Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY BANGALORE

COURSE PLAN

Academic Year 2019-20

Program:	B E – Mechanical Engineering
Semester :	7
Course Code:	15ME71
Course Title:	ENERGY ENGINEERING
Credit / L-T-P:	04/3-2-0
Total Contact Hours:	40
Course Plan Author:	Naveen Kumar Pattar

Academic Evaluation and Monitoring Cell

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A. COURSE INFORMATION

1. Course Overview

Degree:	ME	Program:	ME
Semester:	VII	Academic Year:	2019-2020
Course Title:	ENERGY ENGINEERING	Course Code:	15ME71
Credit / L-T-P:	04/3-2-0	SEE Duration:	180 min
Total Contact Hours:	40 Hrs	SEE Marks:	80 Marks
CIA Marks:	20	Assignment	1 / Module
Course Plan Author:	NAVEEN KUMAR PATTAR	Sign	Dt:
Checked By:	PRASANNA GOWDA	Sign	Dt:
CO Targets	CIA Target :90%	SEE Target:	85%

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Identified Module Concepts	Blooms Learning Levels
1	Thermal Energy conversion system: Review of energy scenario in India, General Philosophy and need of Energy, Different Types of Fuels used for steam generation. Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverized fuel. Equipment for preparation and burning of pulverized coal, unit system and bin System. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam Using forced circulation, high and supercritical pressures. Chimneys: Natural, forced, induced and balanced draft. Calculations and numerical involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Super heaters, De-super heater, control of super heaters. Economizers, Air per-heaters and re-heaters.	9	Energy conversion system and Accessories of stem generators	L2,L3
2	Diesel Engine Power System: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Oil heaters, intake and exhaust system, Layout of diesel power plant. Hydro-Electric Energy Hydro graphs, flow duration and mass curves. Pen stock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.	7	Power system and energy storage	L2,L3
3	Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces. Measurement of solar radiation data, Solar Thermal systems. Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector. Solar concentrator; Solar distillation; Solar cooker. Solar refrigeration and air conditioning;Thermal energy storage systems, Solar Photo voltaic systems. Introduction; Solar cell Fundamentals; Characteristics and classification. Solar cell: Module,panel and Array construction; Photo voltaic thermal systems.	8	Renewable energy	L4
4	Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind. Major problems associated with wind power, wind machines. Types of wind machines and their characteristics, horizontal and Vertical axis wind mills. Coefficient of performance of a wind mill rotor. Numerical Example. Tidal Power: Tides and waves as energy suppliers and their mechanics. Fundamental characteristics of tidal power, harnessing tidal energy , limitations.	8	Forms of energy and alternate source	L2

5	Biomass Energy: Introduction; Photosynthesis Process; Bio fuels; Biomass Resources. Biomass conversion technologies; Urban waste to energy. Conversion; Biomass gasification. Green Energy: Introduction: Fuel cells: Overview; Classification of fuel cells. Fuel cell thermodynamics Nuclear, ocean. MHD, thermo electric and geothermal energy applications: Zero energy Concept.	8	Conversion technologies	L2
-	**Total**	**40**	-	-

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).
1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	-	-
1,2,4,5	B H Khan,Non conventional energy resources,3rd Edition, McGraw Hill Education.	1,2,4,5	In Lib
3	S.P.Sukhatme, Solar energy: Principles of Thermal Collection and storage, Tata McGraw Hill(1984).	3	In Lib
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	-	-
3	Solar Energy utilization-G. D. Rai	3	In dept
4	Power plant Engineering ,Domakundawar,Dhanpath Rai sons.2003	4	In dept
1,2,4,5	Energy Engineering by Dr.P.B.Nagaraj;	1,2,4,5	In dept
C	**Concept Videos or Simulation for Understanding**		
1	https://www.fmtv.com › watch › overfed-and-undernourished		
1	encyclopedia.che.engin.umich.edu › Energy Transfer › Cooling Towers		
2	https://www.powermag.com › diesel-gen sets-aim-at-the-future		
2	https://www.acciona-energia.com › other-technologies › hydro power › major-projects		
3	https://www.delta-t.co.uk › Products › Solar Energy › Solar Radiation Research		
3	https://www.luminousindia.com › solar-pv-panel		
4	https://study.com › academy › lesson › what-are-tides-causes-effects		
5	https://www.studentenergy.org › topics › biomass		
5	https://www.freudenberg.com › technologies › innovation › fuel-cell-technology		

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level

4	15MAT21	Engineering Mathematics	Engineering calculus	II		L2
3	15ME33	Basic thermodynamics	Basic thermodynamics	III		L2
3	15ME57	Fluid Mechanics	Fluid Mechanics	IV		L2

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1	Thermal Energy conversion system	Industry and GATE	Seminar on different energy storage systems	L2
4	Harnessing wind and tidal energy	GATE	NPTEL Videos	L2
2	Diesel Engine Power System and its lubrication system	Industry and GATE	Seminar on different lubrication systems	

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	15ME71.1	Understand energy scenario, energy source and utilization	05	Energy conversion system	Lecture	Chalk and board	L2 Understand
1	15ME71.2	Applying the knowledge of conversion methods	04	Accessories of stem generators	Lecture/ Tutorial	Chalk and board	L3 Apply
2	15ME71.3	Understand Diesel Engine working and layout	03	Power system	Lecture	Chalk and board	L2 Understand
2	15ME71.4	Applying the knowledge of storage plants	04	energy storage	Lecture	Chalk and board	L3 Apply
3	15ME71.5	Illustrating the basic concepts of solar radiation and analyze working of solar pv models	08	Renewable energy	Lecture	Chalk and board	L3 Apply
4	15ME71.6	Understanding the forms of energy conversion from alternate source.	05	Forms of energy	Lecture/Tutorial	Chalk and board	L3 Apply
4	15ME71.7	Able to describe the tidal and wave energy	03	Alternate source	Lecture/Tutorial	Chalk and board	L2 Understand
5	15ME71.8	Describe the photo synthesis process and Biomass gasification	04	Conversion technologies	Lecture/Tutorial	Chalk and board	L2 Understand
5	15ME71.9	Understanding the fuel cell concept and applications.	04	Conversion technologies	Lecture	Chalk and board	L2 Understand
-	-	**Total**	**40**	-	-	-	**L2,L3**

2. Course Applications

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Energy conservation scenarios include rational use of energy policies in all economy sectors.	CO1	L2
1	use the evaporation of water to remove process heat and cool the working fluid	CO2	L2
2	Power generation for prime or standby backup power	CO3	L2

2	Energy storage is used in many applications, from building to concentrating power plants and industry.	CO4	L3
3	Residential Homes. Holiday Properties. Central Power Stations. Water Pumping, lighting, heating in the Developing World. Commercial buildings.	CO5	L2
4	Uses of power illustrating the basic concepts of solar radiation and analyze working of solar pv modernization and power conversion	CO6	L2
4	useful forms of power, mainly electricity. Although not yet widely used, tidal energy has potential for future electricity generation.	CO7	L3
5	Power application for rural electrification and captive use	CO8	L2
5	portable power generation, stationary power generation, and power for transportation.	CO9	L2

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Modules	Mapping		Mapping Level	Justification for each CO-PO pair	Level
-	**CO**	**PO**	-	**'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'**	-
1	CO1	PO1	L2	'Engineering Knowledge:'Acquisition of Engineering_Knowledge is required to understand the different energy sources and there utilization to accomplish solutions to complex engineering problems in Mechanical Engineering.	L2
1	CO1	PO2	L3	'Problem Analysis':Analyzing problems require knowledge / understanding different conversions of energy engineering fundamentals to accomplish solutions to complex engineering problems in Mechanical engineering.	L2
2	CO2	PO1	L3	'Engineering Knowledge:'Acquisition of Engineering_Knowledge is required to understand the different Thermal energy storage systems to accomplish solutions to complex engineering problems in Mechanical Engineering..	L3
2	CO2	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding storage systems to accomplish solutions to complex engineering problems in Mechanical engineering.	L3
3	CO3	PO1	L2	'Engineering Knowledge:'Acquisition of Engineering_Knowledge is required to understand the diesel engine power plant in Mechanical Engineering.	L3
3	CO3	PO2	L2	'Problem Analysis':Analyzing problems require knowledge / understanding diesel engine power plant,to accomplish solutions to complex engineering problems in Mechanical engineering.	L3
4	CO4	PO1	L3	'Engineering Knowledge:'Acquisition Knowledge of storage plants is required to understand hydroelectric power plant in Mechanical Engineering.	L2
4	CO4	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding storage plants in the hydro power plant systems to complex engineering problems in Mechanical engineering.	L2
5	CO5	PO1	L3	'Engineering Knowledge:'Acquisition of Engineering_Knowledge is required to understand the basic concept of solar power plant to accomplish solutions to complex engineering problems in Mechanical Engineering.	L2
5	CO5	PO2	L3	'Problem Analysis': Analyzing problems in an solar Pv modules require knowledge / understanding problems in the soalr power plant in Mechanical engineering.	L2
6	CO6	PO1	L2	'Engineering Knowledge:'Acquisition of Engineering_Knowledge is required to understand the energy conversions from alternate source of energy in an complex engineering problems in Mechanical Engineering.	L2
6	CO6	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding problems in conversion systems in an environment.	L2
7	CO7	PO1	L3	'Engineering Knowledge:'Acquisition of Engineering_Knowledge is required to understand the tide and wave enrgy to accomplish solutions to complex engineering problems in Mechanical Engineering.	L2
7	CO7	PO2	L3	'Problem Analysis': Analyzing problems require knowledge / understanding problems in the different types of wave and tidal energy to complex engineering problems in Mechanical engineering.	L3
8	CO8	PO1	L2	'Engineering Knowledge:'Acquisition of Engineering_Knowledge is required to understand the different biomass gasification process to complex engineering problems in Mechanical Engineering.	L2
8	CO8	PO2	L2	Problem Analysis':Analyzing problems require knowledge / understanding	L2

				problems in the different gasifiers s in Mechanical engineering	
9	CO9	PO1	L2	'Engineering Knowledge:'Acquisition of Engineering_Knowledge is required to understand the fuel cell principles to complex engineering_problems in Mechanical Engineering.	L2
9	CO9	PO2	L2	Problem Analysis':Analyzing problems require knowledge / understanding problems in the different types of fuel cells to complex engineering problems in Mechanical engineering	L2

4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	15ME71.1	Understand energy scenario,energy source and utilization	2	3														L2 Understand
1	15ME71.2	Applying the knowledge of conversion methods	3	2														L3 Apply
2	15ME71.3	Understand Diesel Engine working and layout	2	3														L2 Understand
2	15ME71.4	Applying the knowledge of storage plants	2	3														L3 Apply
3	15ME71.5	Illustrating the basic concepts of solar radiation and analyze working of solar pv models	3	2														L3 Apply
3	15ME71.6	Understanding the forms of energy conversion from alternate source.	3	2														L3 Apply
4	15ME71.7	Able to describe the tidal and wave energy	2	3														L2 Understand
4	15ME71.8	Describe the photo synthesis process and Biomass gasification	3	2														L2 Understand
5	15ME71.9	Understanding the fuel cell concept and applications.	2	1														L2 Understand
-	**15ME71**	**Average attainment (1, 2, or 3)**																

5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping

1	Chimneys working details	NPTEL Videos	-	-	PO2
3	Construction of PV module and an array	NPTEL Videos	-	-	PO2
5	Detailed study of fuel cell	NPTEL Videos	12/11/2019	Self	PO2

6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Modules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	Different types of chimney and there working principal	Placement, GATE, Higher Study, .	Presentation by students	30/08/2019	Self	PO1
3	Construction of an array and PV Module	Placement, GATE, Higher Study	Presentation	9/9/2019	Self	PO5

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Thermal Energy conversion system	9	2	-	-	1	1	2	CO1, CO2	L2, L3
2	Diesel Engine Power System and Hydro-Electric Energy	7	2	-	-	1	1	2	CO3, CO4	L2, L3
3	Solar energy	8	-	2	-	1	1	2	CO5,	L3
4	Wind Energy and Tidal power	8	-	2	-	1	1	2	CO6, C07	L2, L2
5	Biomass energy and Green energy	8	-	-	4	1	1	2	CO8, CO9	L2
-	**Total**	**40**	**4**	**4**	**4**	**5**	**5**	**10**	-	-

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	15	CO1, CO2, CO3, CO4	L2, L3, L2,L3
3, 4	CIA Exam – 2	15	CO5, CO6, CO7,	L4,L2,L2
5	CIA Exam – 3	15	CO8, CO9	L2, L2
1, 2	Assignment - 1	05	CO1, CO2, CO3, CO4	L2, L3, L2,L3
3, 4	Assignment - 2	05	CO5, CO6, CO7,	L3,L2,L2
5	Assignment - 3	05	CO8, CO9	L2, L2
1, 2	Seminar - 1	00		
3, 4	Seminar - 2	00		
5	Seminar - 3	00		
	-			
	Final CIA Marks	**20**	CO1 to Co9	L2, L3

D1. TEACHING PLAN – 1

Module - 1

Title:	Thermal Energy conversion system:	Appr Time:	9 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Understand energy scenario,energy source and utilization	CO1	L2
2	Applying the knowledge of conversion methods	CO2	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Thermal Energy conversion system: Review of energy scenario in India, General Philosophy and need of Energy,	C01	L2
2	Different Types of Fuels used for steam generation. Equipment for burning coal in lump form.	C01	L2
3	stokers, different types, Oil burners, Advantages and Disadvantages of using pulverized fuel.	C01	L2
4	Equipment for preparation and burning of pulverized coal,	C01	L2
5	unit system and bin System. Pulverized fuel furnaces, cyclone furnace,	CO2	L3
6	Coal and ash handling, Generation of steam Using forced circulation, high and supercritical pressures	CO2	L3
7	Chimneys: Natural, forced, induced and balanced draft. Calculations and numerical involving height of chimney to produce a given draft.	CO2	L3
8	Cooling towers and Ponds. Accessories for the Steam generators such as Super heaters.	CO2	L3
9	De-super heater, control of super heaters. Economizers, Air per-heaters and re-heaters.	CO2	L3
c	**Application Areas**	**CO**	**Level**
1	Energy conservation scenarios include rational use of energy policies in all economy sectors.	CO1	L3
2	use the evaporation of water to remove process heat and cool the working fluid.	CO2	L3
d	**Review Questions**	-	-
-		-	-
1	Explain Review of energy scenario in India?	CO1	L2
2	Explain the Velox steam generator, with a neat sketch.	CO2	L3
3	Classify different types of Draughts and explain with a neat sketch the balanced draught.	CO2	L2
4	What is pulverized coal?	CO2	L2
5	Explain with sketch overfeed and underfeed principle of firing coal.?	CO2	L3
6	Sketch and explain a cyclone Burner with advantages and disadvantages.?	CO2	L3
7	Calculate the mass of flue gases flowing through the chimney when the draught produced is equal to 2 cm of water, temperature of flue gases is 300 °C and ambient temperature is 20°C. The flue gases formed per kg of fuel burnt are 25 kg. Neglect the losses and take the diameter of the chimney as 1.9 meter.	CO2	L3
8	Explain a typical hydraulic ash handling system, with neat sketch. List the advantages and disadvantages of pulverized fuel.	CO2	L2
9	Explain briefly about i) Economizer ii) Air preheater.	CO2	L2
10	Derive an expression for chimney height.	CO2	L3
e	**Experiences**	-	-

Module – 2

Title:	**Energy storage systems**	Appr Time:	7Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-		-	**Level**
1	Understand Diesel Engine working and layout	CO3	L2
2	Applying the knowledge of storing plants	CO4	L3
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
11	Diesel Engine Power System Applications of Diesel Engines in Power field.	CO3	L2
12	Method of starting Diesel engines. Oil heaters, intake and exhaust system.	CO3	L2
13	Layout of diesel power plant.	CO3	L2
14	Hydro-Electric Energy Hydro graphs,	CO3	L2
15	flow duration and mass curves.	CO4	L3
16	Pen stock, water hammer, surge tanks, gates and valves.	CO4	L3
17	General layout of hydel power plants.	CO4	L2
C	**Application Areas**	**CO**	**Level**
3	Power generation for prime or standby backup power	CO3	L3
4	Energy storage is used in many applications, from building to concentrating power plants and industry.	CO4	L4
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Draw a line diagram to show the layout of diesel power plant.	CO3	L2
2	Explain different methods of starting the diesel engine.	CO3	L3
3	For a diesel power station. Discuss briefly about the following: (i) Cooling system (ii) Lubricating system.	CO3	L2
4	How are the hydro-electric power plant classified? With a neat sketch, explain the pumped storage plant.?	CO4	L3
5	Give a brief note on i) Hydrograph ii) Flow duration curve.	CO4	L2
6	Draw a general layout of hydro — electric power plant and explain the functions of each part.	CO3	L3
7	Explain briefly about : i) Water hammer effect ii) Surge tank.	CO3	L2
8	Define the term Hydrograph and Unit Hydrographs.	CO3	L3
9	A catchment area of the dam used for hydroelectric station is 250 km2. The annual rainfall is 125cm. If 70% of water is used for power generation in the dam, calculate the capacity of power plant in MW. Assume that the turbine efficiency is 90% and generator efficiency is 95%. Neglect the losses.	CO4	L3
10	State the important factors to be considered while selecting the site for hydro – electric power plant.	CO4	L3
11	Explain different methods of starting of diesel engine.	CO4	L3
e	**Experiences**	-	-

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	15ME71	Sem:	7	Marks:	30	Time:	75 minutes		
Course:	Energy Engineering								
-	**-**	**Note: Answer all questions, each carry equal marks. Module : 1, 2**					**Marks**	**CO**	**Level**
1	a	Explain With sketch Overfeed and underfeed principle of firing coal. write its advantages and disadvantages?					8	1	L2
	b	What is Pulverized coal? Explain Pneumatic or Vacuum extraction ash handling system?					7	1	L2
		OR							
2	a	Explain with a neat sketch working of natural draught and hyperbolic cooling towers?					7	2	L2

<table>
<tr><td></td><td>b</td><td>Find the draught produced in mm of water by a chimney 40m high and discharging 20kg of flues per kg of fuel burnt in combustion chamber. The temperature of the flue gases and ambient temperature of air are 270^0c and 23^0c respectively. Assuming diameter of chimney as 1.5m and 30% of theoretical draught is lost in the friction, find mass of flue gases passing through chimney per minute.</td><td>8</td><td>2</td><td>L3</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>a</td><td>Draw a line diagram to show the layout of Diesel power plant? Write the Advantages and disadvantages ?</td><td>7</td><td>3</td><td>L2</td></tr>
<tr><td></td><td>b</td><td>Explain with neat sketch, Individual pump injection system and common rail injection system in diesel power plant?</td><td>8</td><td>3</td><td>L2</td></tr>
<tr><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>a</td><td>State the important factors to be considered while selecting the site for hydro-electric power plant? What are the merits and demerits?</td><td>7</td><td>4</td><td>L2</td></tr>
<tr><td></td><td>b</td><td>The run off data of a river at a particular site is tabulated below
<table>
<tr><td>Month</td><td>Mean Discharge in Millions of cu.m/month</td><td>Month</td><td>Mean Discharge i millions c cu.m/month</td></tr>
<tr><td>January</td><td>40</td><td>July</td><td>70</td></tr>
<tr><td>February</td><td>25</td><td>August</td><td>100</td></tr>
<tr><td>March</td><td>20</td><td>September</td><td>105</td></tr>
<tr><td>April</td><td>10</td><td>October</td><td>60</td></tr>
<tr><td>May</td><td>0</td><td>November</td><td>50</td></tr>
<tr><td>June</td><td>50</td><td>December</td><td>40</td></tr>
</table>
(a) Draw Hydrograph and find the mean flow
(b) Draw flow duration curve
(c) Find the Power in MW available at mean flow,if the head available is 100m and overall efficiency of generation is 80%.</td><td>8</td><td>4</td><td>L3</td></tr>
</table>

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	15ME71	Sem:	VII	Marks:	5	Time:	90 – 120 minutes
Course:	Energy Engineering			Module : 1, 2			
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1		Explain Review of energy scenario in India?	5	CO1	L2
2		What do you understand by energy conservation?Explain its various aspects.	5	CO2	L3
3		Explain Various aspects of energy conservation.	5	CO2	L3
4		What do you understand by energy storage.	5	CO1	L3
5		Explain various source of energy.	5	CO1	L2
6		Explain with a neat sketch spreader stoker.	5	CO2	L3
7		With a neat sketch explain the pulverized fuel firing.	5	CO2	L3
8		Explain unit system write the advantages and disadvantages.	5	CO2	L3
9		Explain central system write the advantages and disadvantages.	5	CO2	L2
10		Explain the Velox steam generator, with a neat sketch.	5	CO2	L3
11		Classify different types of Draughts and explain with a neat sketch the balanced draught.	5	CO2	L3

<table>
<tr><td>12</td><td></td><td>Derive an expression for chimney height.</td><td>5</td><td>CO1</td><td>L3</td></tr>
<tr><td>13</td><td></td><td>Explain with sketch overfeed and underfeed principle of firing coal.?</td><td>5</td><td>CO1</td><td>L2</td></tr>
<tr><td>14</td><td></td><td>Sketch and explain a cyclone Burner with advantages and disadvantages.?</td><td></td><td>CO2</td><td>L3</td></tr>
<tr><td>15</td><td></td><td>Calculate the mass of flue gases flowing through the chimney when the draught produced is equal to 2 cm of water, temperature of flue gases is 300 °C and ambient temperature is 20°C. The flue gases formed per kg of fuel burnt are 25 kg. Neglect the losses and take the diameter of the chimney as 1.9 meter.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>16</td><td></td><td>Explain a typical hydraulic ash handling system, with neat sketch. List the advantages and disadvantages of pulverized fuel.</td><td>5</td><td>CO2</td><td>L3</td></tr>
<tr><td>17</td><td></td><td>Explain briefly about i) Economizer ii) Air preheater iii)What is pulverized coal.</td><td>5</td><td>CO2</td><td>L2</td></tr>
<tr><td>18</td><td></td><td>Draw a line diagram to show the layout of diesel power plant.</td><td>5</td><td>CO3</td><td>L3</td></tr>
<tr><td>19</td><td></td><td>Explain different methods of starting the diesel engine.</td><td>7</td><td>CO3</td><td>L3</td></tr>
<tr><td>20</td><td></td><td>For a diesel power station. Discuss briefly about the following:(i) Cooling system(ii) Lubricating system.</td><td>7</td><td>CO3</td><td>L3</td></tr>
<tr><td>21</td><td></td><td>How are the hydro-electric power plant classified? With a neat sketch, explain the pumped storage plant.?</td><td>7</td><td>CO4</td><td>L2</td></tr>
<tr><td>22</td><td></td><td>Give a brief note on i) Hydrograph ii) Flow duration curve.</td><td>7</td><td>CO4</td><td>L3</td></tr>
<tr><td>23</td><td></td><td>Draw a general layout of hydro — electric power plant and explain the functions of each part.</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>24</td><td></td><td>Explain briefly about:i) Water hammer effect ii) Surge tank.</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>25</td><td></td><td>Define the term Hydrograph and Unit Hydrographs.</td><td>5</td><td>CO4</td><td>L2</td></tr>
<tr><td>26</td><td></td><td>A catchment area of the dam used for hydroelectric station is 250 km2. The annual rainfall is 125cm. If 70% of water is used for power generation in the dam, calculate the capacity of power plant in MW. Assume that the turbine efficiency is 90% and generator efficiency is 95%. Neglect the losses.</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>27</td><td></td><td>State the important factors to be considered while selecting the site for hydro – electric power plant.</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>28</td><td></td><td>Explain different methods of starting of diesel engine.</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>29</td><td></td><td>With a neat sketch explain natural draught spray</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>30</td><td></td><td>Explain the functions of desuper heater</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>31</td><td></td><td>Compare the Diesel and Thermal power plants</td><td>5</td><td>CO4</td><td>L2</td></tr>
<tr><td>32</td><td></td><td>Briefly explain Lubricating system for Diesel engine</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>33</td><td></td><td>Write advantages and dis advantages of flow duration curves</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>34</td><td></td><td>
<table>
<tr><td>Month</td><td>Discharge m^3/sec</td><td>Month</td><td>Discharge m^3/sec</td></tr>
<tr><td>January</td><td>200</td><td>July</td><td>2000</td></tr>
<tr><td>February</td><td>450</td><td>August</td><td>2400</td></tr>
<tr><td>March</td><td>600</td><td>September</td><td>1800</td></tr>
<tr><td>April</td><td>1200</td><td>October</td><td>1200</td></tr>
<tr><td>May</td><td>1500</td><td>November</td><td>800</td></tr>
<tr><td>June</td><td>1600</td><td>December</td><td>400</td></tr>
<tr><td colspan="4">The Mean monthly discharge at a site is as shown in table draw the hydro graph and flow duration curve.</td></tr>
</table>
</td><td>5</td><td>CO4</td><td>L3</td></tr>
<tr><td>35</td><td></td><td>The monthly discharge for 12 months of a particular site as shown below
<table>
<tr><td>Month</td><td>Discharge m^3/sec</td><td>Month</td><td>Discharge m^3/sec</td></tr>
<tr><td>January</td><td>100</td><td>July</td><td>1000</td></tr>
<tr><td>February</td><td>200</td><td>August</td><td>1200</td></tr>
</table>
</td><td>5</td><td>CO4</td><td>L3</td></tr>
</table>

		March	325	September	850			
		April	600	October	600			
		May	750	November	400			
		June	825	December	200			
		Draw the following a) Hydro graph for the given discharge and find the average flow.b)Flow duration curve c)The power available at mean flow of water if available head is 80meters at the site and overall efficiency of generation is 80%						
36		The run off data of a river at a particular site is tabulated below				5	CO4	L3
		Month	Mean discharge in millions of Cu.m/month	Month	Mean discharge in millions of Cu.m/month			
		January	40	July	70			
		February	25	August	100			
		March	20	September	105			
		April	10	October	60			
		May	00	November	50			
		June	50	December	40			
		a) Draw Hydro graph and find the mean flow.b)Draw Flow duration curve c)Find the power in MW available at mean flow if the head available is 100m and overall efficiency of generation is 80%						
37		For a particular site of river the following run off data was recorded for 10months find the maximum flow available through out the year if storage capacity at the site is 100million m^3				5	CO4	L3
		Month	Discharge(Millions of m^3/month)	Month	Discharge(Millions of m^3/month)			
		1	200	6	180			
		2	100	7	40			
		3	20	8	280			
		4	20	9	60			
		5	260	10	120			
38		Define the pondage factor?determine the capacity of a run off river hydro power plant to be used as 10hrs peaking plant,assuming daily flow in a river to be constant at 20m^3/sec.calculate the pond age factor and pondage,if the head of the plant is 12m and overall efficiency is 80%.				5	CO4	L3
39		Define the run off discuss the factors of run off.				5	CO3	L2
40		Compare hydro electric and steam power plant.				5	CO3	L2
41		Explain the function off spill way.				5	CO3	L2
42		Explain fore bay..				5	CO3	L2
43		Compare the forced draught and Induced draught				5	CO3	L2
44		Find the motor power required to run a fan to produce a draught of 55mm of water for induced drught fan and forced draught fan with				5	CO4	L3

		following data flue gas temperature=250^{0}C Ambient temperature=25^{0}C Air supply per kg of fuel=18kg Mass of coal burnt per hour =1800kg Fan efficiency=85%			

D2. TEACHING PLAN - 2

Module – 3

Title:	**Solar energy**	Appr Time:	8 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Illustrating the basic concepts of solar radiation and analyze working of solar pv models	CO5	L4
b	***Course Schedule***		
Class No	**Portion covered per hour**	-	-
1	Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces.	CO5	L2
2	Measurement of solar radiation data, Solar Thermal systems.	CO5	L3
3	Basics of thermodynamics and heat transfer; Flat plate collector;	CO5	L3
4	Evacuated Tubular Collector; Solar air collector. Solar concentrator; Solar distillation; Solar cooker. Solar refrigeration and air conditioning.	CO5	L4
5	Thermal energy storage systems, Solar Photo voltaic systems.	CO5	L4
6	Solar cell Fundamentals; Characteristics and classification.	CO5	L4
7	Solar cell: Module, panel and Array construction.	CO5	L4
8	Photo voltaic thermal systems.	CO5	L4
c	**Application Areas**	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Residential Homes. Holiday Properties. Central Power Stations. Water Pumping, lighting, heating in the Developing World. Commercial buildings.	CO5	L3
2	Uses of power illustrating the basic concepts of solar radiation and analyze working of solar pv models generation and power conversion	CO5	L4
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	Sketch and explain the working of Pyranometer.	CO5	L3
2	Sketch and explain the principle of working of solar pond.	CO5	L3
3	Calculate the angle made by beam radiation with the normal to a flat plate collector on May1 at 0900h (local apparent time). The collector is located in New Delhi (28°35'N,	CO5	L4

	77°12T). It is tilted at an angle of 36 with the horizontal and is pointing down South.		
4	Name Solar Radiation measuring instruments and explain any one with neat sketch.	CO5	L4
5	The incident beam of sunlight has a power density of 0.9 kW/m2 in the direction of the beam. The angle of incidence 0 is 60°. Calculate the power collected by the surface, having a total flat area of 100 m^2.	CO5	L4
6	Explain Solar Desalination.	CO5	L3
7	Explain the methods of harnessing solar energy.	CO5	L3
8	Explain the Solar Cell Characteristics.	CO5	L3
9	Explain Different types of solar cookers.	CO5	L3
10	Define the following terms a)Latitude angle b)Declination C)Hour angle d)Azimuth angle e)Zenith angle.	CO5	L4
e	**Experiences**	-	-

Module – 4

Title:	**Wind energy and Tidal power**	Appr Time:	8 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	At the end of the topic the student should be able to . . .	-	**Level**
1	Understanding the forms of energy conversion from alternate source.	CO6	L2
2	Able to describe the tidal and wave energy	CO7	L3
b	***Course Schedule***		
Class No	**Portion covered per hour**	-	-
1	Wind Energy: Properties of wind, availability of wind energy in India,	CO6	L2
2	wind velocity and power from wind. Major problems associated with wind power, wind machines.	CO6	L3
3	Types of wind machines and their characteristics	CO6	L2
4	wind machines., horizontal and Vertical axis wind mills.	CO6	L3
5	Coefficient of performance of a wind mill rotor. Numerical Example.	CO6	L3
6	Tidal Power: Tides and waves as energy suppliers and their Mechanics.	CO7	L2
7	Fundamental characteristics of tidal power, harnessing tidal energy , limitations.	CO7	L2
8	Numerical Example	CO7	L3
c	**Application Areas**	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	useful forms of power, mainly electricity. Although not yet widely used, tidal energy has potential for future electricity generation.	CO6	L3
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	What are the advantages and limitations of Tidal power generation?	CO6	L1
2	With a neat sketch, explain the closed cycle OTEC plant	CO6	L3
3	Briefly write a note on geothermal energy.	CO6	L2
4	With a neat diagram, explain the working principle of Rankine Cycle — OTEC power plant.	CO6	L3
5	Name the different Hydro Thermal convective system and explain any one system, with a neat sketch.	CO6	L2
6	Give a short note on tidal power plant.	CO6	L2
8	Explain briefly about OTEC plants.	CO6	L2
9	What is meant by Geothermal energy conversion?	CO7	L3
10	A hot water geothermal plant of the total flow type receives water at 225°C. The pressure at the turbine inlet is 10.5 kg/cm2 . The plant uses a direct contact condenser that operates at 0.35 kg/cm2 . The turbine has a polytrophic efficiency of 0.65 for a cycle net output of10MW. Calculate by using stream table and Molier chart.(i) The hot water flow in kg/hr. (ii) The condenser cooling water flow in kg/hr at water temperature at 27°C.(iii) The cycle efficiency.(iv) The plant heat rate.	CO7	L3

11	Describe low and high tides. What are the different techniques of harnessing tidal energy?	CO7	L3
12	What are the advantages and limitations of Tidal power generation?	CO6	L1
13	With a neat sketch, explain the closed cycle OTEC plant	CO6	L3
e	**Experiences**	-	-

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	15ME71	Sem:	VII	Marks:	30	Time:	75 minutes		
Course:	Energy Engineering								
-	**-**	**Note: Answer all questions, each carry equal marks. Module : 3, 4**					**Marks**	**CO**	**Level**
1	a	Sketch and Explain the working of Pyranometer?					7	5	L2
	b	What are the main applications of the Solar Pond? Explain With the help of a neat diagram,a solar pond electric power plant?					8	5	L2
		OR							
2	a	What is flat plate collector? Write Brief Description of Liquid collector?					7	5	L2
	b	Explain with a sketch Photo voltaic working principal? what are the advantages and disadvantages?					8	5	L2
3	a	Derive an Expression for wind velocity and power of the wind?					8	6	L3
	b	Explain with a sketch Darrieus and Savonius Wind turbines?					7	6	L2
		OR							
4	a	Explain the method of Harnessing tidal energy using Double basin system?					7	7	L2
	b	What are the main components of tidal power plant and list any 6 advantages and 4 disadvantages of tidal power plant?					8	7	L2

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions									
Crs Code:	15ME71	Sem:	VII	Marks:	5	Time:	90 – 120 minutes		
Course:	Energy Engineering				Module : 3, 4				
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.									
SNo	**USN**	**Assignment Description**					**Marks**	**CO**	**Level**
1		Compare the Flat plate collector and Focusing collector.					5	CO5	L2
2		Mention the advantages and disadvantages of photo-voltaic energy conversion.					5	CO5	L2
3		Name the instruments used for measuring beam radiation.					5	CO5	L2
4		Calculate number of day light hours at Bangalore on January 1 and July 1.The latitude of Srinagar is 34· 05′N.					5	C05	L3
5		Calculate number of day light hours in Srinagar on 21 June and 21 December in a leap year. The latitude of Bangalore is 12°C 58N.					5	C05	L3
6		What are the basic features required for an ideal pyranometer.					5	CO5	L3
7		Name the basic sun earth angles and explain.					5	C05	L3
8		Explain the Sunshine recorder.					5	C05	L3
9		Explain Box type solar cooker.					5	C05	L3
10		Explain solar cell construction.					5	C05	L3
11		Explain solar pv module.					5	C05	L3
12		Describe the solar PV panel and solar PV array.					5	C05	L3
13		What are the advantages and limitations of Tidal power generation?					5	CO7	L2
14		With a neat sketch, explain the closed cycle OTEC plant.					5	CO7	L3
15		Briefly write a note on geothermal energy.						CO7	L2
16		With a neat diagram, explain the working principle of Rankine Cycle — OTEC power plant.					5	CO7	L3
17		Name the different Hydro Thermal convective system and explain any one system, with a neat sketch.					5	CO7	L2

18		Give a short note on tidal power plant.	5	CO7	L2
19		Explain briefly about OTEC plants.		CO7	L3
20		What is meant by Geothermal energy conversion?	5	CO7	L2
21		A hot water geothermal plant of the total flow type receives water at 225°C. The pressure at the turbine inlet is 10.5 kg/cm2 . The plant uses a direct contact condenser that operates at 0.35 kg/cm2 . The turbine has a polytrophic efficiency of 0.65 for a cycle net output of10MW. Calculate by using stream table and Molier chart.(i) The hot water flow in kg/hr.(ii) The condenser cooling water flow in kg/hr at water temperature at 27°C.(iii) The cycle efficiency.(iv) The plant heat rate.	5	CO7	L3
22		Describe low and high tides. What are the different techniques of harnessing tidal energy?	5	CO7	L2
23		With a sketch explain the working of "Hot dry rock" geothermal plant.		CO6	L2
24		Describe low and high tides. What are the different techniques of harnessing tidal energy?	5	CO6	L3
25		Explain the major application of wind power.	5	CO6	L3
26		Explain the factors affecting the wind energy on surface of earth.	5	CO6	L3
27		Describe the variation of wind speed with height.	5	CO6	L3
28		Explain components of horizontal axis wind turbine.	5	CO6	L3
29		Describe the wind energy pro gramme in India.	5	CO6	L3
30		Explain the properties of wind energy.	5	CO6	L2
31		Derive the expression for wind velocity and wind power from wind.	5	CO6	L3
32		Explain the major problems associated with wind power.	5	CO6	L2
33		Wind blows with a velocity of 16m/s and $15^{\cdot c}$,Assume 1 standard atmospheric pressure and turbine diameter=115m with operating speed=40 rpm at maximum efficiency calculate the following 1)Total power density in wind stream 2)Maximum obtainable power density 3)Reason ally obtainable power density 4)Total power 5)Torque and axial thrust	5	CO6	L4
34		What is the basic principle of wind energy.	5	CO6	L2
35		Explain how winds are created.	5	CO6	L3
36		Explain scope of Geothermal energy .	5	CO7	L2
37		What are the difficulties in tidal power plants.	5	CO7	L2
38		What is wave energy mention advantages and disadvantages.	5	CO6	L2
39		Define and classify geothermal sources.	5	CO7	L2
40		Explain single and double basin power plant.	5	CO7	L3

D3. TEACHING PLAN - 3

Module – 5

Title:	**Biomass energy and Green energy**	Appr Time:	8Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Describe the photo synthesis process and Biomass gasification.	CO8	L2
2	Understanding the fuel cell concept and applications.	CO9	L2
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	-	-

1	Biomass Energy: Introduction; Photosynthesis Process;	CO8	L2
2	Bio fuels; Biomass Resources.	CO8	L2
3	Biomass conversion technologies;	CO8	L2
4	Urban waste to energy. Conversion; Biomass gasification.	CO8	L2
5	Green Energy: Introduction: Fuel cells	CO9	L2
6	Overview; Classification of fuel cells. Fuel cell thermodynamics Nuclear, ocean.	CO9	L2
7	Geothermal energy applications	CO9	L2
8	Zero energy Concept.	CO9	L2
c	**Application Areas**	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Power application for rural electrification and captive use	CO8	L2
2	portable power generation, stationary power generation, and power for transportation.	CO9	L2
d	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
1	What are the factors affecting biogas generation? Explain any two factors.	CO8	L2
2	Explain with neat sketch of Indian Bio-gas plant.	CO8	L2
3	In brief write a note on energy plantation.	CO9	L2
4	Explain the difference between biomass and bio gas.	CO8	L2
5	Describe the factors affecting bio gas production.	CO8	L2
6	With a neat sketch, explain the construction and working of KVIC digester.	CO9	L2
7	What are the stages in anaerobic digestion process? Explain.	CO9	L2
8	With neat sketch, explain the working of floating type digester	CO8	L2
9	What are the factors affecting the generation of biogas in a digester?	CO9	L2
10	Write the classification of Biomass gasifiers.	CO8	L2
11	Explain the working of Downdraft gasifier, with a neat sketch.	CO9	L2

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	15ME71	Sem:	VII	Marks:	30	Time:	75 minutes
Course:	ENERGY ENGINEERING						

-	-	**Note: Answer any 2 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Define Biogas ? Describe the factors affecting Biogas production.	7	8	L2
	b	With a neat sketch explain the construction and working of KVIC digester. Write advantages and disadvantages.	8	8	L2
		OR			
2	a	Define Biomass Gasification? Explain the process involved in it with neat sketch.	7	8	L2
	b	Write a note on a)Anaerobic fermentation b)Photosynthesis c)Energy plantation d)Effect of temperature on biogas generation.	8	8	L2
3	a	Briefly explain Alkaline and Molten carbonate Fuel Cell.	8	9	L3
	b	With a neat sketch explain MHD power generation.	7	9	L2
		OR			
4	a	Explain briefly Geothermal energy ? Write advantages and disadvantages.	8	9	L2
	b	With a neat sketch explain the closed cycle OTEC plant.	7	9	L2

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	15ME71	Sem:	VII	Marks:	5	Time:	90 – 120 minutes
Course:	ENERGY ENGINEERING				Module : 5		
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1		What are the factors affecting biogas generation? Explain any two factors.	5	CO8	L2
2		Explain with neat sketch of Indian Bio-gas plant.	5	CO8	L2
3		In brief write a note on energy plantation.		CO8	L2
4		Explain the difference between biomass and bio gas.	5	CO8	L2
5		Describe the factors affecting bio gas production.	5	CO8	L2
6		With a neat sketch, explain the construction and working of KVIC digester.	5	CO8	L2
7		What are the stages in anaerobic digestion process? Explain.		CO8	L2
8		With neat sketch, explain the working of floating type digester.	5	CO9	L2
9		What are the factors affecting the generation of biogas in a digester?	5	CO9	L2
10		Write the classification of Biomass gasifiers.	5	CO9	L2
11		Explain the working of Downdraught gasifier, with a neat sketch.		CO9	L2
12		Explain Zero energy concepts.	5	CO9	L2
13		Explain concept of Fuel Cell.	5	CO9	L2
14		Explain the working of Downdraft gasifier, with a neat sketch.	5	CO9	L2
15		Explain fuel cell thermodynamics Nuclear .		CO9	L2
16		Explain MHD .	5	CO9	L2
17		List the geothermal energy applications.	5	CO9	L2
18		Differentiate between Floating drum plant and fixed drum plant.	5	CO9	L2
19		Explain digestion,Pyrolysis,and Hydro gasification.	5	CO9	L2
20		With necessary equations explain gasification process.	5	CO9	L2
21		Explain the difference between biomass and biogas.List the factors affecting biogas production.			
22		Explain the classification of Biomass with an examples.	5	CO9	L2
		What are the advantages and disadvantages of green energy	5	CO9	L2
		Explain wet and dry fermentation	5	CO9	L2
		Explain the condition necessary for photosynthesis	5	CO9	L2

F. EXAM PREPARATION

1. University Model Question Paper

Course:	ENERGY ENGINEERING					Month / Year	May /2019
Crs Code:	15ME71	Sem:	VII	Marks:	80	Time:	180 minutes

Module	Note	Answer all FIVE full questions. All questions carry equal marks.	Marks	CO	Level
1	a	Explain Review of energy scenario in India?	6	CO1	L2
	b	Explain the Velox steam generator, with a neat sketch.	5	CO2	L2
	c	Classify different types of Draughts and explain with a neat sketch the balanced draught.	5	CO2	L2
		OR			
2	a	Sketch and explain a cyclone Burner with advantages and disadvantages.?	5	CO1	L2
	b	Calculate the mass of flue gases flowing through the chimney when the draught produced is equal to 2 cm of water, temperature of flue gases is 300 °C and ambient temperature is 20°C.The flue gases formed per kg of fuel burnt are 25 kg. Neglect the losses and take the diameter of the chimney as 1.9 metre.	6	CO2	L3
	C	Explain a typical hydraulic ash handling system, with neat sketch.	5		L3
3	a	Draw a line diagram to show the layout of diesel power plant.	5	C03	L3
	b	Explain different methods of starting the diesel engine.	5	CO3	L3
	C	For a diesel power station. Discuss briefly about the following: (i) Cooling system (ii) Lubricating system.	6	CO4	L3

4	a	Define the term Hydrograph and Unit Hydrographs.	5	CO3	L3
	b	A catchment area of the dam used for hydroelectric station is 350 km2. The annual rainfall is 135cm. If 80% of water is used for power generation in the dam, calculate the capacity of power plant in MW. Assume that the turbine efficiency is 80% and generator efficiency is 85%. Neglect the losses.	6	CO4	L3
	c	State the important factors to be considered while selecting the site for hydro – electric power plant.	5	CO4	L3
5	a	Sketch and explain the working of Pyranometer.	5	CO5	L3
	b	Sketch and explain the principle of working of solar pond.	5		L3
	c	Calculate the angle made by beam radiation with the normal to a flat plate collector on June1 at 0900h (local apparent time). The collector is located in New Delhi (28°35'N, 77°12T). It is tilted at an angle of 36 with the horizontal and is pointing down South.	6	CO5	L4
		OR			
6	a	Explain the Solar Cell Characteristics	5	CO5	L3
	b	Explain Different types of solar cookers	5	CO5	L3
	c	Define the following terms a)Latitude angle b)Declination C)Hour angle d)Azimuth angle e)Zenith angle	6	CO5	L3
7	a	With a neat diagram, explain the working principle of Rankine Cycle — OTEC power plant.	6	CO6	L3
	b	What is meant by Geothermal energy conversion?	5	CO6	L3
	c	What are the advantages and limitations of Tidal power generation?	5	C06	L3
		OR			
8	a	A hot water geothermal plant of the total flow type receives water at 225°C. The pressure at the turbine inlet is 10.5 kg/cm2 . The plant uses a direct contact condenser that operates at 0.35 kg/cm2 . The turbine has a polytrophic efficiency of 0.65 for a cycle net output of10MW. Calculate by using stream table and Molier chart.(i) The hot water flow in kg/hr. (ii) The condenser cooling water flow in kg/hr at water temperature at 27°C.(iii) The cycle efficiency.(iv) The plant heat rate.	6	CO7	L3
	b	Describe low and high tides. What are the different techniques of harnessing tidal energy?	5	CO7	L3
	c	Explain the factors affecting the wind energy on surface of earth	5	CO7	L3
9	a	What are the factors affecting biogas generation? Explain any two factors.	5	CO8	L2
	b	Explain the difference between biomass and biogas.	5	CO8	L2
	c	Describe the factors affecting biogas production.	6	CO8	L2
		OR			
10	a	With a neat sketch, explain the construction and working of KVIC digester.	6	CO9	L2
	b	What are the stages in anaerobic digestion process? Explain.	5	CO9	L2
	c	Explain Photosynthesis process	5	C09	L2

2. SEE Important Questions

Course:		ENERGY ENGINEERING					Month / Year	May /2019	
Crs Code:		15ME71	Sem:	VII	Marks:	80	Time:	180 minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.					-	-	
Module	Qno.	Important Question					**Marks**	**CO**	**Year**
1	1	Explain the Velox steam generator, with a neat sketch.					8	CO1	2016
	2	Classify different types of Draughts and explain with a neat sketch the balanced draught.					10	CO2	2016
	3	Sketch and explain a cyclone Burner with advantages and disadvantages.?					8	CO2	2014
	4	Explain a typical hydraulic ash handling system, with neat sketch.					8	CO3	2013
2	1	Draw a line diagram to show the layout of diesel power plant.					8	C03	2013
	2	Explain different methods of starting the diesel engine.					8	CO3	2015
	3	For a diesel power station. Discuss briefly about the following:					8	CO4	2014

		(i) Cooling system (ii) Lubricating system.			
	4	Define the term Hydrograph and Unit Hydrographs.	8	CO3	2016
	5	A catchment area of the dam used for hydroelectric station is 350 km2. The annual rainfall is 135cm. If 80% of water is used for power generation in the dam, calculate the capacity of power plant in MW. Assume that the turbine efficiency is 80% and generator efficiency is 85%. Neglect the losses.	10	CO4	2015
	6	State the important factors to be considered while selecting the site for hydro – electric power plant.	8	CO4	2014
3	1	Sketch and explain the working of Pyranometer.	8	CO5	2017
	2	Sketch and explain the principle of working of solar pond.	8	CO5	2016
	3	Calculate the angle made by beam radiation with the normal to a flat plate collector on June1 at 0900h (local apparent time). The collector is located in New Delhi (28°35'N, 77°12T). It is tilted at an angle of 36 with the horizontal and is pointing down South.	8	CO5	2014
4	1	With a neat diagram, explain the working principle of Rankine Cycle — OTEC power plant.	10	CO6	2017
	2	What is meant by Geothermal energy conversion?	8	CO6	2013
	3	What are the advantages and limitations of Tidal power generation?	8	C06	2015
5	1	What are the factors affecting biogas generation? Explain any two factors.	10	CO8	2017
	2	Explain the difference between biomass and biogas.	8	CO8	2015
	3	Describe the factors affecting biogas production.	6	CO8	2014
	4	What are the stages in anaerobic digestion process? Explain.	8	CO9	2016
	5	Explain Photosynthesis process	6	CO9	2017

G. Content to Course Outcomes

1. TLPA Parameters

Table 1: TLPA – Example Course

Module- #	Course Content or Syllabus (Split module content into 2 parts which have similar concepts)	Content Teaching Hours	Blooms' Learning Levels for Content	Final Blooms' Level	Identified Action Verbs for Learning	Instruction Methods for Learning	Assessment Methods to Measure Learning
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1	Thermal Energy conversion system: Review of energy scenario in India, General Philosophy and need of Energy, Different Types of Fuels used for steam generation. Equipment for burning coal in lump form, stokers, different types, Oil burners, Advantages and Disadvantages of using pulverized fuel. Equipment for preparation and burning of pulverized coal, unit system and bin System. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling, Generation of steam Using forced circulation, high and supercritical pressures.	5	L1,L2	L2	Understand	Chalk and board	Assignment
1	Chimneys: Natural, forced, induced and balanced draft. Calculations and numerical involving height of chimney to produce a given draft. Cooling towers and Ponds. Accessories for the Steam generators such as Super heaters, De-super heater, control of super heaters. Economizers, Air per-heaters and re-heaters.	4	L1,L2,L3	L3	Apply	Chalk and board	Assignment
2	Diesel Engine Power System: Applications of Diesel Engines in Power field. Method of starting Diesel engines. Oil heaters, intake and exhaust system, Layout of diesel power	3	L1,L2,L3	L3	Apply	Chalk and board	Assignment and Slip Test

	plant.						
2	Hydro-Electric Energy Hydro graphs, flow duration and mass curves. Pen stock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.	4	L1,L2,L3	L3	Apply	Chalk and board	Assignment
3	Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces. Measurement of solar radiation data, Solar Thermal systems. Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector. Solar concentrator; Solar distillation; Solar cooker. Solar refrigeration and air conditioning;Thermal energy storage systems, Solar Photo voltaic systems.	4	L1,L2,L3	L3	Apply	Chalk and board	Assignment and slip test
3	Introduction; Solar cell Fundamentals; Characteristics and classification. Solar cell:Module,panel and Array construction;Photo voltaic thermal systems.	4	L1,L2	L2	Understand	Chalk and board	Assignment
4	Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind. Major problems associated with wind power, wind machines. Types of wind machines and their characteristics, horizontal and Vertical axis wind mills. Coefficient of performance of a wind mill rotor. Numerical Example	4	L1,L2,L3	L3	Apply	Chalk and board	Assignment
4	Tidal Power: Tides and waves as energy suppliers and their mechanics. Fundamental characteristics of tidal power, harnessing tidal energy , limitations.	4	L1,L2,L3	L3	Apply	Chalk and board	Assignment
5	Biomass Energy:Introduction;Photosynthesis Process; Biofuels;Biomass Resources. Biomass conversion technologies; Urban waste to energy. Conversion; Biomass gasification. Green Energy:	4	L1,L2	L2	Understand	Chalk and board	Assignment
5	Introduction: Fuel cells: Overview; Classification of fuel cells. Fuel cell thermodynamics Nuclear, ocean. MHD, thermo electric and geothermal energy applications:Zero energy Concept.	4	L1,L2	L2	understand	Chalk and board	Assignment

2. Concepts and Outcomes:

Table 2: Concept to Outcome – Example Course

Module- #	Learning or Outcome from study of the Content or Syllabus	Identified Concepts from Content	Final Concept	Concept Justification (What all Learning Happened from the study of Content / Syllabus. A short word for learning or outcome)	CO Components (1.Action Verb, 2.Knowledge, 3.Condition / Methodology, 4.Benchmark)	Course Outcome **Student Should be able to ...**
A	*I*	*J*	*K*	*L*	*M*	*N*
1	-Thermal Energy conversion	-Energy conversion system	Energy conversion system	Different types of energy conversion methods	- Understand - energy conversion methodology	Understand energy scenario,energy source and utilization

	systems, Review energy scenario, Underfeed and overfeed strokers				- -	
1	-Chimneys and types Boiler accessories and there functions -	Accessories of stem generators	Accessories of stem generators	Working principals of steam generators	- Understand the different - accessories in stem generators - -	Applying the knowledge of conversion methods
2	-Layout of Diesel engine power plant -Lubrication systems	Accessories of stem generators	Power system	Diesel engine power system	- Understanding power systems	Understand Diesel Engine working and layout
2	-Layout of Hydro-Electric power plant,Hydro graph Mass curve flow duration curve	-energy storage	energy storage	Understand the storage of energy	- Understand - Energy storage -	Applying the knowledge of storage plants
3	-Solar Radiation concepts, Measurement of Solar radiation,Solar array PV model	Renewable energy	Renewable energy	Understand the renewable energy resources	- Understand - Renewable source - -	Illustrating the basic concepts of solar radiation and analyze working of solar pv models
4	Understanding principal of waves and tides ,Formation different types -	-Forms of energy	Forms of energy	Understanding the different forms of energy	- Understand -Forms of energys - -	Understanding the forms of energy conversion from alternate source.
4	-Vertical axis wind mills and there working, Major problems associated with wind mill variation of power and velocity	Alternate source	Alternate source	Understanding alternate sources wind and tidal energy	- Understand - Alternate sources - -	Able to describe the tidal and wave energy
5	-Biomass conversion technologies photosynthesis process -Fuel cells and its functions	Conversion technologies	Conversion technologies	Understanding the different biomass conversion technologies	- Understand -Conversion technologies	Describe the photo synthesis process and Biomass gasification