

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 | Paper Duration | Assessment Scheme | | | | | | | | | | Total Marks | |
|-------------|------------------------------|------|-------------------|--------------------------|-----|-----|-----|---------|----------------|-------------------|--------|-------|-------|------------------|-----|-----|-----|-------------|---|-------------|-----|
| | | | | Actual Contact Hrs./Week | | | SLH | | | NLH | Theory | | | Based on LL & TL | | | | Based on SL | | | |
| | | | | CL | TL | LL | | | | | FA-TH | SA-TH | Total | Practical | | SLA | | | | | |
| | | | | Max | Max | Max | Min | | | 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

| 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 | <p>TLO 1.1 List components of steam boilers and turbines</p> <p>TLO 1.2 Explain working of portable generator</p> <p>TLO 1.3 Identify different faults in different power plant equipment</p> | <p>Unit - I Power plants equipment</p> <p>1.1 Layout of Thermal Power Plant, Major thermal power plants in India</p> <p>1.2 Introduction to steam boilers- Babcock-Wilcox boilers, Lamont and Loeffler boilers</p> <p>1.3 Introduction to steam Turbines- Impulse and reaction turbine</p> <p>1.4 Layout of Portable Generator, Manufacturers and specifications of portable generator</p> <p>1.5 Introduction to portable generators: I.C engine</p> <p>1.6 Mechanical parameters measurement- Introduction to</p> <ul style="list-style-type: none"> •Pressure measurement: Bourdon tube pressure gauge •Temperature measurement: Optical pyrometer, Thermocouple •Heat measurement: Calorimeter •Speed measurement of rotating elements: Tachometer, Stroboscope <p>1.7 Preliminary mechanical faults occurred in steam boilers and turbines</p> | <p>Demonstrate various models/Charts of boilers and turbines .</p> |

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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. |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 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 <ul style="list-style-type: none"> • Gears • Belt drives • Chain drives • Bearings • Couplings 2.2 Introduction to material handling systems: Manufacturers, specifications, construction and working of <ul style="list-style-type: none"> • 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 |
| 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 |
|----------------------------------------------------------|-------|------------------------------------------------------------|----------------|--------------|
|----------------------------------------------------------|-------|------------------------------------------------------------|----------------|--------------|

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| 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 speed 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 |
| 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 |

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| Practical / Tutorial / Laboratory Learning Outcome (LLO) | Sr No | Laboratory Experiment / Practical Titles / Tutorial Titles | Number of hrs. | Relevant COs |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------|----------------|--------------|
| Note : Out of above suggestive LLOs - | | | | |
| <ul style="list-style-type: none"> • '*1' 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

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 | Charts of Thermal power Plant, Steam Boilers, Steam turbines | 2 |
| 5 | Mercury/Alcohol Thermometers (Range 0 to 150 °C) | 3,15 |
| 6 | Optical Thermometer/Pyrometer (Range 30 to 400 °C) | 3,15 |
| 7 | Bourdon Tube Pressure Gauge (Range 0 to 15 bar) | 4,15 |
| 8 | Portable generator with load bank minimum capacity 2.2 kVA | 7 |
| 9 | Tube in Tube type water calorimeter with temperature measuring devices | 6 |
| 10 | Digital Tachometer (Max. speed 10000 rpm) | 5,16 |
| 11 | Stroboscope (Max. speed 10000 rpm) | 5,16 |
| 12 | Models of Different gears- Spur, Helical, Bevel, Worm and worm, Rack and Pinion | 8,9 |
| 13 | Models of Belt drive- Open and Cross Flat Belt, V belt | 8,9 |
| 14 | Models of Chain Drive- Sprockets and chain | 8,9 |
| 15 | Deep groove Ball bearings – Single row, self-aligned, Roller | 8,9 |
| 16 | Working model of Belt and Pulley for determining speed ratio | 8,9 |
| 17 | Working model of Gear train for determining speed ratio | 8,9 |
| 18 | Pelton wheel turbine set up or working models of turbines | 13 |
| 19 | Centrifugal pump -minimum up to single phase 0.5 HP/Reciprocating pump- minimum up to 1 HP | 14 |
| 20 | Household refrigerator- minimum up to 165 liter | 17 |
| 21 | Air Compressor- Multistage reciprocating, pressure up to 12 bar, Motor- 1 HP | 15,16 |
| 22 | Window air conditioner capacity minimum 1.5 TR | 18 |

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 |

MSBTE Approval Dt. 18/12/2023

Semester - 2, K Scheme

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| Sr.No | Unit | Unit Title | Aligned COs | Learning Hours | R-Level | U-Level | A-Level | Total Marks |
|--------------------|------|----------------------------------------------------------|-------------|----------------|----------|----------|----------|-------------|
| 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 | | | |
| 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 |

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| Sr.No | Author | Title | Publisher with ISBN Number |
|-------|--------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------|
| 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=SPg7hOxFtI | 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=-hooifWJlY | 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) |
| 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) |