

TH1 - Elementary Mechanical Engineering

FULL MARKS: 80

TIME: 3 hours

Answer any five questions including  
Q.NO 1 & 2 are compulsory  
Figures in the right hand margin indicates marks

NO1. Answer all questions. (2X10)

- (a) What is cantilever beam with example?
- (b) Define link with example.
- (c) What is the function of cam follower?
- (d) Define heat and its unit.
- (e) What is dryness fraction of steam?
- (f) What is fire tube boiler with example?
- (g) Define stroke length.
- (h) Define refrigeration.
- (i) Draw P-V and T-S diagram of otto cycle.
- (j) Define machine tool

NO2. Answer any six questions (5X6)

- (a) Describe preventive maintenance.
- (b) Describe summer Air conditioning system.
- (c) Differentiate between impulse turbine and reaction turbine.
- (d) Explain function of Flywheel and Governor.
- (e) Define I.H.P, B.H.P & Mechanical efficiency of an I.C engine and write down their relationship between them.
- (f) Derive work done during Isothermal process.
- (g) Explain advantages of rope drives and its uses.
- (h) State the properties of a good refrigerant. what are the normal refrigerants used.

NO3. Explain with the help of neat sketch a quick return mechanism. (10)

NO4. Derive an expression the length of open belt drive. (10)

NO5. What is the function of lathe machine? Describe different parts of a lathe machine. (10)

NO6. Explain the working of simple vapour compression refrigeration system with neat sketch. (10)

NO7. Show diagrammatically different types of beams and loads.

OR

Find the power transmitted by a belt running over a pulley of 600mm diameter at 200r.p.m. The coefficient of friction between the belt and the pulley is 0.25, angle of lap  $160^\circ$  and maximum tension in the belt is 2500N. (10)

### 3<sup>RD</sup> SEM/METALLURGY/ 2020(W)NEW

#### Th2-Mineral Processing

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
  - a. Define Comminution.
  - b. Write any two difference between mineral and ore.
  - c. Define reduction ratio of crusher.
  - d. How open circuit grinding is different from close circuit grinding?
  - e. Write the common methods for particle size analysis.
  - f. Define the mechanism of screening.
  - g. What is tabling?
  - h. Write the principle of heavy media separation.
  - i. Define the term frothers and activator.
  - j. Classify minerals according to their degree of magnetism.
2. Answer **Any Six** Questions 6 x 5
  - a. Differentiate between Blake jaw crusher and Dodge jaw crusher.
  - b. Derive the expression for angle of nip.
  - c. Explain Ro-tap sieve shaker with a suitable diagram.
  - d. Classify various type of screening processes and write their working principle.
  - e. Briefly explain various type of jigs and mention their uses.
  - f. Explain Du-point process in detail emphasising its special requirements.
  - g. Discuss the theory of magnetic separation.
3. With a neat sketch describe suspended spindle Gyratory Crusher and write its characteristics. 10
4. Write the theory of Ball mill operation and derive the expression for critical speed. 10
5. Explain the principle of Jigging. Discuss all the physical factors responsible for stratification of particles during Jigging. 10
6. Give the elementary principle of Froth-Flotation process. Compare froth-flotation with skin flotation. 10
7. Write Short notes on 10
  - i. Wilfley table
  - ii. Evans classifier

Th3 - Fuel & Refractories

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
  - a. How does total carbon of coal differs from fixed carbon of coal?
  - b. State Kirchoff's law of combustion?
  - c. What does drift theory says?
  - d. Define swelling index of coal?
  - e. What do you mean by "3 Ts" ?
  - f. Which refractories are used in the stack & hearth portion of blast furnace?
  - g. Write down about any two methods of testing liquid fuel?
  - h. What is the composition of producer gas?
  - i. What do you mean by SIC ?
  - j. Define cetane number ?
2. Answer **Any Six** Questions 6 x 5
  - a. How testing of flash point can be done?
  - b. What is the manufacturing method of fireclay refractory?
  - c. Write short note on i) Blast Furnace Gas ii) Natural Gas
  - d. How carbureted water gas is different from water gas? Which gas is better and why ?
  - e. Differentiate between HTC and LTC ?
  - f. Write in detail about the various desirable properties of refractories?
  - g. Write down the production and uses of coal tar?
3. Define fuel , its different categories and their uses with a proper flowdiagram? 10
4. What is the principle of combustion and write down all the parameters suitable for complete combustion? 10
5. Which refractory linings are prominent in i) reheating furnace ii) smelting furnace iii) arc furnace iv) coke oven v) soaking pit 10
6. What do you mean by :i) complete combustion ii) incomplete combustion iii) coefficient of excess air iv) air-fuel ratio v) avogadro's number 10
7. What are the desirable physical and chemical properties of metallurgical coke? 10

Th4 Ferrous Metallurgy - I

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
  - a. Which type of iron ore is mainly found in Odisha and what its colour?
  - b. Write Boudouard's equilibrium reaction.
  - c. Define basicity. What is the basicity value of blast furnace slag?
  - d. Name two reagents used for external desulphurisation of hot metal.
  - e. What is agglomeration? Give two examples of agglomeration technique used for iron ore.
  - f. What is the significance of M40 and M10 value of coke?
  - g. Define Fanning operation in blast furnace.
  - h. How slag granulation is done? Where do we use granulated slag?
  - i. What is On-gas operation of stove?
  - j. What is channelling? Suggest a method to prevent it.
2. Answer **Any Six** Questions 6 x 5
  - a. Briefly explain operation of hot blast stove with a neat sketch.
  - b. Define hanging, its causes and remedies.
  - c. Differentiate between direct and indirect reduction of iron oxide.
  - d. Explain humidification operation in blast furnace and its advantages.
  - e. Calculate the amount of iron ore required to produce 1tonne of hot metal containing 94% Fe in it. (Given: The iron ore contains 82% Fe<sub>2</sub>O<sub>3</sub>)
  - f. Mention five functions of coke in blast furnace.
  - g. Write the various reactions that take place in stack region of blast furnace.
3. Draw a schematic diagram of blast furnace. Discuss about the refractories used in various part of blast furnace. 10
4. Name and explain various zones exist inside blast furnace depending upon the chemical and temperature profile. 10
5. Describe about the physical and chemical properties required for blast furnace charge materials. 10
6. Explain the steps involved in palletisation of iron ore fines. 10
7. Write short notes on 10
  - (a) GCP
  - (b) Scaffolding

**TH 5 Environmental Studies**

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
  - a. Define Environment.
  - b. Define deforestation.
  - c. What do you mean by decomposers?
  - d. What are hot spots of biodiversity?
  - e. Define eco system.
  - f. Write down psychological effect of noise pollution.
  - g. What is solid waste management?
  - h. Define green house effect.
  - i. What are the major reasons of population explosion?
  - j. What is Draught?
2. Answer **Any Six** Questions 6 x 5
  - a. What are causes of deforestation.
  - b. What are the environmental effects of mining.
  - c. Give a brief description about structures of a pond eco –system.
  - d. Discuss about 3R in controlling environmental pollution.
  - e. What is global warming ? Write down the effects of global warming?
  - f. Discuss about rain water harvesting?
  - g. What is the role of an individual in controlling pollution of environment?
3. What is the need of land resources? Write the main reasons of degradation of land? 10
4. What are the changes made in agriculture? Write down the impacts of modern agriculture on environment? 10
5. What are ecological pyramids? Explain the pyramid of number and pyramid of energy? 10
6. Explain the sources of solid waste and solid waste management? 10
7. Write short notes on 10
  - a. World food problem
  - b. Acid rain

TH1 Elementary Mechanical Engineering

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
  - a. What is the functions of cam and cam follower?
  - b. Define cantilever beam with example.
  - c. Define link with example.
  - d. What is the function of dynamometers?
  - e. Define fire tube boiler with example.
  - f. Define 'tonne's of refrigeration.
  - g. Define stroke length of an I.C engine.
  - h. Define wet stream.
  - i. Define heat and its unit.
  - j. What is shear force and bending moment diagram?
  
2. Answer **Any Six** Questions 6 x 5
  - a. Describe breakdown and preventive maintenance.
  - b. State types of refrigerants and explain their properties.
  - c. Explain the function of Flywheel and Governor.
  - d. Differentiate between two stroke and four stroke engine.
  - e. Define and function of Bearing. Describe roller bearing with neat sketch.
  - f. Explain otto cycle with the help of P-V and T-S diagram and derive efficiency.
  - g. What are the advantages of rope drive, chain drive and write down their uses?

- 3 What is isothermal process? Derive the expression of work done during isothermal process. 10
- 4 What is the function of lathe machine? Describe different operations of lathe machine. 10
- 5 What are the different types of loads acting on a beam? Differentiate between a point load and uniformly distributed load with diagrams. 10
- 6 With neat sketch describe the quick return mechanism. 10
- 7 Explain simple vapour compression refrigeration system with neat sketch. 10

### 3<sup>RD</sup> SEM/ METALLURGY / 2022(W)

#### Th-2 Mineral processing

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
  - a. Write the objective of mineral dressing.
  - b. Differentiate between comminution and liberation.
  - c. Write two important chemical properties of ore and their applications in mineral processing.
  - d. Define Ball load.
  - e. Distinguish between dry grinding & wet grinding.
  - f. Define angle of nip.
  - g. What are the different common methods of particle size analysis?
  - h. Define mesh number.
  - i. Write the principle of heavy media separation.
  - j. What are the different size reduction methods used during mineral processing?
  
2. Answer **Any Six** Questions 6 x 5
  - a. Determine the critical speed of ball mill.
  - b. Differentiate between Blake jaw crusher and dodge jaw crusher.
  - c. State and explain all the laws of crushing.
  - d. Explain the Du-Pont process. Write all the special requirements of the Du-Pont process
  - e. Explain the working of two-drum ball Norton wet magnetic separator.
  - f. Classify various type of screening process and write their working principle.
  - g. Make a difference between open circuit grinding and closed circuit grinding.
  
3. Explain the suspended spindle gyratory crusher with a schematic diagram and make a comparison between jaw and gyratory crusher. 10
  
4. With all characteristics explain the crushing roll with its mechanical design and schematic view. 10
  
5. Give the elementary principle of Froth floatation process. Explain the different floating reagent used in the process. Compare froth floatation with skin floatation. 10
  
6. Explain the principle of jigging. Discuss all the factors responsible for stratification of particles during jigging. 10
  
7. Write short notes on any two :- 10
  - (I) Wilfley table
  - (II) Evan classifier
  - ( III)Ro-tap sieve shaker



### 3rd SEM./ METALLURGY / 2022(W)

#### Th-3 FUEL & REFRACTORIES

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
  - a. What are the different products of an incomplete combustion.
  - b. Define and differentiate among GCV & NCV.
  - c. Define 'rank of coal'. Arrange all the categories of coal accordingly.
  - d. Name any 2 manufactured and 2 by-product fuel.
  - e. What is 'RUL'. What is its value for carborundum .
  - f. What do you mean by 'mixed gas' ?
  - g. Which type of coal is suitable for making railway locomotives?
  - h. Define 'gasification of coal'.
  - i. Write down the uses of coal tar.
  - j. Define 'hess's law of constant heat summation' with an example.
  
2. Answer **Any Six** Questions 6 x 5
  - a. Which properties of coke can be measured by Micum Index Test , explain it?
  - b. What are the different desirable properties of Refractories. Write it in brief.
  - c. What are the different components/ products of crude oil distillation?  
Describe any one method of crude oil distillation system.
  - d. How blast furnace gas is manufactured , write down its composition, characteristics and uses.
  - e. Which factors affects coke oven gas composition and how it can be prevented.
  - f. What are the various disadvantages of solid fuel over liquid and gaseous fuel.  
Compare it.
  - g Write short note on 1) Mullite refractory  
2) Silica refractory
  
3. Mention which refractories are used in different zones of following furnaces: 10
  - 1)Blast Furnace 2)Open hearth furnace
  - 3)soaking pit 4)reheating furnace
  
4. Write down the detail process of manufacture ,properties, refractoriness & uses of fireclay refractory. 10
  
5. Name all the properties of petroleum products and describe any four of them in detail. 10
  
6. Volumetric analysis of a sample of flue gas is 10.5%CO<sub>2</sub> ,0.5%CO , 8% O<sub>2</sub> and 81% N<sub>2</sub> . Determine the gravimetric composition. 10
  
7. Write short note on 2x5
  - a) carburetted water gas      e) Solid Fuel
  - b) octane number
  - c) engler theory
  - d) carbon refractory

### 3<sup>RD</sup> SEM. / COMMON / 2022(W)

#### Th-5 Environmental studies

Full Marks: 80

Time- 3 Hours

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
  - a. Define natural resources.
  - b. Write down two examples of non-renewable resources.
  - c. Define soil erosion.
  - d. Define producers in eco system.
  - e. What is bio diversity?
  - f. What do you mean by poaching of wild life?
  - g. What is the unit of sound intensity?
  - h. What is endangered species.
  - i. Define greenhouse effect.
  - j. What are the various objectives of family welfare programme.
  
2. Answer **Any Six** Questions 6 x 5
  - a. What are the environmental effects of mining?
  - b. Give a brief description of man wild life conflict.
  - c. What are the effects of acid rain.
  - d. Define rainwater harvesting? State the objective of rain water harvesting?
  - e. Describe about Bio gas plant.
  - f. Write down the role of an individual protecting environment.
  - g. What are the effects of modern agriculture?
  
3. Define Global warming, write down the causes and effect of global warming. 10
4. Explain sources of solid waste and solid waste management. 10
5. Describe aquatic ecosystem. 10
6. Write down the effect, prevention and control of noise pollution. 10
7. Write short notes on 10
  - a. Pyramid of energy
  - b. Green house effect