

**University of Asia Pacific (UAP)**  
**Department of Electrical and Electronic Engineering (EEE)**

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**Course Outline**

<b>Program:</b>	BSc in Electrical and Electronic Engineering (EEE)
<b>Course Title:</b>	<b>Power Station Engineering</b>
<b>Course Code:</b>	<b>EEE 411</b>
<b>Semester:</b>	<b>Spring -2022</b>
<b>Level:</b>	<b>4<sup>th</sup> Year 1<sup>st</sup> semester</b>
<b>Credit Hour:</b>	<b>3</b>
<b>Name &amp; Designation of Teacher:</b>	Md. Abdullah Al Mahmud, Lecturer, EEE
<b>Office/Room:</b>	Department of EEE, 5 <sup>th</sup> floor, UAP
<b>Class Hours:</b>	Monday 02:00-03:30 p.m., Tuesday 02:00-03:30 p.m [A] Monday 05:00-06:30 pm, Thursday 9:30-11:00 a.m [B]
<b>Consultation Hours:</b>	Sunday: 12:00-5:00 pm. Wednesday: 02:00-05:00 pm
<b>E-mail:</b>	<b>abdullah-eee@uap-bd.edu</b>
<b>Mobile:</b>	01552404513
<b>Rationale:</b>	To learn the functional details of power station's working principles and relate this knowledge with the perspective of our power sector. (Optional subject)
<b>Pre-requisite (if any):</b>	N/A
<b>Course Synopsis:</b>	General layout and principles of power plants: steam turbine, gas turbine, combined cycle gas turbine, hydro and nuclear. Selection of location: Technical, economical and environmental factors. Variable loads: Load curves and different factors and load forecasting, Economic dispatch, Electricity tariff: formulation and types, New energy sources: Renewables, Fuel cell.

**Course Objectives (CO):****The objectives of this course are to:**

1. Provide a review of different sources of energy and electrical load characteristics and forecasting.
2. Explain the working principle, schematic diagram, design and performance of different components, criteria for location selection of power plants: Hydro, Thermal, Nuclear, Combine Cycle Power Plant, Diesel etc.
3. Discuss the cost of electrical energy and formulation and types of tariff.
4. Describe the generation scheduling for economic operation of power plants.
5. Study of renewable energy, environmental effects of different power plants.

**Course Outcomes (CO) and their mapping with Program outcomes (PO) and Teaching-Learning Assessment methods:**

CO No.	CO Statements: Upon successful completion of the course, students should be able to:	Corresponding POs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CO1	Compare different power plant according to their different properties.	1	Understand	Lecture, multimedia, video	Quiz, Assignment
CO2	Find different factors using electrical load curve and explain load forecasting.	2	Apply	Lecture, Problem Solving, Group work	Quiz, Assignment
CO3	Determine the cost of electrical energy and identify different types of tariff.	2	Apply	Lecture, Problem Solving	Quiz, Written exam
CO4	Analyze the optimization for the generation scheduling in power plants	2	Analyze	Lecture, Problem Solving	Quiz, Written exam
CO5	Describe the advantages and applications of new energy sources .i.e. particularly renewables over conventional power plants in terms of environmental impacts.	7	Understand	Lecture, Multimedia, Group Discussion	Quiz, Report (Assignment)

**Weighting COs with Assessment methods:**

Assessment Type	% weight	CO1	CO2	CO3	CO4	CO5
Final Exam	50%	25		8.33	13.33	3.34
Mid Term	20%	13.33	6.67			
Assessment	30%	5	5	5	5	10
<b>Total</b>	<b>100%</b>	<b>43.33</b>	<b>11.67</b>	<b>13.33</b>	<b>18.33</b>	<b>13.34</b>

**Grading Policy:** As per the approved grading policy of UAP (Appendix-3)

**Course Content Outline and mapping with COs**

<u>Week</u>	<u>Topics</u>	<u>Course Outcome</u>	<u>Delivery methods and activities</u>	<u>Reading Materials</u>
W-1	Why electrical energy, Generation of electrical energy, energy sources, vision 2041, Sample grid, Bangladesh Power System, Grid overview, Structure of power system.	CO1	Lecture	Principle of Power System by V.K. Mehta. CH-1
W-2	Load characteristics: Load curves, demand factor, Group diversity factor, Load duration curve, Mathematical example, Base load and peak load plants, Load forecasting, Load forecasting classification, Short term load forecasting.	CO2	Lecture, Group Assignment	Principle of Power System by V.K. Mehta. CH-3
	<b>Thermal Power Plant:</b> Overall plant components in Block diagrams indicating the air circuit, water and	CO1	Lecture, Video, Multimedia	Principle of Power System by V.K. Mehta. CH-2

W-3	steam circuit, cooling water circuit; various types of steam turbines, water tube boiler, fire tube boiler, super heater, economizer, air preheater, dust collection, draft fans and chimney; condensers, feed water heaters, evaporate and makeup water, bleeding of steam; cooling water system.			
W-4	Governors, plant layout and station auxiliaries, Exercise: Relevant mathematical Problems, Choice of site for steam power plant, Efficiency of steam power plant, equipment of steam power plant. Elementary idea about our Thermal Plant in Bangladesh.	CO1	Lecture, Video, Multimedia	Principle of Power System by V.K. Mehta. CH-2
W-5	<b>Study of Hydro Power Plant:</b> Hydrology: Catchments area of a reservoir and estimation of amount of water collected due to annual rainfall, flow curve and flow duration curve of a river and estimation of amount stored in a reservoir formed by a dam across the river, pondage, site selection etc. Turbines: Operational principle of Kaplan, Francis and Pelton wheel, specific speed, work done and efficiency.	CO1	Lecture, Video, Multimedia	Principle of Power System by V.K. Mehta. CH-2
	<b>Hydro plant:</b> Head gate, penstock, surge tank, scroll case, draft tube and tail race, classification of	CO1	Lecture, Video,	Principle of Power System by V.K. Mehta. CH-2



W-6	plants, turbines different heads, plant capacity as a base load and peak load station, power plant auxiliaries, pumped storage plants, advantage and disadvantages etc.  Elementary idea about our Hydro Plant in Bangladesh.		Multimedia	
W-7	<b>Nuclear Power Plant :</b> Introduction to fission & fusion, reactor construction, controlled chain reaction, operational control of reactors, Brief study of various types of reactors (Boiling water, pressurized water, sodium graphite, breeder) layout of nuclear power plant  Exercise : Relevant mathematical Problems	CO1	Lecture, Video, Multimedia	Principle of Power System by V.K. Mehta. CH-2
<b>MID TERM EXAM</b>				
W-8	Economics of Power Plant, cost, depreciation , Impact of Load Factor	CO3	Lecture	Principle of Power System by V.K. Mehta. CH-4
W-9, 10	Economic operation of Plants : Thermal plant cost modeling , input-output curve, Heat rate curve, Incremental cost. Economic Dispatch, optimum generation as function of $\lambda$ and cost coefficients  Exercise : Relevant mathematical Problems	CO4	Lecture, Assignment	Power System Analysis Textbook by John J. Grainger and William D. Stevenson Ch-13

W-11	Tariff, Desirable Characteristics of a tariff , Types of tariff  Exercise : Relevant mathematical Problems	CO3	Lecture	Principle of Power System by V.K. Mehta. CH-5
W-12	Smart Grid and Renewable Energy, Need of Smart Grid, A brief introduction with the structure of smart grid, Renewable Energy generation, photovoltaic system, wind and tidal energy system.	CO5	Lecture	Smart Grid Technology and Applications by Janaka Ekanayake et al.  CH-1
W-13	Solar Energy Collectors, solar power plant, solar energy storage, Wind energy, DFIG wind turbine, Fuel cell, Energy from Biomass.	CO5	Lecture, Assignment	Smart Grid Technology and Applications by Janaka Ekanayake et al.  CH-10
W-14	Environmental Aspects : Energy and Environment , Cooling tower impacts , Clean coal technologies, Nuclear plant impacts , Hydro plant impacts , Social and economic impacts	CO5	Lecture, Discussion	Generation of Electrical Energy by B.R. Gupta  CH-16

**Required Reference(s):** Principle of Power System by V.K. Mehta

**Recommended Reference(s):** Generation of Electrical Energy by B.R. Gupta

**Grading System:** As per the approved grading scale of University of Asia Pacific (Appendix-2).

**Student's responsibilities:**

1. Plenty of new concepts & terminologies will be covered. So, it is highly recommended to put up maximum effort to learn.
2. For course related query, send me an email with a subject "**EEE 411 (Section) Spring(2022): your id**"
3. **Prepare yourself** for the class.
4. Make sure your device is ready at least **10 minutes** before the class starts.
5. Make sure all required study materials such as **pen, paper, books, etc. are in your reach** during the class
6. Try to be **alone and pay full attention** to the lecture. Nobody should be around you while the class is in progress.
7. You need to follow all the etiquettes you would in a **regular classroom**.
8. Follow the **timetable** of the class very strictly that includes class joining time, deadline of assignment etc.
9. Keep your microphone in **mute state** and video in on state. If you need to communicate, raise your hand (raise hand option in Zoom) and seek permission.
10. Do not do anything which may disturb the class (such as passing irrelevant and negative comments etc.); you will be monitored and **disciplinary actions will be taken**.

Prepared by	Checked by	Approved by
Md, Abdullah Al Mahmud Designation: Lecturer Department of EEE	Curriculum Committee Department of EEE	Head, EEE

**Appendix-1:****Washington Accord Program Outcomes (PO) for engineering programs:**

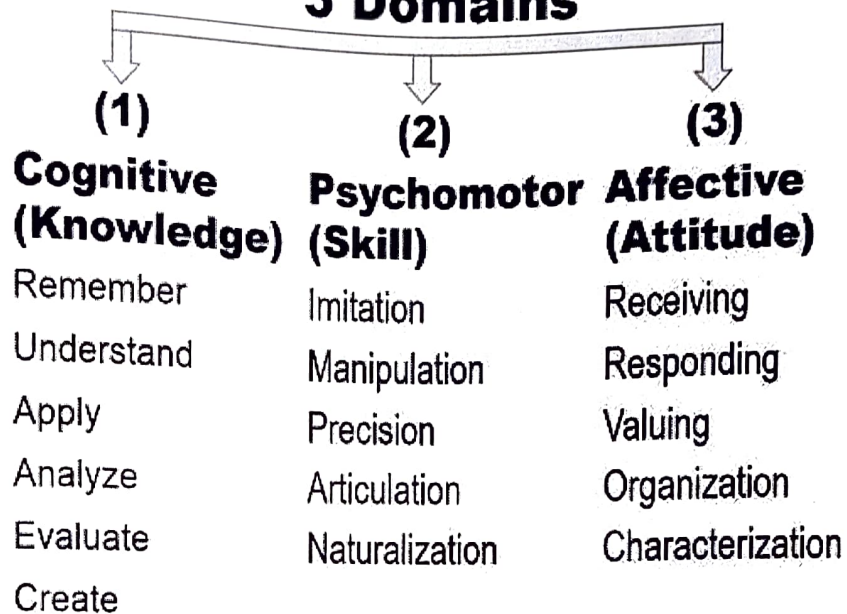
No.	PO	Differentiating Characteristic
1	Engineering Knowledge	Breadth and depth of education and type of knowledge, both theoretical and practical
2	Problem Analysis	Complexity of analysis
3	Design/ development of solutions	Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified
4	Investigation	Breadth and depth of investigation and experimentation
5	Modern Tool Usage	Level of understanding of the appropriateness of the tool
6	The Engineer and Society	Level of knowledge and responsibility
7	Environment and Sustainability	Type of solutions.
8	Ethics	Understanding and level of practice

9	Individual and Team work	Role in and diversity of team
10	Communication	Level of communication according to type of activities performed
11	Project Management and Finance	Level of management required for differing types of activity
12	Lifelong learning	Preparation for and depth of Continuing learning.

## Appendix-2

### Bloom's Taxonomy (Taxonomy of Learning)

#### 3 Domains



## Appendix-3

### UAP Grading Policy:

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00