC17ME006	C ESHWAR	5	5	4	5	5	5	5	5	5	5
A-8	3VC17ME007	DEEPAK PATIL S R	5	5	5	4	5	5	5	5	5	5
A-9	3VC17ME008	DODDA BASAVA B	5	5	5	5	5	5	5	5	5	5
A-10	3VC17ME009	DURJAYA K B	5	5	5	5	5	5	5	5	5	5
A-11	3VC17ME010	EARESH VARMA C	5	5	5	5	5	4	5	5	5	5
A-12	3VC17ME012	ERANAGOUDA K M	5	5	5	5	5	5	4	5	5	5
A-13	3VC17ME014	G RANJITH	5	4	5	5	5	5	5	4	5	5
A-14	3VC17ME016	G S SREE HARSHA	5	5	5	5	5	5	5	5	5	5
A-15	3VC17ME018	GANESH GOWDA M	5	5	4	5	5	5	5	5	5	5
A-16	3VC17ME019	GANESH J	5	5	5	5	5	5	5	5	5	5
A-17	3VC17ME020	GURUSIDDANA GOUDA B	5	5	5	5	5	5	5	4	5	5
A-18	3VC17ME021	HAMPANNA	5	5	5	5	3	5	5	5	5	5
A-19	3VC17ME022	HANUMESH	5	5	5	5	5	5	5	5	5	5
A-20	3VC17ME023	JAFERSADIQ M ABDUL KHADER BASHA	5	5	5	5	5	5	5	5	5	5
A-21	3VC17ME024	JAGADEESH	5	5	4	5	5	5	5	5	5	5
A-22	3VC17ME025	JEFFREY SUJAN KUMAR K	5	5	4	5	5	5	5	5	3	5
A-23	3VC17ME027	KADUBURU MATH PARIKSHITH	5	5	5	5	4	4	5	5	5	5
A-24	3VC17ME028	KAISARAHMED D	5	5	5	4	5	5	5	5	5	5
A-25	3VC17ME029	KARTHIK KUMAR D	5	4	5	5	5	5	5	5	5	5
A-26	3VC17ME030	KARTHIK R B	5	5	5	5	5	5	5	5	5	5
A-27	3VC17ME031	KIRAN MATH	5	5	4	4	3	5	5	5	5	5
A-28	3VC17ME032	LOKESHA NAIK	3	5	5	5	5	5	5	5	5	4
A-29	3VC17ME033	M CHAITANYA	5	5	5	5	5	5	5	5	5	5
A-30	3VC17ME041	MOHAMMED AZAM J	5	5	5	3	5	3	5	4	4	4
A-31	3VC17ME043	MOHAN E	5	5	5	5	5	5	5	5	5	5
A-32	3VC17ME046	NAVEEN SURAGOUNI	5	5	5	3	3	5	3	5	5	5
A-33	3VC17ME049	PAVAN KUMAR B	5	5	5	5	5	3	5	4	3	4
A-34	3VC17ME054	PAVITHRA R	4	5	5	4	5	5	5	5	5	5
A-35	3VC17ME081	VINAY KUMAR S	5	5	5	5	5	3	5	3	5	5
A-36	3VC18ME401	ANAND K R	5	5	5	5	5	5	5	5	3	5
A-37	3VC18ME402	ANIL KUMAR V	5	5	5	3	4	5	5	3	5	5
A-38	3VC18ME411	H M UDAY KUMAR	5	5	5	3	5	5	5	5	5	5

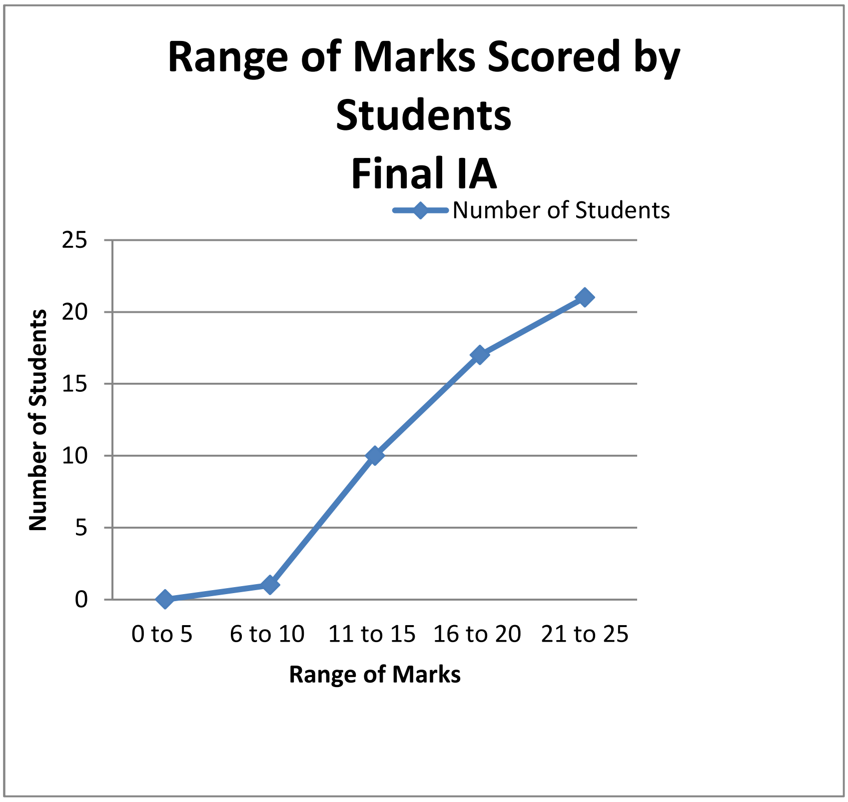
A-39	3VC18ME413	IMRAN ABDUL WAHEED BELGUMI	5	5	5	4	5	3	4	5	5	5
A-40	3VC18ME415	K VINAY KUMAR	4	4	5	4	5	5	4	3	3	5
A-41	3VC18ME418	KIRAN KUMAR D	5	5	4	5	5	4	5	5	3	5
A-42	3VC18ME420	KUMAR K	5	5	5	3	4	5	5	4	4	5
A-43	3VC18ME423	MADHUSUDHAN B	5	5	4	5	5	4	5	5	5	5
A-44	3VC18ME424	MAHANTESH H M	5	5	5	3	5	5	5	5	4	5
A-45	3VC18ME425	MANIKANTA K	5	4	4	5	5	5	5	5	5	5
A-46	3VC18ME431	MULLA ALTAF HUSSAIN	5	5	5	5	4	5	5	5	5	5
A-47	3VC18ME433	NISAR AHAMED K M	5	4	5	4	5	4	5	4	5	4
A-48	3VC18ME434	G PAVAN KALYAN	5	5	5	5	5	5	4	4	5	5
A-49	3VC18ME435	PAVITHRA K	5	4	5	4	4	4	5	5	4	5
A-50	3VC18ME441	SAGAR MP	4	5	4	5	4	5	5	5	5	5
A-51	3VC18ME443	SAMPATH KUMAR Y M	5	5	5	4	4	5	4	5	4	5
A-52	3VC18ME444	SANTOSH G	5	5	5	5	5	4	5	4	5	4
A-53	3VC18ME446	K SHIVA KUMAR	5	5	5	4	5	4	4	5	4	5
A-54	3VC18ME449	SHIVA SHANKAR ADUR	5	4	5	4	5	5	5	5	4	5
A-55	3VC18ME454	THIPPESWAMY B	4	5	5	5	5	5	5	5	5	5
A-56	3VC18ME455	THIPPESWAMY R	5	5	5	5	5	5	5	5	4	5
A-57	3VC18ME457	V SIDDHI VINAYAKA	5	5	5	4	3	5	5	5	5	5
A-58	3VC18ME459	VINOD KUMAR B	5	5	4	4	5	4	3	5	5	5
A-59	3VC18ME460	VISHWANATH H	4	5	5	4	3	5	4	3	4	5
A-60	3VC18ME461	VISHWANATH GOWDA K	5	5	5	5	5	5	5	5	4	5
A-61	3VC18ME462	VYSHNAVI	5	5	5	4	3	5	5	5	5	5
A-62	3VC18ME464	YESHWANTH D	5	5	4	4	5	4	3	5	5	5
A-63	3VC17ME425	S MUSHTAQ AHMED	4	5	5	4	3	5	4	3	4	5

FINAL RESULT ANALYSIS

TURBO MACHINE 2019-20

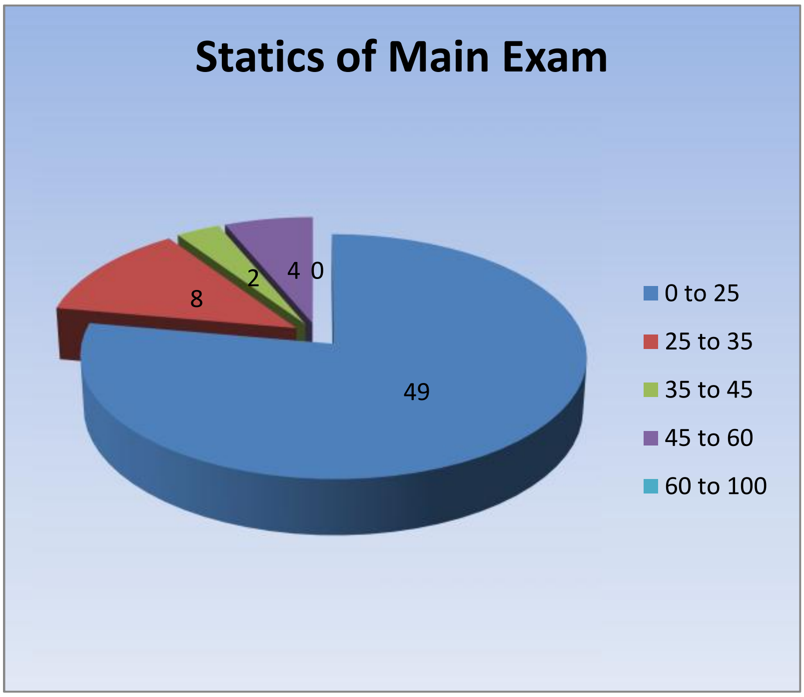
Statics of Main Exam		
Range of Marks Scored by Students		
Marks range	Number of Students	Percentage of Students
0 to 25	0	0
25 to 35	1	2
35 to 45	10	20
45 to 60	17	35
60 to 100	21	43
Total Number of Students	49	

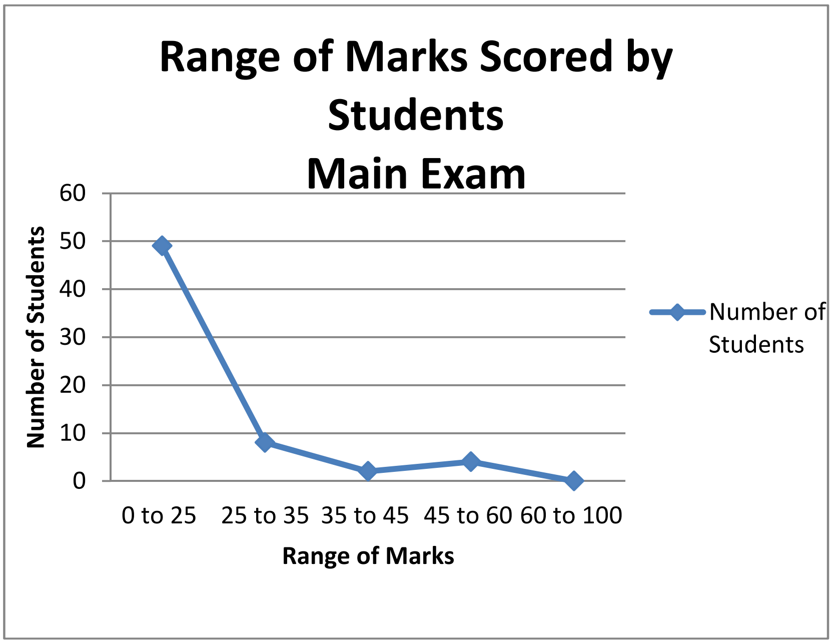



Range of Marks Scored by Students
Final IA
Number of Students
25
20
15
10
5
0
Number of Students
0 to 5
6 to 10
11 to 15
16 to 20
21 to 25
Range of Marks

TURBO MACHINE 2019-20

Statics of Final IA + Main Exam		
Range of Marks Scored by Students		
Marks range	Number of Students	Percentage of Students
0 to 49	49	78
50 to 62	8	13
62 to 75	2	3
75 to 87	4	6
87 to 125	0	0
Total Number of Students	63	




Range of Marks Scored by Students
Main Exam
60
50
40
30
20
10
0
Number of Students
0 to 25
25 to 35
35 to 45
45 to 60
60 to 100
Range of Marks
Number of Students

RAO BAHADUR Y MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI

DEPARTMENT OF MECHANICAL ENGNEERING

DIRECT ATTAINMENT 2019-20

Faculty: DR MANJUNATHA KONDEKAL **Code:** 17C303

Subject: TURBOMACHINES

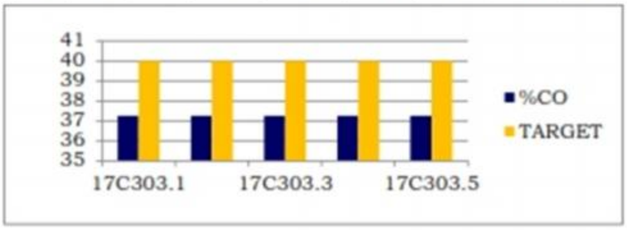
SEM: V **SEC:** A

COURSE OUTCOME STATEMENT	
17C303.1	Understand the basic quantities related to power absorbing and generating machines.
17C303.2	Comprehend thermodynamic relations applied to turbo machines.
17C303.3	Analyse the performance of steam turbines.
17C303.4	Evaluate the work interactions and characterstics of hydraulic turbines.
17C303.5	Intrepret the working of pumps and compressors.

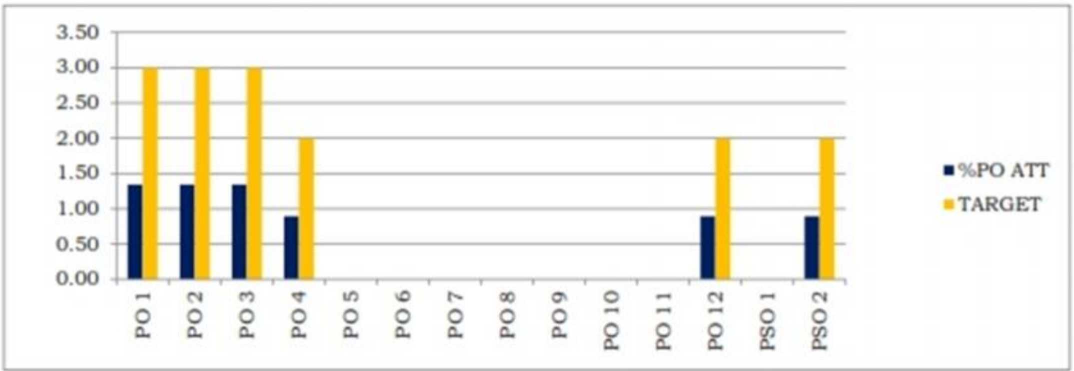
CO-PO/PSO Mapping

	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
17C303.1	3	3	0	2	0	0	0	0	0	0	0	2	0	0
17C303.2	3	3	0	2	0	0	0	0	0	0	0	2	0	0
17C303.3	3	3	3	2	0	0	0	0	0	0	0	2	0	2
17C303.4	3	3	3	2	0	0	0	0	0	0	0	2	0	2
17C303.5	3	3	3	2	0	0	0	0	0	0	0	2	0	2

	%CO	TARGET
17C303.1	37.25	40
17C303.2	37.25	40
17C303.3	37.25	40
17C303.4	37.25	40
17C303.5	37.25	40



	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
%PO ATT	1.34	1.34	1.34	0.89								0.89		0.89
TARGET	3	3	3	2								2		2



RAO BAHADUR Y MAHABALESWARAPPA ENGINEERING COLLEGE, BALLARI
DEPARTMENT OF MECHANICAL ENGINEERING
DIRECT AND INDIRECT ATTAINMENT 2019-20

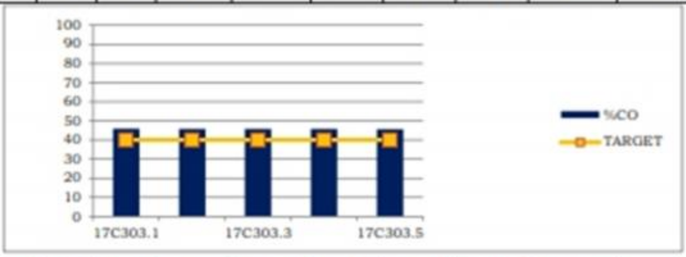
Faculty: DR MANJUNATHA KONDEKAL **Code:** 17C303
Subject: TURBOMACHINES
SEM: V **SEC:** A

COURSE OUTCOME STATEMENT	
17C303.1	Understand the basic quantities related to power absorbing and generating machines.
17C303.2	Comprehend thermodynamic relations applied to turbo machines.
17C303.3	Analyse the performance of steam turbines.
17C303.4	Evaluate the work interactions and characterstics of hydraulic turbines.
17C303.5	Intrepret the working of pumps and compressors.

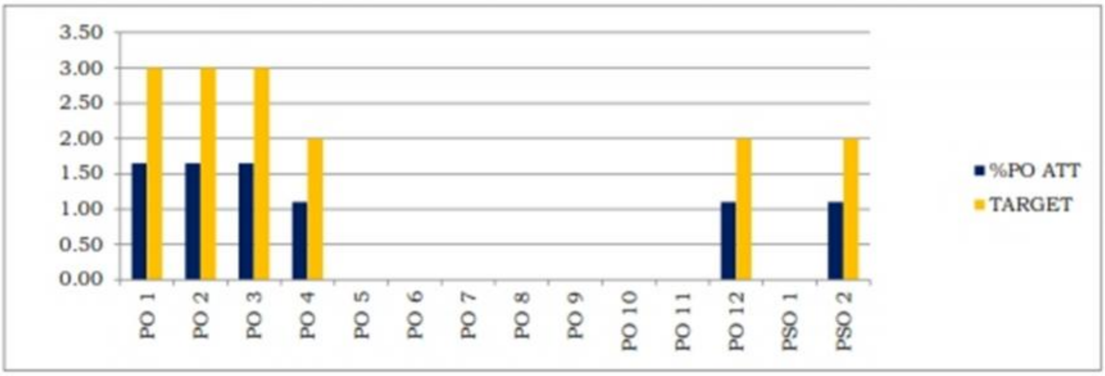
CO-PO/PSO Mapping

	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
17C303.1	3	3	0	2	0	0	0	0	0	0	0	2	0	0
17C303.2	3	3	0	2	0	0	0	0	0	0	0	2	0	0
17C303.3	3	3	3	2	0	0	0	0	0	0	0	2	0	2
17C303.4	3	3	3	2	0	0	0	0	0	0	0	2	0	2
17C303.5	3	3	3	2	0	0	0	0	0	0	0	2	0	2

	%CO	TARGET
17C303.1	46	40
17C303.2	45.76	40
17C303.3	45.83	40
17C303.4	45.82	40
17C303.5	45.75	40



	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
%PO ATT	1.65	1.65	1.65	1.10								1.10		1.10
TARGET	3	3	3	2								2		2



CO ATTAINMENT GAP ANALYSIS 2019-20

Course Outcomes	CO Direct Attainment =0.60(FE)+0.40(IA)	CO Target	CO Attainment Gap
17C303.1	37.25	40	2.75
17C303.2	37.25	40	2.75
17C303.3	37.25	40	2.75
17C303.4	37.25	40	2.75
17C303.5	37.25	40	2.75

ACTION REPORT ON GAP ANALYSIS

Course Outcomes	Action proposed to bridge the gap	Modification of target if achieved
17C303.1	Explained basics in depth to make students understand the Turbo machine concepts	-----
17C303.2	Assignments given on Turbo machines and problems	-----
17C303.3	Solved many VTU question paper problems to students	-----
17C303.4	Concentrated on self learning	-----
17C303.5	Asked students to present a topic as seminar	-----