Sir M.Visvesvaraya Institute of Technology

Bengaluru - 562157

Approved by AICTE | Affiliated to VTU Belagavi | Accredited by NAAC

Department of Mechanical Engineering

Course File

Name of the Faculty : Dr G. Balakumar **Name of the Subject with code** : RES BETCK/205E

Academic Year : 2023-24 **Semester and year** II/2023-24

Name of the Faculty : Mechanical Engg

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Signature of Staff

Signature of HOD

PROFESSOR & HEAD
Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Technology
Bengaluru-562 157

Sir M Visvesvaraya Institute of Technology

Bengaluru-562157

Department of Mechanical Engineering

Institute Vision and Mission Statements

Vision:

- To be a Centre of excellence in technical and management education concurrently focusing on disciplined and integrated development of personality through quality education, sports, cultural and co-curricular activities.
- To promote transformation of students into better human beings, responsible citizens and competent professionals to serve as a valuable resource for industry, work environment and society.

Mission:

- To impart quality technical education, provide state-of-art facilities, achieve high quality in teaching-learning & research and encourage extra & co-curricular activities.
- To stimulate in students a spirit of inquiry and desire to gain knowledge and skills to meet the changing needs that can enrich their lives.
- To provide opportunity and resources for developing skills for employability and entrepreneurship, nurturing leadership qualities, imbibing professional ethics and societal commitment.
- To create an ambience and nurture conducive environment for dedicated and quality staff to upgrade their knowledge & skills and disseminate the same to students on a sustainable long term basis.
- Facilitate effective interaction with the industries, alumni and research institutions.

PROFESSOR & HEAD

Department Vision, Mission, Program Educational Objectives (PEOs) & PSOs

Vision: To become a leading learning Center in Mechanical Engineering

Mission:

- Enrich the undergraduate experience through experimental learning, and fostering a personalized and supportive environment for their overall development.
- Provide opportunities to develop talented and committed human resource to meet the needs of profession and society.
- Provide research and intellectual resources to address contemporary and complex problems of industry and research.

Program Educational Objectives (PEOs)

After 3/4 years of graduation, the students will have the ability to

- Establish themselves as successful professionals either as individuals or in team, exhibiting leadership qualities to meet the goals of a project or organization.
- Analyze, design and solve problems related to Mechanical Engineering.
- Continuously enhance skills and technologies through self learning.
- Engage themselves in higher learning leading to degrees or certifications.

Program Specific Outcomes (PSOs) of the Mechanical Engineering Program

- An understanding of fundamentals, design and analysis procedures, thermal engineering, material aspects, manufacturing methods, management of resources of various kinds, and application of various modern tools / techniques to develop products/components related to mechanical engineering and allied fields.
- An ability to solve engineering problems and work in industry, R&D organizations and institutions of higher learning in mechanical engineering and related areas.

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Department of Mechanical Engineering

Program Outcomes (POs)

1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
4. **Conduct investigations of complex problems** using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
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 under- standing of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
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.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to owners own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
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.

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Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Technology
Bengaluru-562 157

SL.NO: 2

Subject Allotment

Academic Year	2023-24		
Faculty name	Dr G Balakumar		
Scheme	22	**Batch**	23
Semester	II	**Section**	E5
Course Name	Renewable Energy Sources – Emerging Technology Course (ETC)		
Course Code	BETCK205E		

Signature of Program Coordinator/HOD

PROFESSOR & HEAD
Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Technology
Bengaluru-562 157

Sri Krishnadevaraya Educational Trust
Sir M. Visvesvaraya Institute of Technology, Bengaluru-562 157
Department of Mechanical Engineering

SL.NO: 3

COURSE INFORMATION SHEET

Course Name / Code	RENEWABLE ENERGY SOURCES / BETCK /205E		
Degree / Branch	B.E / EEE/ ISE / ME /		
Course Credit	03		
Course Category	Emerging Technology Course (ETC)		
Course Teacher Contact Details	**Course Teacher Name**	**Contact Details**	
		Mobile	**E-mail**
	Dr G Balakumar	9886753589	drgbalakumar_mech@sirmvit.edu
Head of the Department	Dr. K S Shanmukharadhya		

Academic Calendar for EVEN Semester of UG programs for the year 2023-24

	II semester B.E./B.Tech	II semester B.Plan/B.Arch/ B.Des	II semester B.Sc(Hons)	IV semester B.Arch.	IV semester B.Plan	VI Semester B.Arch.	VI semester B. Plan
Commencement of the Semester	06.03.2024	06.03.2024	04.03.2024	04.03.2024	04.03.2024	26.02.202	06.03.2024
Internship / Students Induction Program	---	---	---	---	---	---	---
Commencement of Classes	06.03.2024	06.03.2024	06.03.2024	06.03.2024	06.03.2024	26.02.2024	06.03.2024
Last Working day of theSemester	29.06.2024	29.06.2024	29.06.2024	29.06.2024	29.06.2024	22.06.2024	29.06.2024
Practical Examination	01.07.2024 To 11.07.2024	01.07.2024 To 11.07.2024	01.07.2024 To 06.07.2024	01.07.2024 To 06.07.2024	01.07.2024 To 06.07.2024	25.07.2024 To 31.07.2024	01.07.2024 To 06.07.2024
Theory Examinations	15.07.2024 To 10.08.2024	15.07.2024 To 10.08.2024	08.07.2024 To 27.07.2024	08.07.2024 To 27.07.2024	08.07.2024 To 02.08.2024	08.07.2024 To 02.08.2024	08.07.2024 To 02.08.2024
Internship/Practical Exam for Lateral Entry Students	---	---	---	---	03.08.2024 To 31.08.2024	---	03.08.2024 To 31.08.2024
Internship Viva Voce/ Project viva	---	---	---	---	---	---	---
Commencement of NEXT Semester	19.08.2024	19.08.2024	19.08.2024	05.08.2024	02.09.2024	05.08.2024	02.09.2024

REGISTRAR
Visvesvaraya Technological University
BELAGAVI.

Sir M. Visvesvaraya Institute of Technology

Physics Cyc

w.e.f 06-03-202

Day	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 12:40 PM	12:40 PM to 01:35 PM	01:35 PM to 02:30 PM	02:30 PM to 03:25 PM	03:25 P to 04:20 P
Monday	**BIDTK258 - Innovation and Design Thinking (Lecture)** {Dr. CVM} [B-209]	**BMATE201 - Mathematics-II for Electrical & Electronics Engineering Stream (Lecture)** {RNS} [B-209]	TEA BREAK	**BESCK204B - Introduction to Electrical Engineering (Lecture)** {Bt} [B-209] **BESCK204B - Introduction to Electrical Engineering (Lecture)** {Siddhu} [B203] **BESCK204B - Introduction to Electrical Engineering (Lecture)** {Pkjk}	LUNCH BREAK	**BPWSK206 - Professional Writing Skills in English (Lecture)** {Mr. Vishwas U M} [B-209]	**BPHYE202 - Applied Physics for EEE Stream (Lecture)** {Jaya} [B-209]		
Tuesday	**BKBKK207 - Balake Kannada (Lecture)** {Mr. PRASHANTHA B B} **BKSKK207 - Samskrutika Kannada (Lecture)** {Ramkumar}	**BMATE201 - Mathematics-II for Electrical & Electronics Engineering Stream (Lecture)** {RNS} [B-209]	TEA BREAK	**BPHYE202 - Applied Physics for EEE Stream (Lecture)** {Jaya} [B-209]	LUNCH BREAK	**BEEE203 - Elements of Electrical Engineering (Lecture)** {Dr. Ashwini A V} [B209]	**BMATE201 - Mathematics-II for Electrical & Electronics Engineering Stream (Lecture)** {RNS} [B-209]	**LG ACTIVITY**	
ednesday		Batch-1 **BPHYE202 - Applied Physics for EEE Stream (Lab)** {NP, Ms. Likhitha N} [B-209] Batch-2 **BMATE201 - Mathematics-II for Electrical & Electronics Engineering Stream (Lab)** {Vasu, Ms. Niveditha C N}			LUNCH BREAK	**BESCK204B - Introduction to Electrical Engineering (Lecture)** {Pkjk} **BESCK204B - Introduction to Electrical Engineering (Lecture)** {Siddhu} [B203] **BESCK204B - Introduction to Electrical Engineering (Lecture)** {Bt} [B-209]	**FORUM / CLUB ACTIVITY**		
hursday	Batch-1 **BMATE201 - Mathematics-II for Electrical & Electronics Engineering Stream (Lab)** {Deepthi, Mr. Harish K C} [B-209] Batch-2 **BPHYE202 - Applied**		TEA BREAK	**BPHYE202 - Applied Physics for EEE Stream (Lecture)** {Jaya} [B-209]	LUNCH BREAK		**BMATE201 - Mathematics-II for Electrical & Electronics Engineering Stream (Lecture)** {RNS} [B-209]	**BEEE203 - Elements of Electrical Engineering (Lecture)** {Dr. Ashwini A V} [B209]	**LIBRAR**

	to 09:55 AM	to 10:50 AM	to 11:00 AM	to 11:55 AM	to 12:40 PM	to 01:35 PM	to 02:30 PM	to 03:25 PM	to 04:20 P
	(Lab) {NP, Ms. Likhitha N}								
Friday		**BPHYE202 - Applied Physics for EEE Stream (Lecture)** {Jaya} [B-209]	TEA BREAK	**BESCK204B - Introduction to Electrical Engineering (Lecture)** {Pkjk} **BESCK204B - Introduction to Electrical Engineering (Lecture)** {Siddhu} [B203] **BESCK204B - Introduction to Electrical Engineering (Lecture)** {Bt} [B-209]	LUNCH BREAK	**BEEE203 - Elements of Electrical Engineering (Lecture)** {Dr. Ashwini A V} [B209]	**LG ACTIVITY**	**LIBRARY**	

e: S[redacted] || BE || 2D - EE || EVEN TERM || 2023 - 24

ision: 2D - EE

Batch:
ch 1: Roll No. 1 to 29 | Batch 2: Roll No. 30 to 57

ted On : 31-07-2024 09:52 AM

Sri Krishnadevaraya Educational Trust

Sir M. Visvesvaraya Institute of Technology, Bengaluru

Department of Mechanical Engineering

Date: 13-03-2024

SL.NO: 6

STUDENT LIST

Subject	Code	Semester	Branch	Academic Year
Renewable Energy Sources	BETCK/205E	II	EEE/ISE/ME	2023-24 / Even

Sl. No.	USN	NAME
1	1MV23IS099	Shaurya Sanjeev
2	1MV23IS100	Shreya VR
3	1MV23IS100	Shloka Mandal
4	1MV23IS101	Shreyas R
5	1MV23IS102	Shrishail Balageri
6	1MV23IS103	Shubha nandini B M
7	1MV23IS107	Sudeep Ghatnatti
8	1MV23IS108	Suhan S Shetty
9	1MV23IS109	Suraj K S
10	1MV23IS112	Tanmayi P
11	1MV23IS113	Tanvi
12	1MV23IS114	Tejashwini K P
13	1MV23IS116	Utkarsh ojha
14	1MV23IS117	Utkarsh Yadav
15	1MV23IS118	Varun Kumar K
16	1MV23IS119	Venu R
17	1MV23IS120	Vijay kumar
18	1MV23IS124	Vishrutha M J
19	1MV23IS125	Yashaswini U G
20	1MV23IS126	Yathish M
21	1MV23ISO70	Nisarga T.A
22	1MV23ME002	Achintya
23	1MV23ME003	Akhil
24	1MV23ME004	Ankit Purkayastha
25	1MV23ME005	Arjun Matnalli
26	1MV23ME008	BINDUSHREE T M
27	1MV23ME009	C V SUDHANVA RAO
28	1MV23ME011	D.Salma

29	1mv23me012	Darshan e gowda
30	1MV23ME015	Dheeraj Varma Muppala
31	1MV23ME016	Ganesh.Y
32	1MV23ME020	Himanshu Singh
33	1MV23ME021	Koushik B R
34	1MV23ME026	
35	1MV23ME027	Neeraj Kumar
36	1MV23ME030	Preet Priyasi
37	1MV23ME031	Premalatha K
38	1MV23ME033	Rakesh Shetty
39	1MV23ME034	Santosh
40	1MV23ME035	SARAN SK
41	1MV23ME036	Shikhar Mishra
42	1MV23ME042	Tushar Sugandhi
43	1MV23ME043	Ujjwal Kumar Singh
44	1MV23ME045	VIJAY N
45	1MV23ME049	Vinod Chandrashekhar Hugar
46	1MV23ME051	Vishal
47	1MV23ME053	Yashwanth kumar bs
48	1mv23EE099	Sudhanshu Kumar Singh
49	1MV23EE100	Suryansh Raj
50	1MV23EE102	Swetha DE
51	1MV23EE104	Tejas V
52	1MV23EE105	Tuhin Patgiri
53	1MV23EE106	V AKHILA
54	1MV23EE107	Vandana H M
55	1MV23EE109	VEDANT
56	1MV23EE110	VEERABHADRAYYA MATHAPATI
57	1MV23EE113	Vishwanath vastrad
58	1MV23EE114	Taraka Adithya Yellelli

Dr G Balakumar
Associate Professor

HoD

PROFESSOR & HEAD
Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Technology
Bengaluru-562 157

RENEWABLE ENERGY SOURCES			
Course Code:	BETCK105E/205E	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Course objectives

- To understand energy scenario, energy sources and theirutilization.
- To explore society's present needs and future energy demands.
- To Study the principles of renewable energy conversionsystems.
- To exposed to energy conservation methods.

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Use pie chart showing distribution of renewable energy sources
2. Use wind turbine models
3. Use sun path diagrams

Module-1 (08 hours)

Introduction: Principles of renewable energy; energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE).

Module-2 (08 hours)

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder.Solar Thermal systems: Flat plate collector; Solar distillation; Solar pond electric power plant.

Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system.

Module-3(08 hours)

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and muliblade system. Vertical axis- Savonius and darrieus types.

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft) .

Module-4(08 hours)

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations.

Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC.

Module-5 (08 hours)

Green Energy: Introduction, Fuel cells: Classification of fuel cells – H_2; Operating principles, ZeroenergyConcepts.Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	Describe the environmental aspects of renewable energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
CO2	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation.
CO3	Understand the conversion principles of wind and tidal energy
CO4	Understand the concept of biomass energy resources and green energy.
CO5	Acquire the basic knowledge of ocean thermal energy conversion and hydrogen energy.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

Three Tests each of 20 Marks;

- 1st, 2nd, and 3rd tests shall be conducted after completion of the syllabus of 30-35%, 70-75%, and 90-100% of the course/s respectively.
- Assignments/Seminar/quiz/group discussion /field survey & report presentation/ course project/Skill development activities, suitably planned to attain the COs and POs for a total of 40 Marks.

  If the nature of the courses requires assignments/Seminars/Quizzes/group discussion two evaluation components shall be conducted. If course project/field survey/skill development activities etc then the evaluation method shall be one.

Total CIE marks (out of 100 marks) shall be scaled down to 50 marks

Semester End Examination (SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

- The question paper shall be set for 100 marks. The medium of the question paper shall be English). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks.**
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

Semester End Examination(SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.

Suggested Learning Resources:

Text Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Nonconventional Energy sources, G D Rai, Khanna Publication, Fourth Edition,
2. Energy Technology, S.Rao and Dr. B.B. Parulekar, Khanna Publication.Solarenergy, SubhasPSukhatme, TataMcGrawHill, 2nd Edition,1996.

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Reference Books:

1. Principles of Energy conversion, A. W. Culp Jr.,, McGraw Hill, 1996
2. Non-Convention EnergyResources, Shobh Nath Singh, Pearson, 2018

Web links and Video Lectures (e-Resources):

- E-book URL:https://www.pdfdrive.com/non-conventional-energy-sources-e10086374.html
- E-book URL:https://www.pdfdrive.com/non-conventional-energy-systems-nptel-d17376903.html
- E-book URL: https://www.pdfdrive.com/renewable-energy-sources-and-their-applications- e33423592.html
- E-book URL: https://www.pdfdrive.com/lecture-notes-on-renewable-energy-sources-e34339149.html
- https://onlinecourses.nptel.ac.in/noc18_ge09/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Poster presentation on the theme of renewable energy sources
- Industry Visit

COs and POs Mapping (Individual teacher has to fill up)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

	SIR M VISVESVARAYA INSTITUTE OF TECHNOLOGY BANGALORE	RECORD FORMATS (ISO 9008-2001)
	R/PP 04/04	LESSON PLAN

DEPARTMENT OF MECHANICAL ENGINEERING

SUBJECT: Renewable Energy Sources **SEMESTER: II**
SUB CODE: BETCK/205E **SECTION: E**

WEEK	DATE FROM	DATE TO	TOPICS PLANNED	CO'S
1	13/3/2024	15/3/2024	**Module-1** Principles of renewable energy; energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability	CO1/ CO2
2	20/3/2024	22/3/2024	renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy	
3	27/3/2024	29/3/2024	Wave energy, ocean thermal energy, biomass energy, geothermal energy, oilshale. Introduction to Internet of energy (IOE).	
4	03/4/2024	05/4/2024	**Module-2** Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces;	
5	10/4/2024	12/4/2024	Solar distillation; Solar pond electric power plant. Solar radiation Measurements Pyrheliometers, Pyrometer Sunshine Recorder. Solar Thermal systems: Flat plate collector. Introduction to Solar electric power generation	CO3
6	17/4/2024	19/4/2024	Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system	
7	24/4/2024	26/4/2024	**Module-3** **Wind Energy**: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power	
	08/5/2024	10/5/2024	Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and muliblade system. Vertical axis- Savonius and darrieus types.	
8	15/5/2024	17/5/2024	**TEST-1**	CO3
9	22/5/2024	24/5/2024	**Biomass Energy**: Introduction Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft	
10	29/5/2024	31/5/2024	**Module-4** **Tidal Power**: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations. .	
11	05/6/2024	07/6/2024	**Ocean Thermal Energy Conversion:** Principle of working, OTEC power stations in the world, problems associated with OTEC	CO4

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12	12/6/2024	14/6/2024	**Module-5** **Green Energy**: Introduction, Fuel cells: Classification of fuel cells – H_2; Operating principles, .	
13	05/6/2024	07/6/2024	Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only)	
14	12/06/2024	14/6/2024	hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy	CO4
15	19/06/2024	21/06/2024	**REVISION ON QUESTION PAPERS**	
16	26/06/2024	28/06/2024	TEST-2	

Prepared By: Dr G Balakumar Designation: Associate Professor Signature:	Approved By: Dr K S Shanmukharadhya Designation: Professor & HOD Signature:

PROFESSOR & HEAD
Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Technology
Bengaluru-562 157

SL.NO: 9 Evaluation Pattern for the course

CONTINUOUS INTERNAL EVALUATION (CIE)

Subject	Code	Semester	Branch	Academic Year
Renewable Energy Sources	BETCK/205E	II	EEE/ISE/ME	2023-24 / Even

Internal Test 25 Marks	Assignments 05 Marks	Quiz 20 Marks	
Average of two T1 +T2	Average of two	01	**Total CIE 50 Marks**

Dr G Balakumar
Associate Professor

HoD

PROFESSOR & HEAD
Department of Mechanical Engineering
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Bengaluru-562 157

SL.NO: 10 CO-PO-PSOs Mapping and justification

1. NAME OF THE FACULTY: Dr G BALAKUMAR

BATCH: 2023 SCHEME: 22 SECTION/BRANCH: EEE/IS/ME

Year of Study: 2 0 2 4

Subject & Code: BETCK205/E RENEWABLE ENERGY SOURCES

1. POs CORRELATION AND PSOs CORRELATION

Sl. No	NBA Course Code	VTU Course Code	Course Name	POs Correlation	PSOs Correlation
1	C205	TCK205/E	Renewable Energy Sources	PO1, PO7 & PO12	PSO1 & PSO2

2. COURSE OUTCOMES (CO)

COs	Semester: II Year of Study: 2023-24
1	Summarize the sources of renewable energy
2	Describe of solar energy utilization for heating and electric power generation
3	Explain the technology involved in the conversion of wind-energy, tidal energy and biomass into electrical energy
4	Discuss on the scientific concepts involved in green energy

3. CO-PSO MAPPING MATRICES

Semester: II									Year of Study:2024			
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**P09**	**PO10**	**PO11**	**PO12**
C205.1	2						3					2
C205.2	2						3					2
C205.3	2						3					2
C205.4	2						3					2
C205	**2**						**3**					**2**

4. CO-PSO MAPPING MATRICES (APPLIES ONLY FOR MECHANICAL STUDENTS)

Semester: II	Year of Study:2024	
CO	**PSO1**	**PSO2**
C205.1	1	1
C205.2	1	1
C205.3	1	1
C205.4	1	1
C205	1	1

5. CO-PO MAPPING JUSTIFICATION

CO	Explanation
C205.1	**Moderately mapped to PO1:** The related CO contributes towards understanding of engineering fundamentals. **Strongly mapped to PO7:**Understanding the impact on usage of renewable energy sources in the environmental context (does not pollute the environment) **Moderately mapped to PO12:** Recognize the need for renewable energy in life-time on the context of technological impact on the environment
C205.2	**Moderately mapped to PO1:** The related CO contributes towards understanding of engineering fundamentals. **Strongly mapped to PO7:**Understanding the impact on usage of renewable energy sources in the environmental context (does not pollute the environment) **Moderately mapped to PO12:** Recognize the need for renewable energy in life-time on the context of technological impact on the environment
C205.3	**Moderately mapped to PO1:** The related CO contributes towards understanding of engineering fundamentals. **Strongly mapped to PO7:**Understanding the impact on usage of renewable energy sources in the environmental context (does not pollute the environment) **Moderately mapped to PO12:** Recognize the need for renewable energy in life-time on the context of technological impact on the environment
C205.4	**Moderately mapped to PO1:** The related CO contributes towards understanding of engineering fundamentals. **Strongly mapped to PO7:**Understanding the impact on usage of fuel cells in-

	terms of environmental context (does not pollute the environment) **Moderately mapped to PO12:** Recognize the need for usage of fuel cells in real-time applications

6. CO-PSO MAPPING JUSTIFICATION

CO	Explanation
C205.1	**Slightly mapped to PSO1:** The related CO contributes towards understanding of engineering fundamentals in renewable energy sources. **Slightly related PSO2:** The related CO contributes to work in related industries/ R&D centres/ take-up higher studies in same domain
C205.2	**Slightly mapped to PSO1:** The related CO contributes towards understanding of engineering fundamentals in renewable energy sources. **Slightly mapped to PSO2:** The related CO contributes to work in related industries/ R&D centres/ take-up higher studies in same domain
C205.3	**Slightly mapped to PSO1:** The related CO contributes towards understanding of engineering fundamentals in renewable energy sources. **Slightly mapped to PSO2:** The related CO contributes to work in related industries/ R&D centres/ take-up higher studies in same domain
C205.4	**Slightly mapped to PSO1:** The related CO contributes towards understanding of engineering fundamentals in renewable energy sources. **Slightly mapped to PSO2:** The related CO contributes to work in related industries/ R&D centres/ take-up higher studies in same domain

7. CO-PO ATTAINMENT MATRICES:

Semester: II										Year of Study:2024		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**P09**	**PO10**	**PO11**	**PO12**
C205.1												
C205.2												
C205.3												
C205.4												
C205												

8. CO-PSO ATTAINMENT MATRICES

Semester: II		Year of Study:2024
CO	**PSO1**	**PSO2**
C205.1		
C205.2		
C205.3		
C205.4		
C205		

Course Coordinators	**Module Coordinators**	
1. Dr G Balakumar		**HOD, ME**

PROFESSOR & HEAD
Department of Mechanical Engineeri
Sir M. Visvesvaraya Institute of Techor
Bengaluru-562 157

SL.NO: 13 Gaps in the curriculum as identified during the introduction of new scheme

1. Design & Analysis in the of solar energy systems
2. Design & Analysis in the wind energy systems
3. Design & Analysis in the Tidal energy systems
4. Design & Analysis in the Ocean Thermal energy (OTE) systems

PO2	**Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences
PO3	**Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations

Dr G Balakumar
Associate Professor

HoD

PROFESSOR & HEAD
Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Technology
Bengaluru-562 157

SL NO: 14 Topics Beyond Syllabus to bridge the Gaps in the Curriculum

1. Design & analysis in the of solar energy systems
2. Design & analysis in the wind energy systems,
3. Design & analysis in the Tidal energy systems
4. Design & analysis Ocean Thermal energy system

Dr G Balakumar
Associate Professor

HoD

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Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Techonolgy
Bengaluru-562 157

Date | 17 | 05 | 2024 | Subject Code | BETCK205E |

USN | 1 | M | V | | | | | | | |

Sir M. Visvesvaraya Institute of Technology
Bangalore 562 157
INTERNAL TEST PAPER

TEST NO : I SEM : II COURSE / BRANCH : BE MAX. MARKS : 25 DURATION : 60 Min

SUBJECT : Renewable Energy Sources / BETCK205E Faculty Name : Dr Balakumar / Shivakumar S / Kumar swamy R/ Vyshnavi D R /Sriram M

Instructions: Answer any one Question from each PART

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating)

CO – Course Outcomes PO – Program Outcomes; PI – Performance Indicator

Q.No	Questions	Marks	CO	BL	PO	PI
	PART A					
1	a) Discuss on the principles of renewable energy sources.	6.0	1	2	1	1.3.1
	b) With a neat sketch explain the principle of solar pond.	6.5	1	2	1	1.3.1
	OR					
2	a) Summarize with renewable energy availability in India	6.0	1	2	1	1.3.1
	b) Explain generation of Electricity with wind mill and lists the advantages and disadvantages.	6.5	1	2	1	1.3.1
	PART B					
3	a) Explain the principle of photovoltaic cell.	6.0	2	3	1	1.3.1
	b) Explain the working principle of flat-plate solar collector.	6.5	2	3	1	1.3.1
	OR					
4	a) Explain the principle of Pyrheliometer.	6.0	2	3	1	1.3.1
	b) Explain the working principle of sun-shine recorder	6.5	2	3	1	1.3.1

CO1: Summarize the sources of renewable energy

CO2: Describe of solar energy utilization for heating and electric power generation

***

Verified by
OPSC Member

Approved By
HOD

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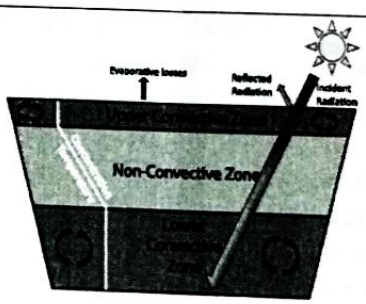
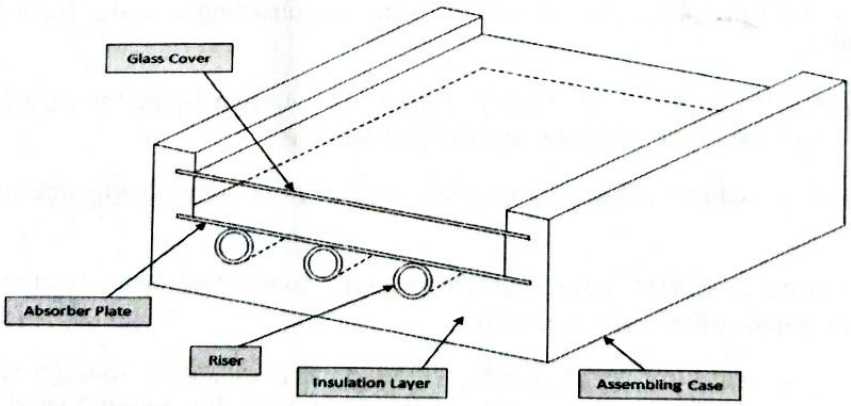
SIR M VISVESVARAYA INSTITUTE OF TECHNOLOGY, Bengaluru - 562 157
DEPARTMENT OF MECHANICAL ENGINEERING

Name of Faculty: Dr. GB/SS/KS/SM/VDR	**SEM: 2nd**
Subject: Renewable Energy Sources	**Sub Code: BETCK205E**

Q.NO.	SCHEME & SOLUTION	MARKS
1a	Principles of Renewable energy sources Any 6 principles of RES (1x6=6)	06
1b	**Sketch of Solar Pond (2 Marks)**  **WORKING OF SOLAR POND (EXPLANATION) (4. 5M)** The key characteristic of solar ponds that allow them to function effectively as a solar energy collector is a salt-concentration gradient of the water. This gradient results in water that is heavily salinated collecting at the bottom of the pond, with concentration decreasing towards the surface resulting in cool, fresh water on top of the pond. This collection of salty water at the bottom of the lake is known as the "storage zone", while the freshwater top layer is known as the "surface zone". The overall pond is several meters deep, with the "storage zone" being one or two meters thick. These ponds must be clear for them to operate properly, as sunlight cannot penetrate to the bottom of the pond if the water is murky. When sunlight is incident on these ponds, most of the incoming sunlight reaches the bottom and thus the "storage zone" heats up. However, this newly heated water cannot rise and thus heat loss upwards is prevented. The salty water cannot rise because it is heavier than the fresh water that is on top of the pond, and thus the upper layer prevents convection currents from forming.	(2+4. 5)
2 a	As of Mar 2024, Renewable energy sources, including large hydropower, have a	

	combined installed capacity of 190.57 GW. The following is the installed capacity for Renewables: Wind power: 45.88 GW, Solar Power: 81.81 GW, Biomass/Co-generation: 10.35 GW Small Hydro Power: 5 GW, Waste To Energy: 0.58 GW, Large Hydro: 46.92 GW India has set a target to reduce the carbon intensity of the nation's economy by less than 45% by the end of the decade, achieve 50 percent cumulative electric power installed by2030 from renewables, and achieve net-zero carbon emissions by 2070. India aims for 500 GW of renewable energy installed capacity by 2030. (Explanation of Above points)	**06**
2 b	Sketch of Wind mill and Explanation (2M+2M) Advantages and disadvantages (3 each)	**4** **2. 5**
3 a	The **photovoltaic effect** is a process that generates voltage or electric current in a photovoltaic cell when it is exposed to sunlight. These solar cells are composed of two different types of semiconductors—a p-type and an n-type—that are joined together to create a **p-n junction**. By joining these two types of semiconductors, an electric field is formed in the region of the junction as electrons move to the positive p-side and holes move to the negative n-side. This field causes negatively charged particles to move in one direction and positively charged particles in the other direction.[5] Light is composed of photons, which are simply small bundles of electromagnetic radiation or energy. When light of a suitable wavelength is incident on these cells, energy from the photon is transferred to an electron of the semiconducting material, causing it to jump to a higher energy state known as the conduction band. In their excited state in the conduction band, these electrons are free to move through the material, and it is this motion of the electron that creates an electric current in the cell.	**06**
3b.	 Flat–plate solar collector (sketch- 3M) Flat–plate solar collector is a unique type of heat exchangers. It receives energy from a far radiation source (sun) and converts the irradiance into useful thermal energy in the form of hot working fluid (water or air). Flat–plate collectors are usually used in	**03**

	low to medium temperature applications rarely exceeding 100°C. They can be water or air collectors. The solar radiation does not undergo any concentration in flat-plate collectors. Parts of a typical flat-plate collector 1) Absorber metal plate: 2) Transparent cover:3) Working fluid pipes:4) Insulation layer 5) Assembling case **(Explanation of Above)**	**3. 5**
4 a	The pyrheliometer is one type of instrument, used to measure the direct beam of solar radiation at the regular occurrence. This instrument is used with a tracking mechanism to follow the sun continuously. It is responsive to wavelengths bands that range from 280 nm to 3000 nm. The units of irradiance are W/m². These instruments are specially used for weather monitoring & climatological research purposes Pyrheliometer Circuit Diagram It includes two equal strips specified with two strips S1 & S2 with area 'A'. Here, a thermocouple is used where its one junction can be connected to S1 whereas the other is connected to S2. A responsive galvanometer can be connected to the thermocouple. The S2 Strip is connected to an exterior electrical circuit. Once both the strips are protected from the radiation of solar, then the galvanometer illustrates there is no deflection because both the junctions are at equal temperature. Now 'S1' strip is exposed to the solar radiation & S2 is protected with a cover like M. When S1 strip gets heat radiations from the sun, then strip temperature will be increased, thus the galvanometer illustrates deflection. When current is supplied throughout the S2 strip, then it is adjusted and the galvanometer illustrates there is no deflection. Now, again both the strips are at equal temperature. If the heat radiation amount occurred over the unit area within the unit time on S1 strip is 'Q' & its absorption co-efficient, so the heat radiation amount which is absorbed through the S1 strip S1 within unit time is 'QAa'. In addition, the heat generated in unit time within the S2 strip can be given through VI. Here, 'V' is the potential difference & 'I' is the flow of current through it. (Sketch 3M + Explanation 3M)	**(3+3)**
4b	A sunshine recorder is a meteorological instrument used for recording the amount of sunlight that a particular location receives throughout a day. Sun's rays are refracted and focused sharply on the record card beneath the glass sphere, leaving burnt marks on the card. As the sun traverses, continuous burnt marks will appear on the card. Observers can measure the sunshine duration based on the length of the burnt marks. The instrument measures only the duration of sunshine, for intensity measurements you would require a solarimeter. The sphere is made from well-annealed optical glass and the card on which sunshine hours are recorded is inserted into the base of the unit (Sketch 2M + Explanation 4. **5)**	**(2+4. 5)**

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Date 27 06 2024 Subject Code BETCK-205E

USN 1 M V

Sir M. Visvesvaraya Institute of Technology
Bangalore 562 157
INTERNAL TEST PAPER

TEST NO : II SEM : II COURSE / BRANCH : BE- ET/EE/IS/ME/EC MAX.MARKS : 25 DURATION : 60 Min

SUBJECT : Renewable Energy Sources FACULTY NAME: Dr. G Balakumar / Shivakumar S. / Kumarswamy R./ Vyshanvi D.R/ Sriram M.

Instructions: Answer any one Question from each PART

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating)
CO – Course Outcomes PO – Program Outcomes; PI – Performance Indicator

Q.No	Question	Marks	CO	BL	PO	PI
	PART A					
1	a) Explain with the neat sketch basic components and their function of wind energy conversion system (WECS).	6.0	3	2	1,7	1.3.1 7.2.1
	b) Explain the working principle of vertical axis wind turbines with a neat sketch.	6.5	3	2	1,7	1.3.1 7.2.1
	OR					
2	a) Discuss briefly on the resources of biomass.	6.0	3	2	1,7	1.3.1 7.2.1
	b) With a neat sketch explain the principle of fixed doom bio-gas conversion system.	6.5	3	2	1,7	1.3.1 7.2.1
	PART B					
3	a) Explain the working principle a fuel cell.	6.0	4	2	1,7	1.3.1 7.2.1
	b)With a neat sketch explain the working principles of single basin & double basin tidal power plant	6.5	3	2	1,7	1.3.1 7.2.1
	OR					
4	a) Explain the concepts of zero energy.	6.0	4	2	1,7	1.3.1 7.2.1
	b) Explain with Sketch, working principle of Open cycle Ocean Thermal Energy conversion (OTEC) System.	6.5	3	2	1,7	1.3.1 7.2.1

CO3: Explain the technology involved in the conversion of wind-energy, tidal energy and biomass into electrical energy

CO4: Discuss on the scientific concepts involved in green energy

Verified by QPSC Member

Approved By HOD

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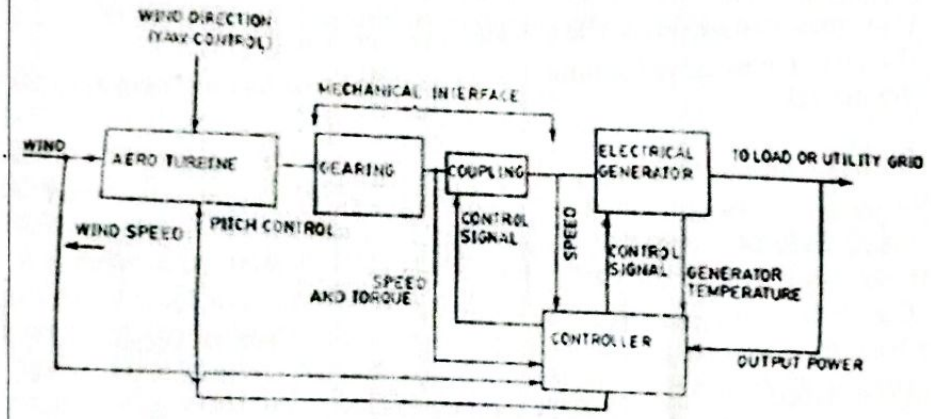
	SIR M VISVESVARAYA INSTITUTE OF TECHNOLOGY, BENGALURU - 562157 **DEPARTMENT OF MECHANICAL ENGINEERING**

SCHEME OF EVALUATION

IA TEST NO.: II

Subject: Renewable Energy Resources	**Branch: ET, EEE, IS, ME**
Subject Code: BETCK205E	**Semester: II**
Faculty Name: Dr G Balakumar	**Total Marks: 25**

Q. No.	Description	Marks
1a.	**Explain with the neat sketch basic components and their function of wind energy conversion system (WECS).** The basic principle of every windmill is to convert kinetic energy of wind into  mechanical energy which is used to rotate the turbine of an electrical generator to produce electricity. **COMPONENTS OF WIND TURBINE** **Blades**-Most turbines have either 2 or 3 blades. Wind blowing over the blades causes the blades to "lift" and rotate. Blades are made of Fibers with a polymer matrix, such as epoxy resin since it is known for its good mechanical properties, such as high tensile strength, low weight, and resistance to corrosion. Carbon fiber reinforced plastic (CFRP) can also be used as blade material. CFRP) is a composite material made by combining carbon fibers with a polymer matrix, such as epoxy resin. **Nacelle**-Nacelle sits at top of the tower and contains the gear box, low and high speed shafts, generator, controller and brakes. A cover protects the components inside the nacelle. Some nacelles are large enough for a technician to stand inside while working. **Rotor**-Blades and hub together are called rotor **Tower**- Towers are made from tubular steel or steel lattice. Because wind speed increases with height, taller towers enable turbines to capture more energy and generate more electricity **Pitch**: Blades are turned, or pitched, out of the wind to keep the rotor from turning in winds that are too high or too low to produce electricity. **Yaw drive**: Upwind turbines face into the wind; the yaw drive is used to keep	SKETCH: 2M EXPLAINATION:4M

the rotor facing into the wind as the wind direction changes. Downwind turbines don't require a yaw drive, the wind blows the rotor downwind.

Yaw motor: Powers the yaw drive.

Wind vane: Measures wind direction and communicates with the yaw drive to orient the turbine properly with respect to the wind.

Anemometer-Measures the wind speed and transmit wind speed data to the controller

Controller-Controller starts up the machine at wind speeds of about 8 to 16 miles per hour(mph) & shuts off machine at about 55 mph to avoid damage at high winds

Gearbox- Gears connect the low-speed shaft to the high-speed shaft and increase the rotational speeds from about 30 to 60 rotations per minute (rpm) to about 1200 to 1500 rpm, the rotational speed required by most generators to produce electricity.

1b. Explain the working principle of vertical axis wind turbines with a neat sketch.

VERTICAL AXIS WIND TURBINE

Types of vertical axis wind turbines

- Savonius -two half-cylindrical blades arranged in an 'S' shape.
- Darrieus types- curved aerofoil blades mounted on a rotating shaft or framework.

SKETCH: 2M

Here the axis of rotation (Vertical axis) of blades is perpendicular to the wind flow direction.

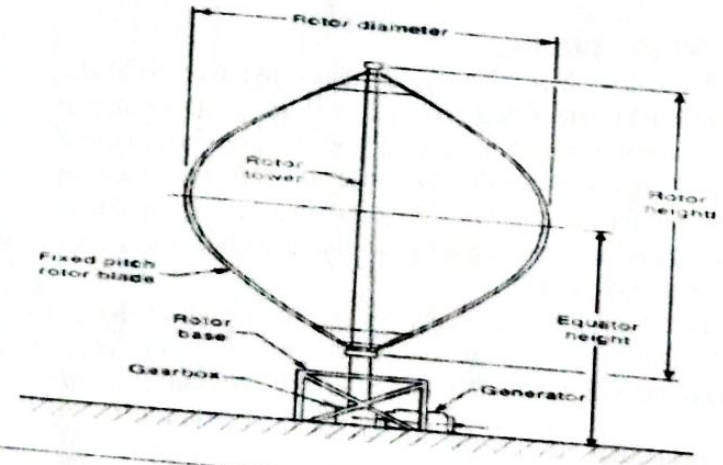
Additional equipment mechanism is required to start it from a stationary position.

EXPLANATION:4.5M

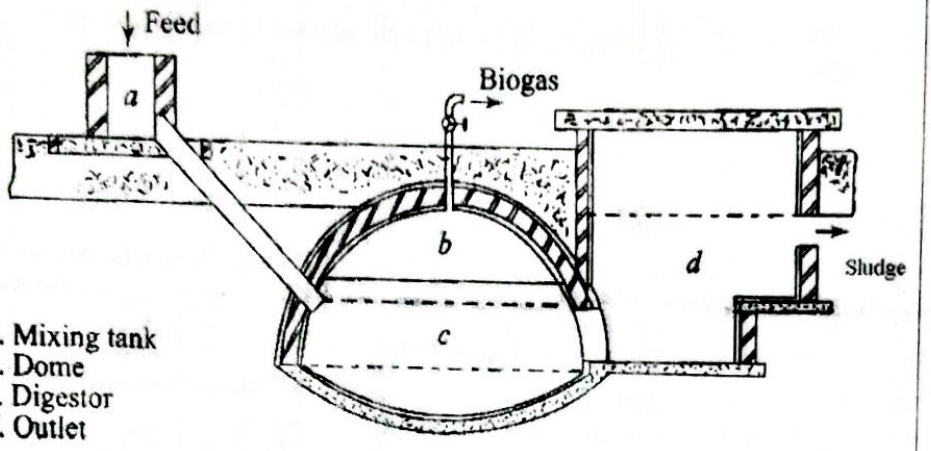
The vertical axis wind turbine does not require a yaw mechanism because it receives wind from all directions.

Gearbox is installed at the bottom of the turbine.

There is no need for nacelle in case of vertical axis wind turbines.



Q. No.	Description	Marks
	Advantages • The generator and gearbox can be placed on the ground • The structure is usually simpler. • You do not need a yaw (pointing) mechanism to turn the rotor against the wind. • VAWTs typically generate less noise than horizontal axis wind turbines (HAWT). **Disadvantage** • Some VAWT designs can be more complex than HAWTs, making them more difficult to manufacture and maintain • These structures are low to the ground, where wind speeds are lowest. • The overall efficiency is much lower than horizontal axis machines. • Maintenance is usually more difficult. For example, replacement of the generator typically requires disassembly of the entire machine. • Some VAWT designs have a higher start-up wind speed, meaning they may not generate electricity in light wind conditions.	
2a.	**Discuss briefly on the resources of biomass.** **BIOMASS RESOURCES** Biomass resources are materials derived from living organisms or their waste products that can be used as a source of energy. Biomass resources include: **Wood:** Wood is one of the most commonly used biomass resources. It is produced from trees and other woody plants and can be burned directly or converted into pellets or other forms of biofuel. **Agricultural waste:** Agricultural waste, such as straw, corn stalks, and sugarcane bagasse, can be used as a source of biomass energy. **Animal waste:** Animal waste, such as manure, can be processed to produce biogas, a renewable source of energy. **Algae:** Algae are tiny aquatic plants that can be grown quickly and efficiently to produce large amounts of biomass. They can be used to produce biofuels, such as bio-jet fuel, and other products. **Food waste:** Food waste, such as kitchen scraps and uneaten food, can be processed to produce biogas, a renewable source of energy. **Municipal waste:** Municipal waste, such as paper, cardboard, and yard waste, can be burned or converted into biofuels. **Plant-based crops:** Crops such as corn, soybeans, and sugarcane can be used to produce biofuels, such as ethanol and biodiesel. Biomass resources are materials derived from living organisms or their waste	EXPLAINATION:6M

Q. No.	Description	Marks
2b.	**With a neat sketch explain the principle of fixed doom bio-gas conversion system.** Deenbandhu biogas plant :  *a.* Mixing tank *b.* Dome *c.* Digestor *d.* Outlet ***Schematic diagram of a Deenabandhu biogas plant*** • The dome is made from prefabricated ferrocement or reinforced concrete and attached to the digester, which has a curved bottom in the shape of a hemisphere. • The slurry is fed from a mixing tank through an inlet pipe connected to the digester. • Inside the digester, it will undergo a process called anaerobic digestion and due to which gas formation starts. • When organic matter undergoes fermentation (process of chemical change in organic matter brought about by living organisms) through anaerobic digestion, gas is generated. This gas is known as bio-gas. • After fermentation, the biogas collects in the space under the dome. • Bio gas formed is taken out for use through a pipe connected to the top of the dome. • The sludge, which is a by-product, comes out through an opening in the side of the digester. • About 90 percent of the biogas plants in India are of the Deenbandhu type. Advantages: • Low initial costs and long useful life-span • No moving or rusting parts involved • Basic design is compact, saves space and is well insulated. • Construction creates local employment.	SKETCH: 2M EXPLAINATION:4.5M

- The underground construction saves space and protects the digester from temperature changes.

Disadvantages:

- Masonry gas-holders require special sealants and high technical skills for gas-tight construction.
- Problems with the gas-tightness of the brickwork gas holder (a small crack in the upper brickwork can cause heavy losses of biogas)
- Gas leaks occur quite frequently.
- Fluctuating gas pressure complicates gas utilization.
- Fixed-dome plants are, therefore, recommended only where construction can be supervised by experienced biogas technicians

3a. **Explain the working principle a fuel cell.**

SKETCH: 2M

EXPLAINATION:4M

Fuel cells generate electricity through an electrochemical process that converts thechemical energy of a fuel directly into electrical energy.

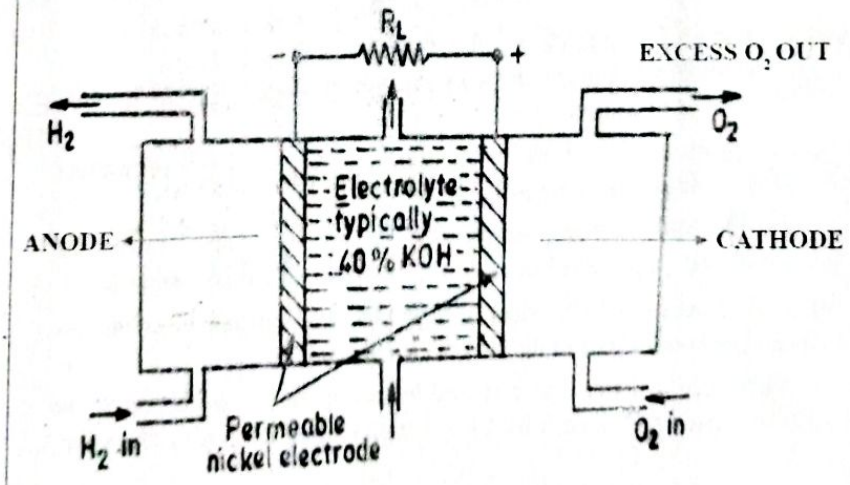
The main components of a fuel cell are:

(i) A fuel electrode (anode),

(ii) An oxidant or air electrode (cathode), and

(iii) An electrolyte.

In most fuel cells, hydrogen (pure or impure) is the active material at the negativeelectrode and oxygen (from the oxygen or air) is active at the positive electrode.



Fuel delivery: Hydrogen gas is delivered to the anode (negative electrode) of thefuel cell.

Electrolyte membrane: The electrolyte membrane allows only positively charged protons to pass through it and separates the anode from the cathode. The two electrodes are separated by a porous matrix saturated with an aqueous alkalinesolution, such as potassium hydroxide (KOH).

The KOH in the electrolyte dissociates:

$$KOH \rightleftharpoons K^+ + OH^-$$

Anode reaction: Neutral hydrogen at the anode combines with the hydroxyl ion toform water, releasing the electrons that circulate through the external load.

At anode:

$$2\ H_2 + 4\ OH^- \rightarrow 4\ H_2O + 4\ e^-$$

Oxygen delivery: Oxygen gas is delivered to the cathode (positive electrode) ofthe fuel cell.

Cathode reaction: At the cathode, the electrons regenerate the hydroxyl ion:At cathode:

$$4\ e^- + O_2 + 2\ H_2O \rightarrow 4\ OH^-$$

Electrical power: The flow of electrons through the external circuit generateselectrical power that can be used to power various devices or stored in a battery.

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

Overall reaction:

Overall, hydrogen fuel cells operate through the conversion of hydrogen and oxygen into electrical energy, with water vapor and heat as the only byproducts.

3b. **With a neat sketch explain the working principles of single basin & double basin tidal power plant.**

SKETCH: 2M

EXPLAINATION:4.5M

SINGLE BASIN ARRANGEMENT

In a single basin arrangement there is only one basin interacting with the sea.

The two are separated by a dam (or barrage) and the flow between them is through sluice ways located conveniently along the dam.

A dam is constructed in such a way that a basin gets separated from the sea and a difference in the water level is obtained between the basin and sea

The constructed basin is filled during high tide and emptied during low tide passing through the tunnel called sluice and turbine.

The potential energy of the water stored in the basin is used to drive the turbine which in turn generates electricity as it directly coupled with generator.

4a. **Explain the concepts of zero energy.**

ZERO ENERGY CONCEPTS

Zero energy buildings are designed to produce as much energy as they consume over the course of a year, resulting in a net-zero energy consumption. To achieve this goal, they typically employ a combination of energy efficiency measures and renewable energy systems.

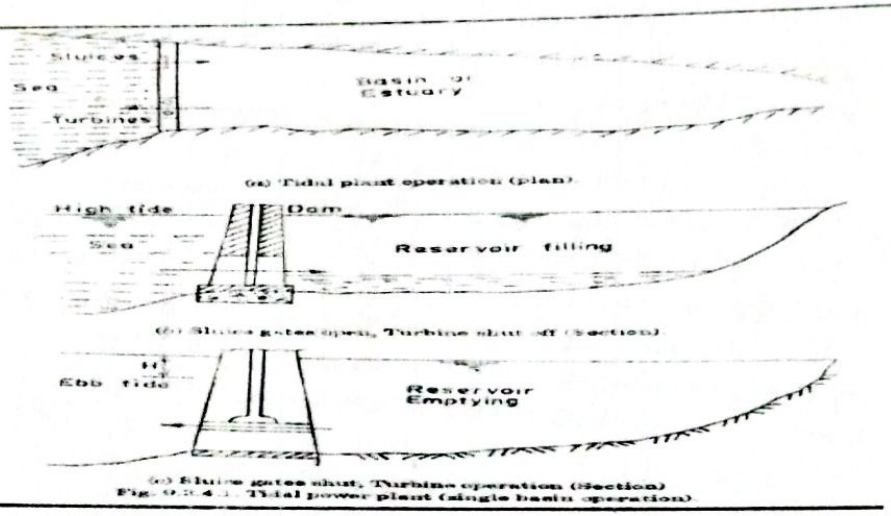
1. **Energy Efficiency Measures:**

The first step in designing a zero energy building is to optimize energy efficiency. This can be achieved through various measures, including:

- **Insulation and Air Sealing:** The building envelope, including walls, roof, and windows, is designed to minimize heat loss and gain. This is typically achieved through high-performance insulation and air sealing, which help maintain a stable indoor temperature and reduce the need for heating and cooling.
- **Energy-efficient Lighting and Appliances:** The building is equipped with energy-efficient lighting, appliances, and equipment that use less energy thanstandard models.
- **Passive Solar Design:** The building is designed to take advantage of natural sunlight and heat through strategic placement of windows, skylights, and shading devices. This can help reduce the need for artificial lighting and heating.
- **Natural Ventilation:** The building is designed to utilize natural ventilation for cooling and heating, which can reduce the need for mechanical ventilation and HVAC systems.
- **Thermal Mass:** The building incorporates materials with high thermal mass, such as concrete or brick, to absorb and store heat, which can help stabilize indoor temperatures.

2. **Renewable Energy Systems:** To achieve zero net energy consumption, zero energy buildings also incorporate renewable energy systems, such as:

- **Solar Panels**: Photovoltaic (PV) solar panels can be installed on the roof or walls of the building to generate electricity from the sun.



The generation of power can be achieved in a **single basin arrangement** either as

- Single ebb-cycle system
- Single tide-cycle system
- Double cycle system.

DOUBLE BASIN ARRANGEMENT

It requires two separate but adjacent basins. In one basin called "upper basin" (or high pool), the water level is maintained above that in the other, the low basin (or low pool).

- In this system the turbines are located in between the two adjacent basins.
- At the beginning of the flood tide, the turbines are shut down, the gates of upper basin A are opened and those of the lower basin B are closed.
- The basin A is thus filled up while the basin B remains empty.
- As soon as the rising water level in A provides sufficient difference of head between the two basins, the turbines are started.
- The water flows from A to B through the turbines, generating power.
- The power generation thus continues simultaneously with the filling up the basin A.
- At the end of the flood tide when A is full and the water level in it is the maximum, its sluice gates are closed.

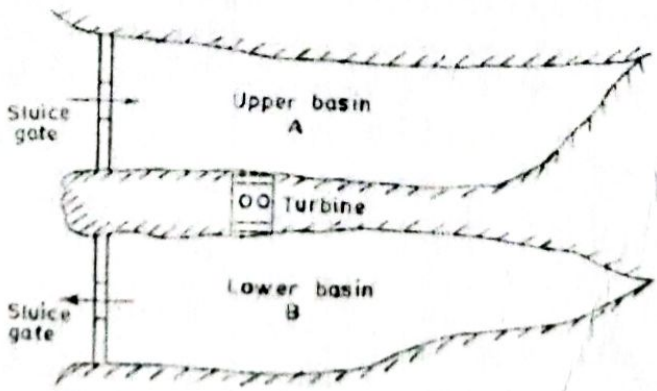


Fig. 9.3.4.4 Tidal power plant Double Basin Operation

EXPLAINATION:6M

- Wind Turbines: Wind turbines can be installed on or near the building to generate electricity from wind energy.
- Geothermal Energy: Geothermal heat pumps can be installed to provide heating and cooling using the earth's natural thermal energy.
- Biomass: Biomass boilers or stoves can be used to burn organic materials, such as wood chips, to generate heat.
- Hydrogen Fuel Cells: Hydrogen fuel cells can be used to generate electricity from hydrogen gas, which can be produced from renewable sources like solar or wind power.

3. **Water Conservation:** In addition to energy conservation, zero energy buildings also typically incorporate water conservation measures, such as low-flow fixtures and rainwater harvesting systems, to reduce water consumption and conserve resources.

Overall, the concept of zero energy buildings represents a sustainable approach to building design, with the potential to significantly reduce carbon emissions and mitigate the effects of climate change. While the initial cost of designing and building a zero-energy building may be higher than a conventional building, the long-term savings in energy costs and environmental benefits can make it a worthwhile investment.

4b. **Explain with Sketch, working principle of Open cycle Ocean Thermal Energy conversion (OTEC) System.**

SKETCH: 2M

EXPLAINATION:4.5M

PRINCIPLE OF WORKING OF OTEC: The water at the surface of the ocean is warmer than the water at deeper depths. This temperature difference can be used by Ocean Thermal Energy Conversion (OTEC) systems to generate electricity.

Construction:

Warm water intake: OTEC requires a large amount of warm surface seawater to drive the heat engine. The temperature of this water should be around 20-25°C (68-77°F) or higher, depending on the specific OTEC design.

Cold water intake: OTEC also requires a large amount of cold deep seawater to condense the working fluid of the heat engine. The temperature of this water should be around 5-10°C (41-50°F) or lower, depending on the specific OTEC design.

Heat exchanger: The heat exchanger is the component that transfers heat from the warm seawater to the working fluid, which is typically a low-boiling-point fluid such as ammonia.

Turbine: The working fluid vaporizes as it is heated and expands through a turbine, which generates electricity.

Condenser: The working fluid is then cooled and condensed back to a liquid state using cold seawater in the condenser, ready to be used again in the heat exchanger.

Working:

In an OTEC plant, the energy of warm surface water is used to convert low boiling point liquid ammonia into a gaseous state.

The vapor of ammonia at high pressure is used to spin the turbines of

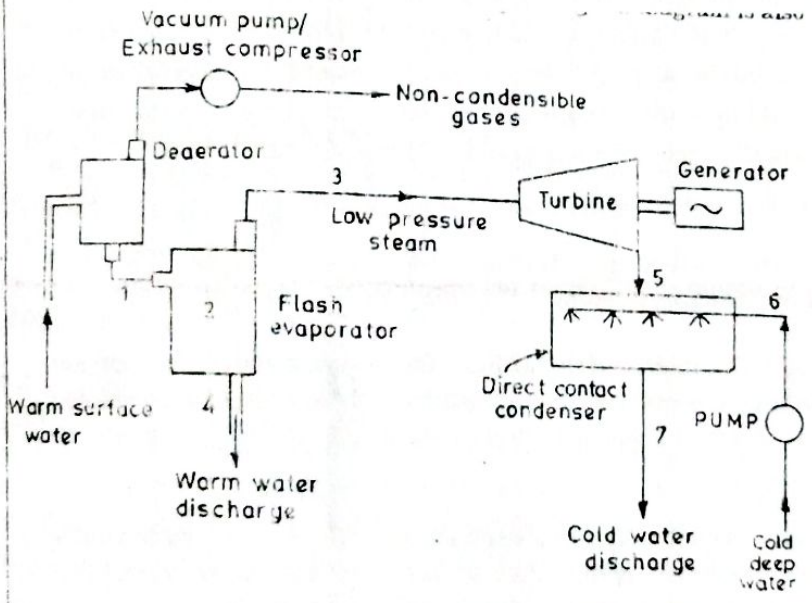
generators converting the Ocean thermal energy to electricity.

The used vapor passes through the condenser where cold water, pumped from the deeper parts of the ocean condenses ammonia vapor back into a liquid.

This process is repeated again and again, to get continuous production of electricity.

Essential condition for it to operate properly: The temperature difference between the warmer water at the surface and colder water at depths up to 2 km should be 293 K (20°C) or more.

Open Cycle: Open cycle OTEC directly uses the warm water from the surface to make electricity. The warm seawater is first pumped into a low-pressure chamber, where it undergoes a drop in boiling point due to the pressure drop. This causes the water to boil. This steam drives a low-pressure turbine which is attached to an electrical generator. The advantage this system has over a closed system is that, in the open cycle, desalinated water is obtained in the form of steam. Since it is steam, it is free from all impurities. This water can be used for domestic, industrial, or agricultural purposes.



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Department of Mechanical Engineering

ETEII / BETCK205E- FINAL IA MARKS [E]

S.N	Roll No.	Name of the student	T1	T2	T	Assign	Quiz	50Marks	Signature EXAM MARK 50
			25M	25M	Average	5M	20M	Final Average	
1	1MV23IS099	Shaurya Sanjeev	15	16	16	5	12	33 4	27
2	1MV23IS100	Shloka Mandal	23	22	23	5	15	43 4	37
4	1MV23IS101	Shreyas R	20	25	23	5	18	46 4	35
5	1MV23IS102	Shrishail Balageri	25	25	25	5	19	49 4	36
6	1MV23IS103	Shubha nandini B M	8	17	13	5	4 AB	22 4	18
7	1MV23IS107	Sudeep Ghatnatti	21	21	21	5	15	41 4	41
8	1MV23IS108	Suhan S Shetty	18	23	21	5	14	40 4	40
9	1MV23IS109	Suraj K S	19	16	18	5	15	38 4	28
10	1MV23IS112	Tanmayi P	21	25	23	5	18	46 4	33
11	1MV23IS113	Tanvi	10	25	18	5	5 BN	28 4	33
12	1MV23IS114	Tejashwini K P	17	24	21	5	15	41 4	41
13	1MV23IS116	Utkarsh ojha	17	25	21	5	16	42 4	32
14	1MV23IS117	Utkarsh Yadav	11	25	18	5	13	36 4	29
15	1MV23IS118	Varun Kumar K	17	21	19	5	14	38 4	29
16	1MV23IS119	Venu R	20	25	23	5	13	41 4	34
17	1MV23IS120	Vijay kumar	13	23	18	5	10	33 4	38
18	1MV23IS124	Vishrutha M J	25	25	25	5	15	45 4	37
19	1MV23IS125	Yashaswini u g	20	23	22	5	11	38 4	21
20	1MV23IS126	Yathish M	20	25	23	5	15	43 4	28
21	1MV23ISO70	Nisarga T.A	25	25	25	5	18	48 4	37
22	1MV23ME002	Achintya	18	22	20	5	16	41 4	28
23	1MV23ME003	Akhil	11	20	16	5	10	31 4	27
24	1MV23ME004	Ankit Purkayastha	7	12	10	5	14	29 4	21
25	1MV23ME005	Arjun Matnalli	1	8	5	5	10	20 4	34
26	1MV23ME008	BINDUSHREE T M	15	4	10	5	13	28 4	34

27	1MV23ME009	C V Sudhanva Rao	7	13	10	5	10	25	18
28	**1MV23ME011**	**D.Salma**	**AB**	**AB**	**0**	**0**	**AB**	**0**	
29	1mv23me012	Darshan e gowda	11	13	12	5	12	29	20
30	1MV23ME015	Dheeraj Varma Muppala	8	21	15	5	10	30	26
31	1MV23ME016	Ganesh.Y	6	19	13	5	10	28	21
32	1MV23ME020	Himanshu Singh	20	25	23	5	15	43	37
33	1MV23ME021	Koushik B R	5	5	5	5	10	20	09
34	1MV23ME026	M Madan Kumar	5	6	6	5	15	26	20
35	1MV23ME027	Neeraj Kumar	21	23	22	5	14	41	36
36	1MV23ME030	Preet Priyasi	23	25	24	5	16	45	35
37	1MV23ME031	Premalatha K	13	21	17	5	16	38	24
38	1MV23ME033	Rakesh Shetty	20	21	21	5	13	39	18
39	1MV23ME034	Santosh	5	14	10	5	11	26	19
40	1MV23ME035	SARAN SK	5	5	5	5	18	28	18
41	1MV23ME036	Shikhar Mishra	2	19	11	5	16	32	32
42	1MV23ME042	Tushar Sugandhi	7	22	15	5	13	33	35
43	1MV23ME043	Ujjwal Kumar Singh	12	25	19	5	12	36	24
44	1MV23ME045	VIJAY N	7	14	11	5	12	28	20
46	1MV23ME051	Vishal	18	24	21	5	12	38	31
47	1MV23ME053	Yashwanth kumar B S	7	9	8	5	15	28	09 F
48	1mv23EE099	Sudhanshu Kumar Singh	16	24	20	5	15	40	29
49	1MV23EE100	Suryansh Raj	7	19	13	5	AB	23	20
50	1MV23EE102	Swetha De	22	15	19	5	14	38	32
51	1MV23EE104	Tejas V	9	9	9	5	14	28	34
52	1MV23EE105	Tuhin Patgiri	13	25	19	5	6	30	23
53	1MV23EE106	V AKHILA	20	24	22	5	14	41	18
54	1MV23EE107	Vandana H M	17	24	21	5	10	36	29
55	1MV23EE109	VEDANT	8	18	13	5	18	36	24

56	1MV23EE110	VEERABHADRAYYA MATHAPATI	11	13	12	5	14	31	29
57	1MV23EE113	Vishwanath vastrad	9	10	10	5	12	27	25
58	1MV23EE114	Taraka Adithya Yellelli	9	19	14	5	15	34	29

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SL. NO: 17 **List of slow learners**

Based on the first internal marks scored by the students having less than or equal to 50% are identified as slow learners.

S.N	Roll No.	Name of the student	T1 25M
1	1MV23IS103	Shubha nandini B M	08
2	1MV23IS113	Tanvi	10
3	1MV23ME004	Ankit Purkayastha	07
4	1MV23ME005	Arjun Matnalli	01
5	1MV23ME009	C V Sudhanva Rao	07
6	1MV23ME015	Dheeraj Varma Muppala	08
7	1MV23ME016	Ganesh.Y	06
8	1MV23ME021	Koushik B R	05
9	1MV23ME026	M Madan Kumar	05
10	1MV23ME034	Santosh	05
11	1MV23ME035	SARAN SK	05
12	1MV23ME036	Shikhar Mishra	02
13	1MV23ME042	Tushar Sugandhi	07
14	1MV23ME053	Yashwanth kumar B S	07
15	1MV23EE100	Suryansh Raj	07
16	1MV23EE104	Tejas V	09
17	1MV23EE109	VEDANT	8
18	1MV23EE110	VEERABHADRAYYA MATHAPATI	11
19	1MV23EE113	Vishwanath vastrad	09
20	1MV23EE114	Taraka Adithya Yellelli	09

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Attendance sheet of the remedial classes conducted

S.N	Roll No.	Name of the student	25/5	31/5	8/6	22/6	-	-	-	-	-	-
1	1MV23IS103	Shubha nandini B M	1	2	3	4						
2	1MV23IS113	Tanvi	1	2	3	4						
3	1MV23ME004	Ankit Purkayastha	A	1	2	3						
4	1MV23ME005	Arjun Matnalli	1	A	2	A						
5	1MV23ME009	C V Sudhanva Rao	1	2	3	4						
6	1MV23ME015	Dheeraj Varma Muppala	1	2	3	4						
7	1MV23ME016	Ganesh.Y	1	2	A	3						
8	1MV23ME021	Koushik B R	A	A	1	2						
9	1MV23ME026	M Madan Kumar	1	2	A	3						
10	1MV23ME034	Santosh	A	1	2	3						
11	1MV23ME035	SARAN SK	1	2	3	4						
12	1MV23ME036	Shikhar Mishra	1	2	3	4						
13	1MV23ME042	Tushar Sugandhi	1	2	3	4						
14	1MV23ME053	Yashwanth kumar B S	1	A	A	2						
15	1MV23EE100	Suryansh Raj	1	2	3	4						
16	1MV23EE104	Tejas V	A	1	2	3						
17	1MV23EE109	VEDANT	1	2	3	4						
18	1MV23EE110	VEERABHADRAYYA MATHAPATI	A	A	1	2						
19	1MV23EE113	Vishwanath vastrad	1	2	3	4						
20	1MV23EE114	Taraka Adithya Yellelli	1	2	3	4						

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Sl. No: 18 List of Fast learners

Based on the first & second internal, if their average marks lies above 80% are identified as fast learners:

S.N	Roll No.	Name of the student	T1 25M	T2 25M
1	1MV23IS100	Shloka Mandal	23	21
2	1MV23IS101	Shreyas R	20	25
3	1MV23IS102	Shrishail Balageri	25	25
4	1MV23IS107	Sudeep Ghatnatti	21	21
5	1MV23IS108	Suhan S Shetty	18	23
6	1MV23IS112	Tanmayi P	21	25
7	1MV23IS119	Venu R	20	25
8	1MV23IS124	Vishrutha M J	25	25
9	1MV23IS125	Yashaswini u g	20	23
10	1MV23IS126	Yathish M	20	25
11	1MV23ISO70	Nisarga T.A	25	25
12	1MV23ME002	Achintya	18	22
13	1MV23ME020	Himanshu Singh	20	25
14	1MV23ME027	Neeraj Kumar	21	23
15	1MV23ME030	Preet Priyasi	23	25
16	1MV23ME033	Rakesh Shetty	20	21
17	1MV23ME051	Vishal	18	24
18	1MV23EE106	V AKHILA	20	24
19	1MV23EE107	Vandana H M	17	24

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Sl. No 21: Pedagogical / Innovative Teaching

1. Power point Presentation with examples, real-time application pictures of power plants related to renewable energy sources, specific applications of renewable energy sources, Green energy etc,
2. NPTL Video lectures

Sl. No	Website URL	Topic	Author / Source
1	https://www.youtube.com/watch?v=rO5rUqeCFY4	Concentrated Solar Power	U S Department of Energy
2	https://www.youtube.com/watch?v=1kUE0BZtTRc	Renewable energy	General video
3	https://www.youtube.com/watch?v=qwvdIhOuaFY	Types of renewable energy sources	https://www.youtube.com/watch?v=qwvdIhOuaFY
4	https://www.youtube.com/watch?v=qSWm_nprfqE	Wind Turbine	General video
5	https://www.youtube.com/watch?v=Q1uedC-1gko	Components of wind energy system conversion	R R Unecha Marathwada Mitra Mandal's College of Engineering
6	https://www.youtube.com/watch?v=mCRDf7QxjDk	Geothermal Energy	U S Department of Energy
7	https://www.youtube.com/watch?v=DzudoGMOM9w	Tidal PowerPlant	Prof. A H Kamble
8	https://www.youtube.com/shorts/_l06ZTXuG78	Tidal Power Plant	@KDEDUTECHE
9	https://www.youtube.com/watch?v=gcStpg3i5V8	Ocean Energy – Wave Power Station	General video
10	https://www.youtube.com/watch?v=JwRTpWZReJk	Smart Grid	U S Department of Energy
11	https://www.youtube.com/watch?v=anDF-nUHZW4&list=PLOzRYVm0a65dtZiqOUeyWCiCWL4vWaDwj	Hydrogen Energy Production, storage & Transportation	Prof. Pratibha Sharma Dept. of Energy Science & Engg., IIT, Bombay

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Impact Analysis

S.N	Roll No.	Name of the student	T2	Average marks 50	Remarks
1	1MV23IS103	Shubha nandini B M	17	22	improved
2	1MV23IS113	Tanvi	25	28	improved
3	1MV23ME004	Ankit Purkayastha	12	29	improved
4	1MV23ME005	Arjun Matnalli	08	20	To improve
5	1MV23ME009	C V Sudhanva Rao	13	25	improved
6	1MV23ME015	Dheeraj Varma Muppala	21	30	improved
7	1MV23ME016	Ganesh.Y	19	28	improved
8	1MV23ME021	Koushik B R	05	20	To improve
9	1MV23ME026	M Madan Kumar	06	26	To improve
10	1MV23ME034	Santosh	14	26	improved
11	1MV23ME035	SARAN SK	05	28	To improve
12	1MV23ME036	Shikhar Mishra	19	32	improved
13	1MV23ME042	Tushar Sugandhi	22	33	improved
14	1MV23ME053	Yashwanth kumar B S	09	28	improved
15	1MV23EE100	Suryansh Raj	19	23	improved
16	1MV23EE104	Tejas V	09	28	To improve
17	1MV23EE109	VEDANT	18	36	improved
18	1MV23EE110	VEERABHADRAYYA MATHAPATI	13	31	improved
19	1MV23EE113	Vishwanath vastrad	10	27	To improve
20	1MV23EE114	Taraka Adithya Yellelli	19	34	improved

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Sir M. Visvesvaraya Institute of Technology Bengaluru – 562 157
Department of Mechanical Engineering
Assignment Questions

Course with Code	Renewable Energy Sources (BETCK/205E)	Faculty Name: : Dr G Balakumar	Year & Semester:	1st & II	Assignment No. II
					Date of Submission: 28/06/2024

Q Nos	Questions	M	L	C
1	Discuss on the advantages, limitations and application s of wind energy	10	L2	CO3
2	Explain the basic components and their function in wind energy conversion system (WECS)	10	L3	CO3
3	Classify WECS. Explain the working principle of horizontal axis and vertical axis wind turbines with neat sketches	10	L3	CO3
4	Obtain an expression for the power output from wind energy	08	L3	CO3
5	Discuss briefly the resources of biomass	10	L2	CO3
6	With a neat sketch explain the principle of fixed doom bio-gas conversion system	10	L3	CO3
7	Discuss on the advantages, limitations and application s of biomass energy	10	L2	CO3
8	With a neat sketch explain the working principles of single basin & double basin tidal power plant	12	L3	CO3
9	Explain the following ocean thermal energy conversion technologies: i) Open cycle OTEC ii) Closed cycle OTEC iii) Hybrid cycle OTEC	12	L3	CO3
10	Explain how fuel cells are classified and explain the working principle a fuel cell	10	L3	CO4
11	Discuss on the advantages, limitations and application s of fuel cell	10	L2	CO4
12	What is zero energy concept – discuss briefly	10	L2	CO4

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① Introduction to Renewable Energy

1.1 Environmental Consiquences of fossil fuell use:-

* Fossil fuels which includes coal, natural gas, Petroleum, shale oil and bitumen are the main source of Heat and electrical energy. All these fuel contain - besides the major constituents (carbon, hydrogen, oxygen) - other materials including metal, sulfur and nitrogen compounds. During the combustion process different pollutants like fly ash, sulfur oxides (SO_2 and SO_3), Nitrogen oxides ($NO_3 = NO_2 + NO$) and volatile organic compounds are emitted. Fly ash contains different trace elements (heavy metals) Gross emission of pollutants is tremendous all over the world. These pollutants are present in the atmosphere in such conditions that they can affect man and his environment.

* Air pollution caused by particulate matter and other pollutants not only acts directly on the environment but by contamination of water and soil leads to their degradation. wet and dry deposition of inorganic pollutants leads to acidification of environment. These phenomena affect the health of the people, increase corrosion and destroy cultivated soil and forests. Most of the plants, especially coniferous tree are not resistant oxides. Following longer exposure leaves wither and fall. Widspread forest damage has been reported in Europe and North America. Many cultivated plants are not resistant to these pollutants, especially in the early period of vegetation.

1.2. Importance Of Renewable Sources Of Energy:

* Concern for the environment due to ever-increasing use of fossil fuels and rapid depletion of natural resources have led to developement of alternative source of energy which are renewable and environmental friendly. The following points may be mentioned in this connection:

(1) The demand of energy is increasing by leaps and bound due to rapid industrialization and population growth, and hence the conventional source of energy will not be sufficient to meet the growing demand.

(2) Conventional sources (Except hydro) are non-renewable and are bound to finish up one day.

(3) Conventional sources fossil fuels, nuclears also cause pollution, thereby their use degrade the environment.

(4) Large hydro resources affect wildlife, cause deforestation and pose various social problems.

(5) In addition to supplying energy, fossil fuels are also used extensively as feed stock materials for the manufacture of organic chemicals. As reserve deplete, the need for using fossil fuels exclusively for such purpose may become greater.

* Due to these reasons it has become important to explore and develope renewable energy resources to reduce too much dependence on conventional resources. However, the present trend of developement of non-conventional sources indicate that these will serve as supplement rather than substitute for conventional sources for some more time to come.

1.3. Sustainable design and Development:

* Global environmental degradation is one of the most serious threats facing Mankind as a result of the expansion of it's activities around the globe. One of the international responses to global environmental problems - the framework Convention on climate change was ratified and came into effect in March 1994.
* The convention aims not only at stabilizing CO_2 emissions in developed countries but also at ultimately reducing man-made CO_2 emissions globally so as to stablize the global climate.
* However, with fossil fuels comprising nearby 90 per cent of primary energy sources in the world, the final target of the framework convention seems very ambitious.
* Environmental degradation cannot be signed out as an independent matter among various global issues. Also important are the interactions among economic development, stable energy supplies and globe environmental conservation.
* In the next few decades fossil fuels will continue to be the principal source of energy driving economic development. The source of fossil fuels is stable and their extraction is affordable.
* Attempts to restrict the use of fossil fuels for environmental reasons are likely to have a negative impact on economic development and the overall availability of energy. Thus the "three Es" - Environment Energy and economic development are closely interrelated in a complex manner.

* The strategy for mitigating "three Es" issues is a strategy for environmentally sustainable economic development. Herman Daly, a famous ecological economist laid down three conditions for sustainability:

(1) The consumption rate of renewable resources is not higher than its recovery rate.

(2) The consumption rate of non-renewable resources is not higher than the rate of increase in renewable resources supply.

(3) The emission of pollutants is within the absorption capacity of the environment.

* Unfortunately, these conditions have been violated for years. Example of respective violations typically include deforestation, the depletion of fossil fuels, and the increase in CO_3 concentration in the air.

* Such violation may be hard to reverse in the short term but unless long term remedial action taken present global development trends will not be sustainable.

* In particular, a substaintial reduction in resources consumption and emission of pollutants is essential for the development of a sustainable human society on this planet.

* As evident from the above discussions, economy, environment and energy are closely interrelated and an overall policy is required to deal with them.

1.4. Types of Renewable Energy Sources:

• Renewable Energy:

* Renewable energy is useful energy that are obtained naturally from the environment. These energies are quikly becoming inexpensive as well as efficient. And that includes solar, biomass, wind, hydropower, geothermal etc. It is very benificial due to their partial negative ecological impact when costrasted to fossil fuels.
* A long time ago this energy is not used much due to their cost. But some of the energy sources are smart financial choices for hospitals, business and homes. Particularly, solar energy is the best option for house owners who want to reduce their environmental track while conserving money.

• Different types of Renewable Energy Sources:

There are different types of energies that are considered renewable energies namely solar energy, wind energy, tidal energy, hydroelectric energy, geothermal energy, Biomass energy etc.

(1) Solar Energy:

* Solar energy is one of the most popular and also the fastest growing renewable energy sources. As a free renewable energy source, technology has created a techniques for connecting the energy of the sun through solar panels.
* Solar panels are classified into two types namely.
  (i) Solar PV cells.
  (ii) Solar thermal panel.

(i) Solar PV cells absorbs the sun's energy and change it into electrical energy, which is used in different applications like electric heating, power appliences, in electric cars, etc.

(ii) Solar thermal panels uses energy and these panels are used in taps, heating systems, showers, etc.

* A solar energy is the best option in rising renewable energy marketplace.

(2) Biomass Energy:

* Biomass energy is most widely used renewable energy. It uses organic materials like animals, plants and converts them into another form of energy that can be used. For instance, when the plants absorb the solar energy through photosynthesis process, then this energy will pass on through the plant's organism for making biomass energy.
* The common type used for generating biomass energy is crops, wood, and compost. If the Biomass energy technology is not controlled properly then it can have a harmful effect on the environment.

(3) Wind Energy:

* Wind energy has been using for several years for power windmills, pushing sails and also for generating force for water pumps. When we constrasted to other types of renewable energies wind energy is considered as well as very reliable.
* At first, the wind farm construction was an expensive venture but now the recent developments have begun for fixing the peak prices in wholesale energy markets globally and reduce the profits and revenues of the fossil fuel production companies.

(4) Hydroelectric Energy:

* The hydroelectric energy uses the flow of water to rotate turbines for generating electricity. According to the US survey of geological, this renewable energy provides 20% of the energy in the world energy requirements.
* There are some issues while using hydroelectric energy. This energy can be generated from the dammed rivers; otherwise it can have a major effect on the soil as well as wildlife and also affects on fish communities that must journey through the river dams.

(5) Tidal Energy:

* Tidal energy is the same as wind energy but these are predictable as well as steady. This is the main reason that tidal mills have been used sience the ancient days to middle ages similar to windmills.
* Usually, Tidal energy has faced from relatively high cost as well as incomplete accesibility of sites through suitably high tidal ranges. But, several current technological developments both in technology and design point outs that the entire tidal power availability may be superior to previous, and the environmental costs may be getting down to competitive stages.
* The "Rance Tidal power stations" is the world's largest tidal energy power plant in France. And in scotland and Orkney, the first world's marine energy enter, as well as European marine energy center, was established in the year 2003 for developing the tidal energy and wave energy industry in the UK.

(6) Geothermal Energy:

* The term Geothermal taken from the Greek word Geo (Earth), and it receives the heat from the earth and converts it into energy. For instance, hot water or steam energy which are generated from the earth can be utilized for generating energy. it is called to be a renewable supply of energy because the water is filled by normal rainfall and the heat used is generated through the planet.
* Grocend basis heat pcemps can be fixed to connect the normal heat from underground using fluid tubes. covered outside the assets. the fluid in the tubes absorbs the heat from the grocend so it can be used to heat your home and water. for assets that are located close to a river or lake, it is achivable to fix a heat pcemp for water source. these pipes are flooded in the water as well as a heat pump drives a heat absorbs liquid during the arrangement of piping. This liquid removes normal heat from the nearby water to be utilized in the seating arrangement.

* Advantages of Renewable Energy Sources:

(1) Renewabl Energy is eco-friendly:

- Renewable energy is considered clean energy since it doesn't cause grave epvironmental pollution, and it has low or zero carbon and green house emmission.
- Fossil fuels emit high levels of greenhouse gas and carbon dioxide, which are greatly responsible for global warming, climate change and degradation of air quality.

(2) It's a Renewable Resource:

- This implies that they do not deplete over a lifetime, and there is zero possibility that they will reenout.
- Source of fossil fuels (oil, gas and coal) are considered limited resources and there is a strong posibility that they will reenout in the futere.

(3) Renewable Energy is a Reliable Source of Energy:

- The fossil feel has sharply increased. This over-reliance on fossil fuels has led to our secerity being threatened. fossil fuels are prone to trade disputes, a spike in energy prices and unnecessary wars. These variable affect a lot more than a nations energy policy; They can significantly drain a country's economy.
- Although most argue that solar and wind energy is unreliable, a solid infrastructure puts this argument to rest. If solar and wind plants are distributed over a large geographical location, there can be minimal electricity generation interreption because wheather disreptions in one location cannot be the same in other locations.

(4) Leads to job creation:

- Renewable energy makes real economic sence because it is a cheaper alternative to most traditional Source of energy. Since the inception of renewable energy, new and stable jobs have been added to the most world economies.
- For instance, in Germany and UK, many jobs have already been created.

Sri Krishnadevaraya Educational Trust

Sir M. Visvesvaraya Institute of Technology, Bengaluru

Department of Mechanical Engineering

COURSE-END SURVEY **Date: 28-06-2024**

Semester & Sec: II (EEE/IS/ME)	**Subject & Code:** Renewable Energy Sources / BETCK205E

Course Outcomes (CO's)

COs	Semester: II Year of Study: 2024
1	Summarize the renewable energy sources
2	Describe of solar energy utilization for heating and electric power production
3	Explain the technology involved in the conversion of wind-energy, tidal energy and biomass into electrical energy
4	Discuss on the scientific concepts involved in green energy

1: Slightly	2: Moderately	3: Strongly

Sl. No.	USN	NAME	CO1	CO 2	CO3	CO4	Signature
1	1MV23IS099	Shaurya Sanjeev					
2	1MV23IS100	Shreya VR					
3	1MV23IS100	Shloka Mandal	3	3	3	3	
4	1MV23IS101	Shreyas R	3	3	3	3	
5	1MV23IS102	Shrishail Balageri	3	3	3	3	
6	1MV23IS103	Shubha nandini b m					
7	1MV23IS107	Sudeep Ghatnatti	3	3	3	3	
8	1MV23IS108	Suhan S Shetty	3	3	3	3	
9	1MV23IS109	Suraj K S	3	3	3	3	
10	1MV23IS112	Tanmayi P	3	3	3	3	
11	1MV23IS113	Tanvi					
12	1MV23IS114	Tejashwini K P	3	3	3	3	
13	1MV23IS116	Utkarsh ojha	3	3	3	3	
14	1MV23IS117	Utkarsh Yadav	3	3	3	3	
15	1MV23IS118	Varun Kumar K					
16	1MV23IS119	Venu R	3	3	3	3	
17	1MV23IS120	Vijay kumar	3	3	3	3	
18	1MV23IS124	Vishrutha M J	3	3	3	3	
19	1MV23IS125	Yashaswini u g	3	3	3	3	
20	1MV23IS126	Yathish M	3	3	3	3	
21	1MV23ISO70	Nisarga T.A	3	3	3	3	
22	1MV23ME002	Achintya	3	3	3	3	
23	1MV23ME003	Akhil	3	3	3	3	

24	1MV23ME004	Ankit Purkayastha					
25	1MV23ME005	Arjun Matnalli	2	3	3	3	
26	1MV23ME008	BINDUSHREE T M	3	3	3	3	
27	1MV23ME009	C V SUDHANVA RAO					
28	1MV23ME011	D.Salma					
29	1mv23me012	Darshan e gowda	2	2	3	3	
30	1MV23ME015	Dheeraj Varma Muppala	3	3	3	3	
31	1MV23ME016	Ganesh.Y	3	3	3	3	
32	1MV23ME020	Himanshu Singh	3	3	3	3	
33	1MV23ME021	Koushik B R					
34	1MV23ME026	M.Madan Kumar	3	3	3	3	
35	1MV23ME027	Neeraj Kumar	3	3	3	3	
36	1MV23ME030	Preet Priyasi	3	3	3	3	
37	1MV23ME031	Premalatha K	3	3	3	3	
38	1MV23ME033	Rakesh Shetty	3	3	3	3	
39	1MV23ME034	Santosh	3	3	3	3	
40	1MV23ME035	SARAN SK	3	3	3	3	
41	1MV23ME036	Shikhar Mishra	2	2	3	2	
42	1MV23ME042	Tushar Sugandhi	3	3	3	3	
43	1MV23ME043	Ujjwal Kumar Singh					
44	1MV23ME045	VIJAY N	3	3	3	3	
45	1MV23ME049	Vinod Chandrashekhar Hugar					
46	1MV23ME051	Vishal	3	3	3	3	
47	1MV23ME053	Yashwanth kumar bs					
48	1mv23EE099	Sudhanshu Kumar Singh	3	3	3	3	
49	1MV23EE100	Suryansh Raj					
50	1MV23EE102	Swetha De	3	3	3	3	
51	1MV23EE104	Tejas V	3	3	3	3	
52	1MV23EE105	Tuhin Patgiri					
53	1MV23EE106	V AKHILA	3	3	3	3	
54	1MV23EE107	Vandana H M	3	3	3	3	
55	1MV23EE109	VEDANT	2	2	2	2	
56	1MV23EE110	VEERABHADRAYYA MATHAPATI	3	3	3	3	
57	1MV23EE113	Vishwanath vastrad	3	3	3	3	
58	1MV23EE114	Taraka Adithya Yellelli	3	3	3	2	

Dr GB

HoD

PROFESSOR & HEAD
Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Techonolgy
Bengaluru-562 157

Faculty : Dr. BalaKumar G
Program :
Filled By : 11

Subject : BETCK205E - Renewable Energy Sources
Semester : 2
Division : 2E - EE

Sr. No.	Question	Weight	Score Obtained	%	No. of students who have said				
					Excellent(5)	Very Good (4)	Good(3)	Fair(2)	Bad(1)
1	Planning of lectures and Presentation of subject matter in logical sequence	3	141	85.45	5	4	2	0	0
2	Presentation and Communication skills	3	135	81.82	5	3	2	1	0
3	Subject knowledge	3	144	87.27	5	5	1	0	0
4	Willingness to clarify doubts and provide guidance	3	138	83.64	5	4	1	1	0
5	Class Room Management	3	138	83.64	5	4	1	1	0
6	Use of Black board and other teaching aids	3	138	83.64	5	3	3	0	0
7	Preparedness for class	2	94	85.45	5	4	2	0	0
8	Fostering punctuality through his / her example	2	94	85.45	6	3	1	1	0
9	Confidence level of the teacher	2	94	85.45	5	4	2	0	0
10	Attire and mannerism	2	94	85.45	5	4	2	0	0
11	Overall assessment of the teacher	3	141	85.45	6	3	1	1	0
					Most of the times(5)	Rarely(3)	Never(1)		
12	Relates theory to applications of real world problems	1	49	89.09	9	1	1		
					Always(5)	Most of the time(3)	Rarely(1)		
13	Teaching in a way resulting in real learning / understanding and motivation	2	90	81.82	7	3	1		
					Impartial(5)	Justifiable(3)	Partial(1)		
14	Fairness in evaluation	1	41	74.55	4	7	0		
					Acceptable (5)	Slow(3)	Fast(1)		
15	Pace at which the subject is taught	2	106	96.36	10	1	0		

Overall Score

Max. Possible points	Obtained	Percentage
1925	1637	85.04%

Faculty : Dr. BalaKumar G
Program :
Filled By : 20

Subject : BETCK205E - Renewable Energy Sources
Semester : 2
Division : 2G - IS

Sr. No.	Question	Weight	Score Obtained	%	No. of students who have said				
					Excellent(5)	Very Good (4)	Good(3)	Fair(2)	Bad(1)
1	Planning of lectures and Presentation of subject matter in logical sequence	3	240	80.00	7	6	7	0	0
2	Presentation and Communication skills	3	234	78.00	6	7	6	1	0
3	Subject knowledge	3	246	82.00	7	8	5	0	0
4	Willingness to clarify doubts and provide guidance	3	240	80.00	6	8	6	0	0
5	Class Room Management	3	240	80.00	7	6	7	0	0
6	Use of Black board and other teaching aids	3	240	80.00	7	7	5	1	0
7	Preparedness for class	2	158	79.00	7	5	8	0	0
8	Fostering punctuality through his / her example	2	154	77.00	7	4	8	1	0
9	Confidence level of the teacher	2	160	80.00	7	6	7	0	0
10	Attire and mannerism	2	158	79.00	7	5	8	0	0
11	Overall assessment of the teacher	3	255	85.00	10	5	5	0	0
					Most of the times(5)	Rarely(3)	Never(1)		
12	Relates theory to applications of real world problems	1	90	90.00	15	5	0		
					Always(5)	Most of the time(3)	Rarely(1)		
13	Teaching in a way resulting in real learning / understanding and motivation	2	148	74.00	8	11	1		
					Impartial(5)	Justifiable(3)	Partial(1)		
14	Fairness in evaluation	1	78	78.00	9	11	0		
					Acceptable (5)	Slow(3)	Fast(1)		
15	Pace at which the subject is taught	2	188	94.00	17	3	0		

Overall Score

Max. Possible points	Obtained	Percentage
3500	2829	80.83%

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Faculty : Dr. BalaKumar G
Program :
Filled By : 23
Subject : BETCK205E - Renewable Energy Sources
Semester : 2
Division : 2H - ME

Sr. No.	Question	Weight	Score Obtained	%	No. of students who have said				
					Excellent(5)	Very Good (4)	Good(3)	Fair(2)	Bad(1)
1	Planning of lectures and Presentation of subject matter in logical sequence	3	258	74.78	9	3	7	4	0
2	Presentation and Communication skills	3	249	72.17	8	4	5	6	0
3	Subject knowledge	3	255	73.91	8	4	7	4	0
4	Willingness to clarify doubts and provide guidance	3	246	71.30	7	4	8	3	1
5	Class Room Management	3	255	73.91	9	2	8	4	0
6	Use of Black board and other teaching aids	3	273	79.13	11	3	6	3	0
7	Preparedness for class	2	164	71.30	8	2	8	5	0
8	Fostering punctuality through his / her example	2	162	70.43	7	3	9	3	1
9	Confidence level of the teacher	2	164	71.30	8	3	7	4	1
10	Attire and mannerism	2	170	73.91	9	3	7	3	1
11	Overall assessment of the teacher	3	252	73.04	9	3	7	2	2
					Most of the times(5)	Rarely(3)	Never(1)		
12	Relates theory to applications of real world problems	1	91	79.13	14	6	3		
					Always(5)	Most of the time(3)	Rarely(1)		
13	Teaching in a way resulting in real learning / understanding and motivation	2	174	75.65	13	6	4		
					Impartial(5)	Justifiable(3)	Partial(1)		
14	Fairness in evaluation	1	89	77.39	14	5	4		
					Acceptable (5)	Slow(3)	Fast(1)		
15	Pace at which the subject is taught	2	198	86.09	18	2	3		

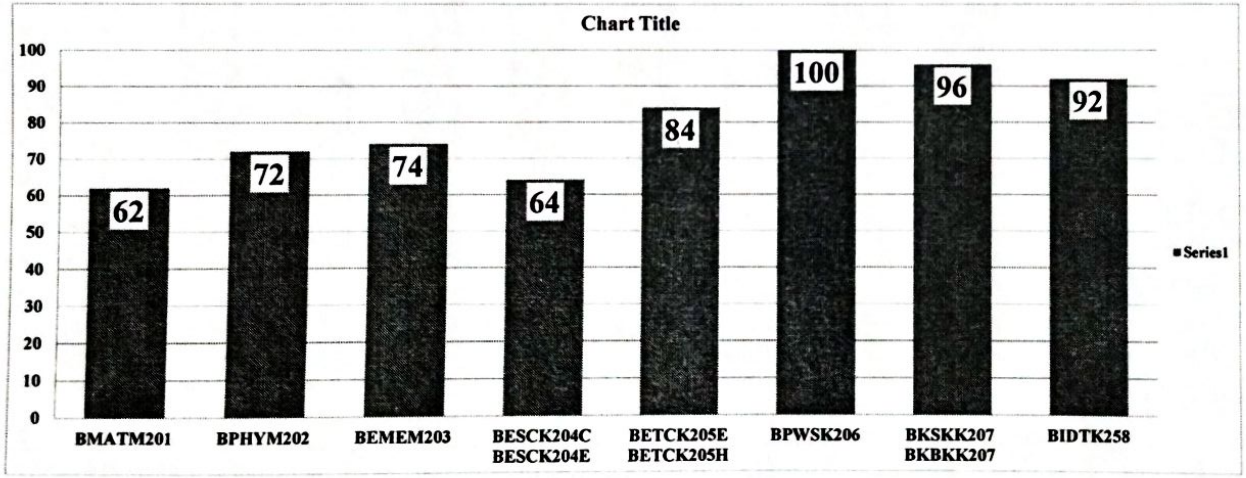
Overall Score		
Max. Possible points	Obtained	Percentage
4025	3000	74.53%

SIR M VISVESVARAYA INSTITUTE OF TECHNOLOGY, BANGALORE - 562 157

RESULT ANALYSIS [BEFORE REVALUATION]

DEPARTMENT : MECHANICAL ENGINEERING | **DATE : 25-08-2024**
SEMESTER : II | **EXAMINATION : Jun-24**
SECTION : A & B | **BATCH : 2023**

Sl No	SUBJECT CODE	NAME OF THE SUBJECT	REGULAR			REPEATERS			DIPLOMA QUOTA			TOTAL PASS %			NAME OF THE STAFF
			APP	PASS	PASS %	APP	PASS	PASS %	APP	PASS	PASS %	APP	PASS	PASS %	
1	BMATM201	MATHEMATICS-II FOR MECHANICAL ENGG STREAM	50	31	62	0	0	####	0	0	#####	50	31	62	1ST YEAR STAFFS
2	BPHYM202	APPLIED PHYSICS FOR ME STREAMS	50	36	72	0	0	####	0	0	#####	50	36	72	
3	BEMEM203	ELEMENTS OF MECHANICAL ENGINEERING	50	37	74	0	0	####	0	0	#####	50	37	74	
4	BESCK204C BESCK204E	INTRODUCTION TO ELECTRONICS COMMUNICATION INTRODUCTION TO C PROGRAMMING	50	32	64	0	0	####	0	0	#####	50	32	64	
5	BETCK205E BETCK205H	RENEWABLE ENERGY SOURCES INTRODUCTION TO INTERNET OF THINGS(IOT)	50	42	84	0	0	####	0	0	#####	50	42	84	
6	BPWSK206	PROFESSIONAL WRITING SKILLS IN ENGLISH	50	50	100	0	0	####	0	0	#####	50	50	100	
7	BKSKK207 BKBKK207	SAMSKRUTIKA KANNADA BALAKE KANNADA	50	48	96	0	0	####	0	0	#####	50	48	96	
8	BIDTK258	INNOVATION AND DESIGN THINKING	50	46	92	0	0	####	0	0	#####	50	46	92	



Admission Details					
CET	CMK	MQ	Diploma	SNQ	Total

Failure Details					
CET	CMK	MQ	Diploma	SNQ	Total

No.of Toppers (>80%)	
No.of Re-admitted students	
No.of Non-eligible students	

	Regular	Repeaters	Diploma	SNQ	Total
Total Appeared	46	0	0	5	51
FCD	12	0	0	2	14
FIRST CLASS	6	0	0	1	7
SECOND CLASS	1	0	0	0	1
TOTAL PASS	19	0	0	3	22
FAIL	27	0	0	2	29
PERCENTAGE	57%	0%	0	100%	43

TOTAL PASS % = 43 %

Head of the Department
PROFESSOR & HEAD
Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Techonolgy
Bengaluru-562 157

Staff Name Dr G BALAKUMAR Subject Code BETCK 205E (A) Subject Name RENEWABLE ENERGY SOURCES

Targets and Level			
Target		Marks	Level
60%	60% and Above	30.0	3
55%	Between 50% to 59%	27.5	2
50%	Below 50%	25.0	1

Test Attainment Level			University Attained		Survey		Attainment
Co's	% Attained	Level	% Attained	Level	% Attained	Level	
C205.1	36.38	1	35.60	3	90.00	3	2.64
C205.2	36.38	1	35.60	3	90.00	3	2.64
C205.3	36.38	1	35.60	3	90.00	3	2.64
C205.4	36.38	1	35.60	3	90.00	3	2.64

Weightage	
Test %	18%
University %	72%
Survey %	10%

Semester	2
Academic Year	2023-24
Class Strength	58
Maximum Marks	50

CONTRIBUTION TO PROGRAMME OUTCOMES IN PERCENTAGE (PO's) Intake Year 2023 for Academic Year 2023-24

CO's			Program Outcomes											Program Specific Outcome			
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
C205.1	Mapping		2						3					2	1	1		
	Attainment	2.64	1.76						2.64					1.76	0.88	0.88		
C205.2	Mapping		2						3					2	1	1		
	Attainment	2.64	1.76						2.64					1.76	0.88	0.88		
C205.3	Mapping		2						3					2	1	1		
	Attainment	2.64	1.76						2.64					1.76	0.88	0.88		
C205.4	Mapping		2						3					2	1	1		
	Attainment	2.64	1.76						2.64					1.76	0.88	0.88		
C205			1.76						2.64					1.76	0.88	0.88		

SIR M VISVESVARAYA INSTITUTE OF TECHNOLOGY
Bengaluru - 562 157

Department of Mechanical Engineering

Date: 06.10.2023

ADDITIONAL RESPONSIBILITIES FOR THE ACADEMIC YEAR: 2023 - 2024
(With effect from 06.10.2023)

Sl No	Responsibilities	Name of the Coordinator (s)
1	VTU Exam Applications/ Revaluation/Result Analysis	Dr K S Shanmukharadhya Mrs Shery Mol S M DEO
2	Departmental Meetings and Minutes/ Maintenance of office files	Dr K S Shanmukharadhya Mrs Shery Mol S M DEO
3	Website Coordinator	Mrs Asha Rani A
4	Varthamanjari	Mrs Asha Rani A
5	Brindavana Magazine	Mrs Asha Rani A
6	SDP Coordinators	Dr V Shantha Mr K Ejaz Ahmed Mrs Asha Rani A
7	AICTE Activity Points	Dr Kiran Kumar M
8	Guest Lectures/ Industrial Visits	Dr V Shantha Mrs Asha Rani A
9	Academic Committee (Subject Allotment, Time table, Student list, Faculty Requirement, Data Hand Books and Tables for VTU Exams)	Mr S B Halesh Dr Hanamantraygouda M B
10	Department Calendar of Events	Dr K S Shanmukharadhya Dr V Shantha Mr K Ejaz Ahmed
11	Lesson Plan/ Fortnight Faculty Attendance + Syllabus completion Monitoring	Mr S B Halesh Mr Chandrashekar B
12	Course file Monitoring	Mr S B Halesh Dr Hanamantraygouda M B
13	ERP Curriculum/Subject Contents/ Timetable Monitoring	Mr S B Halesh Dr Hanamantraygouda M B
14	LG Department Coordinator	Mr Nataraja M
15	Internal Test paper review and IQAC (Internal Quality Assurance Cell)	Mr Halesh S B Mr Chandrashekar B
16	Project Work and Mini Project Work	Dr Janardhana K Mrs Asha Rani A
17	Technical Seminar	Mr Madhu Kumar K

18	NBA - PAC	Mr Madhu Kumar K
19	Internship	Mr Sampath Kumar L
20	VTU Exams Coordinator /Practical Examination Time Table/Subject mapping	Mr K Ejaz Ahmed Mrs Veena B G
21	Departmental Budget	Dr Janardhana K Mrs Shery Mol S M DEO
22	Fresher's Day – Information Kiosk	Mr Shivakumar S Mr Kumar Swamy R
23	Laboratories/Workshops: Equipment, Consumables, Computing Systems, Software etc. and all lab/workshop related matters	Workshop/Lab In-charges and Technicians
24	CAED/CAMD Lab In-charge	Mr Sampath Kumar L
25	Material Testing Lab In-charge	Dr Yeshvantha H S
26	Foundry and Forging Lab In-charge	Mr Shivakumar S
27	Metrology and Measurements Lab In-charge	Mrs Asha Rani A
28	Machine Shop/ Workshop In-charge	Dr Janardhana K/Mrs Veena B G
29	Energy Conversion (EC)Lab In-charge	Mr Kumar Swamy R
30	Heat Transfer (HT) Lab In-charge	Mr Chandrashekar B
31	Design Lab In-charge	Dr Hanamantraygouda M B
32	CIM Lab In-charge	Mr Ramesh C G
33	Industrial Engineering Lab In-charge	Mr K Ejaz Ahmed
34	ERP Lab / Simulation Lab In- charge	Dr V Shantha
35	Department Skill Development Lab	Dr K S Shanmukharadhya Dr V Shantha Dr Janardhana K Mrs Veena B G
36	Class Rooms/Department Furniture/Lab Furniture/ LCD Projectors and Screens	Mrs Veena B G Mr Subba Raju N C Mr Lokesh T
37	Seminar Hall In-charge	Mr Bhaskar N and Mr Giridhar K
38	R & D Centre: VTU Affiliation Works	Mr Madhu Kumar K
39	SC/ST/OBC Department Cell	Mr Sampath Kumar L
40	Departmental Library	Mr Prashanth L
41	LIC Coordinator	Mr K Ejaz Ahmed Mr Prashanth L
42	NIRF Coordinator	Mr Ramesh C G
43	ARIIA Coordinator	Mr Chandrashekar B
44	NBA and NAAC Department Coordinator	Mr S B Halesh

45	NBA Criteria Coordinator	1. Mr Madhu Kumar K/Mrs Asha Rani A 2. Dr V Shantha/Mr Sampath Kumar L 3. Mr S B Halesh/Dr Hanamantraygouda M B 4. Dr Kiran Kumar M/Mr Prashanth L 5. Mr Ramesh C G/Mr Kumar Swamy R 6. Dr Prashant S H/Mr Shivakumar S 7. Dr Yeshvantha H S/Mrs Veena B G 8. Dr G Balakumar /Mr Nataraja M 9. & 10. Dr Janardhana K/Mr Chandrashekar B
46	NBA Files Coordinators (P1 to P32)	Dr G Balakumar (P1 - P10) Dr Janardhana K (P11 - P21) Dr Yeshvantha H S (P22 - P32)
47	PG Coordinator	Mr Prashanth L
48	Alumni Activities	Mr K Ejaz Ahmed Mr Shivakumar S Mr Kumar Swamy R
49	Parents Teachers Meeting	Mr Ramesh C G Mr Prashanth L
50	VTU Final IA Marks Verification	Dr K S Shanmukharadhya Mr K Ejaz Ahmed
51	VTU E Shikshana	Mrs Veena B G Mrs Asha Rani A
52	Documentation Works/Ranking of Colleges	Mrs Shery Mol S M DEO
53	ISTE Students Chapter: Department Coordinator	Dr Yeshvantha H S
54	Department Computers/Printers	Mr Sampath Kumar L Mr N C Subba Raju
55	Class Advisors	S7 - A : Dr Kiran Kmar M S7 - B : Mr Nataraja M S5 - A : Mr Kumar Swamy R S3 - A: Mrs Veena B G S1 - G: Mrs Asha Rani A
56	Department Academic Audit	Dr G Bala Kumar

NOTE:

All the *faculty members are requested to take the complete responsibility of the assigned works. They can discuss with HOD for any clarification.*

I request all your cooperation.

06.10.2023

HOD

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Department of Mechanical Engineering
Sir M. Visvesvaraya Institute of Technology
Bengaluru-562 157