BASIC MECHANICAL ENGINEERING **Course Code : 312006**

Programme Name/s : **Electrical Engineering/ Electrical Power System**
Programme Code : **EE/ EP**
Semester : **Second**
Course Title : **BASIC MECHANICAL ENGINEERING**
Course Code : **312006**

I. RATIONALE

Electrical power supply system is needed for operating various mechanical equipment. Electrical engineer has to take care of installation and maintenance of mechanical systems like refrigeration and air conditioning, portable generators, industrial material handling system and power generation plants. This course will help to understand various mechanical systems for identifying different mechanical faults.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Interpret various mechanical faults in industrial mechanical systems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Find faults in Thermal Power Plant using acquired knowledge and skills in a given situation.
- CO2 - Diagnose faults of Material handling system using acquired knowledge and skills.
- CO3 - Identify faults of Hydraulic turbines and Hydraulic pumps in a given situation.
- CO4 - Diagnose faults of given Air compressor and Refrigeration system using acquired knowledge and skills.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312006	BASIC MECHANICAL ENGINEERING	BME	SEC	2	-	2	-	4	2	-	-	-	-	-	50	20	50@	20	-	-	100

Total IKS Hrs for Sem. : 2 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 List components of steam boilers and turbines TLO 1.2 Explain working of portable generator TLO 1.3 Identify different faults in different power plant equipment	**Unit - I Power plants equipment** 1.1 Layout of Thermal Power Plant, Major thermal power plants in India 1.2 Introduction to steam boilers- Babcock-Wilcox boilers, Lamont and Loeffler boilers 1.3 Introduction to steam Turbines- Impulse and reaction turbine 1.4 Layout of Portable Generator, Manufacturers and specifications of portable generator 1.5 Introduction to portable generators: I.C engine 1.6 Mechanical parameters measurement- Introduction to •Pressure measurement: Bourdon tube pressure gauge •Temperature measurement: Optical pyrometer, Thermocouple •Heat measurement: Calorimeter •Speed measurement of rotating elements: Tachometer, Stroboscope 1.7 Preliminary mechanical faults occurred in steam boilers and turbines	Demonstrate various models/Charts of boilers and turbines .
2	TLO 2.1 Use of mechanical components in simple Machines/ equipment TLO 2.2 Select appropriate material handling system. TLO 2.3 Identify faults in Industrial Material handling systems	**Unit - II Industrial Material handling systems and components** 2.1 Mechanical components for motion and power transmission: Types and uses of • Gears • Belt drives • Chain drives • Bearings • Couplings 2.2 Introduction to material handling systems: Manufacturers, specifications, construction and working of • Material transfer lifts, • Conveyors, • Overhead cranes 2.3 Preliminary mechanical faults occurred in Industrial Material handling systems	Demonstration of various mechanical components using charts and models
3	TLO 3.1 List different components of hydraulic turbines and Pumps. TLO 3.2 Explain working of hydraulic pumps. TLO 3.3 Identify faults in hydraulic equipment	**Unit - III Hydraulic pumps, turbines, and equipment** 3.1 Layout of Hydraulic Power Plant, Major hydraulic power plants in India 3.2 Introduction to hydraulic turbines: construction and working of Pelton wheel, Francis turbine, Kaplan turbine 3.3 Introduction to hydraulic pumps: construction and working centrifugal pump, reciprocation pump and submersible pump 3.4 Preliminary mechanical faults occurred in Centrifugal, reciprocating, and submersible pumps	Demonstrate working of Hydraulic power plant /Pumps using Chart/models

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Explain working of air compressor. TLO 4.2 List different components of refrigerator and air conditioner. TLO 4.3 Explain working of refrigerator and air conditioner. TLO 4.4 Identify faults in Refrigeration and air conditioning equipment system	**Unit - IV Compressor, Refrigeration and Air conditioning equipment** 4.1 Introduction to Compressor- Manufacturers, Specifications, construction and working of reciprocating compressor, screw compressor 4.2 Introduction to Refrigeration and Air conditioning : Vapour compression cycle, Construction and working of simple domestic refrigerator and window air conditioner, Manufacturers and specification 4.3 Preliminary mechanical faults occurred in reciprocating compressor and Refrigeration and air conditioning equipment	Demonstrate air compressor, Refrigeration system and air conditioning system using charts.

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify different components of Thermal Power Plants	1	*Identify steam boilers using models and charts	2	CO1
LLO 2.1 Observe working of Steam turbine	2	*Demonstrate working of steam turbine	2	CO1
LLO 3.1 Use temperature measuring devices	3	*Measure temperature of different equipment using temperature measuring devices.	2	CO1
LLO 4.1 Use pressure measuring devices	4	*Measure pressure of different equipment using pressure measuring devices	2	CO1
LLO 5.1 Use speed measuring devices	5	Measure speed of different rotating elements using sped measuring devices.	2	CO1
LLO 6.1 Use heat measuring devices	6	Measure heat of given fluid using calorimeter	2	CO1
LLO 7.1 Observe working of portable generator	7	Demonstrate working of portable generator	2	CO1
LLO 8.1 Select different drive system for given application with justification	8	*Identify drive system using models/ actual set up.	2	CO2
LLO 9.1 Calculate velocity ratio of given mechanical system	9	*Calculate Velocity Ratio of given gear/belt drive of suitable mechanical system.	2	CO2
LLO 10.1 Identify different components of material handling system used in Industry	10	Demonstrate working of lift / conveyor used in Industry.	2	CO2
LLO 11.1 Observe working of material handling system used in Industry	11	Demonstrate working of Overhead Crane used in Industry	2	CO2
LLO 12.1 Observe working of Hydraulic power plant.	12	*Demonstrate Working of Hydraulic Power plant using pelton wheel turbine set up or suitable turbine models /set up	2	CO3
LLO 13.1 Use of centrifugal pump for given application	13	*Identify different components of Centrifugal Pump.	2	CO3
LLO 14.1 Use of reciprocating pump for given application	14	Identify different components of Reciprocating Pump	2	CO3
LLO 15.1 Use pressure and temperature measuring devices	15	*Measure pressure, Temperature at different points of Air Compressor.	2	CO4

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.1 Calculate velocity ratio of given air compressor	16	*Calculate Speed ratio of Belt Drive used in air compressor and Driven Motor.	2	CO2 CO4
LLO 17.1 Identify different components of household refrigerator	17	*Demonstrate working of household refrigerator for identifying different components and type.	2	CO4
LLO 18.1 Identify different components of window air conditioner	18	Demonstrate working of window air conditioner for identifying different components	2	CO4
LLO 19.1 Collect information related to water lifting systems in ancient India.(IKS)	19	*Collect information of water lifting systems in ancient India relation with Hydraulic pumps (IKS)	2	CO1 CO2 CO3 CO4

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

NA

- NA

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Model of Babcock Wilcox Boiler	1
2	Model of Lamont Boiler	1
3	Model of Loeffler Boiler	1
4	Pelton wheel turbine set up or working models of turbines	13
5	Centrifugal pump -minimum up to single phase 0.5 HP/Reciprocating pump-minimum up to 1 HP	14
6	Air Compressor- Multistage reciprocating, pressure up to 12 bar, Motor- 1 HP	15,16
7	Household refrigerator- minimum up to 165 liter	17
8	Window air conditioner capacity minimum1.5 TR	18
9	Charts of Thermal power Plant, Steam Boilers, Steam turbines	2
10	Mercury/Alcohol Thermometers (Range 0 to 150 °C)	3,15
11	Optical Thermometer/Pyrometer (Range 30 to 400 °C)	3,15

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
12	Bourdon Tube Pressure Gauge (Range 0 to 15 bar)	4,15
13	Digital Tachometer (Max. speed 10000 rpm)	5,16
14	Stroboscope (Max. speed 10000 rpm)	5,16
15	Tube in Tube type water calorimeter with temperature measuring devices	6
16	Portable generator with load bank minimum capacity 2.2 kVA	7
17	Models of Different gears- Spur, Helical, Bevel, Worm and worm, Rack and Pinion	8,9
18	Models of Belt drive- Open and Cross Flat Belt, V belt	8,9
19	Models of Chain Drive- Sprockets and chain	8,9
20	Deep groove Ball bearings – Single row, self-aligned, Roller	8,9
21	Working model of Belt and Pulley for determining speed ratio	8,9
22	Working model of Gear train for determining speed ratio	8,9

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Power plants equipment	CO1	8	0	0	0	0
2	II	Industrial Material handling systems and components	CO2	8	0	0	0	0
3	III	Hydraulic pumps, turbines, and equipment	CO3	7	0	0	0	0
4	IV	Compressor, Refrigeration and Air conditioning equipment	CO4	7	0	0	0	0
Grand Total				**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term work
- "Each practical will be assessed considering 60% weightage to process 40% weightage to product" & other instructions of Assessment.

Summative Assessment (Assessment of Learning)

- Practical
- "Each practical will be assessed considering 60% weightage to process 40% weightage to product" & other instructions of Assessment.

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	-	-	2	-	-	2			

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CO2	2	-	-	2	-	-	2			
CO3	2	-	-	2	-	-	2			
CO4	2	-	-	-	-	-	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	P.K.Nag	Power Plant Engineering	McGraw Hill Education ,ISBN: 978-9339204044
2	R.K. Rajput	Power Plant Engineering	Tata-McGraw Hill Education. ISBN : 9788131802557
3	K. Subramanya	Hydraulic Machines	McGraw Hill Education (India) Private, ISBN, 1259006840, 9781259006845
4	S.S.Rattan	Theory of Machines	Tata-McGraw Hill Education. ISBN, 1283187124, 9781283187121
5	C. P. Arora	Refrigeration and Air conditioning	Tata-McGraw Hill Education ISBN-13: 978-0-07-008390-5
6	Mahadevan B., Bhat Vinayak Rajat, Nagendra Pavana R.N.	Introduction to Indian Knowledge System(IKS) : concepts and Applications	PHI Learning Pvt. Ltd., ISBN -2022,9391818218, 9789391818210
7	Siddhartha Ray	Introduction to Materials Handling	New Age International Private Limited; ISBN-9788122440072

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=IdPTuwKEfmA	Steam Power Plant working animation
2	https://www.youtube.com/watch?v=fk3DjD9gSsk	Principle and working of Steam boiler animation
3	https://www.youtube.com/watch?v=dVBoZ4PfZmE	Working of Steam boiler animation
4	https://www.youtube.com/watch?v=SPg7hOxFItI	Working of Steam turbine animation
5	https://www.youtube.com/watch?v=N70vbRbF36A	Mechanical Drive System
6	https://www.youtube.com/watch?v=hhE_2oVIZiI	Manual Material Handling system
7	https://www.youtube.com/watch?v=o_C2XISZ3Uc	Belt conveyor animation
8	https://www.youtube.com/watch?v=-hooifWJ1jY	Hydraulic Power Plant animation
9	https://www.youtube.com/watch?v=BaEHVpKc-1Q	Principle of Centrifugal Pump
10	https://www.youtube.com/watch?v=XpcCUtYzwy0	Centrifugal Pump working animation
11	https://www.youtube.com/watch?v=41vb6T42_Tk	Reciprocating Pump - Construction and working
12	https://www.youtube.com/watch?v=3BCiFeykRzo&t=155s	Water turbine (Francis)
13	https://www.youtube.com/watch?v=7NwxMyqUyJw	Refrigerator system working animation
14	https://www.youtube.com/watch?v=FzydmAmZM54	Window Air Conditioner working animation
15	https://www.youtube.com/watch?v=PjcdqAkP0UA	Vapour compression system construction and working
16	https://www.youtube.com/watch?v=_qyF1yolDgY	Problems & Remedies of Centrifugal Pump
17	https://www.youtube.com/watch?v=k0NOLbZXSNc	Refrigeration - System Troubleshooting
18	https://www.indiawaterportal.org/articles/persian-wheel-water-lifting-device-kolar-karnataka	Information on Persian wheel : The water lifting device in Kolar, Karnataka (IKS)
19	https://www.youtube.com/watch?v=eCNpJ-_iksQ&t=5s	Persian wheel : The water lifting device in Kolar, Karnataka (IKS)

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Sr.No	Link / Portal	Description
20	https://rezavisblastfromthepast.co.in/2018/04/30/the-early-waterlifting-devices-dhenkli-or-shaduf-and-the-araghatta-noria/	The early waterlifting devices: Dhenkli or shaduf and the araghatta (Noria) (IKS)

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 01/10/2024 **Semester - 2, K Scheme**