WINTER– 2019 EXAMINATION

Model Answer

Subject Code: 17203

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1		**Attempt any nine of the following:**	**18**
	(a)	**Define: i)Matrix, ii) slag**	**2**
		i) **Matrix**: Unwanted impurities associated with ore is called matrix.	1 Mark each
		ii) **Slag:** The substance which is formed when flux reacts gangue.	
	(b)	**Write two ores of iron with chemical formula.**	**2**
		1) Magnetite - Fe_3O_4 2) Haematite - Fe_2O_3 3) Limonite - 2 $Fe_2O_3.3H_2O$ 4) Iron Pyrites - FeS_2 5) Siderite - $FeCO_3$	1 mark each
	(c)	**Name the products of blast furnace.**	**2**
		i) Pig Iron ii) Slag iii) Flue Gases	2

Model Answer

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	(d)	**Define heat treatment of steel**.	**2**
		Heat treatment:- The process of heating steel to a certain high temperature and then cooling it at a controlled rate in order to develop certain physical properties without changing its chemical composition is known as heat treatment of steel.	2
	(e)	**Define corrosion. Give its types.**	**2**
		Corrosion: "Any process of chemical or electrochemical decay or destruction of a metal due to the action of surrounding medium is called as corrosion."	1
		Types of corrosion:	
		i) Atmospheric corrosion / Direct chemical / Dry corrosion	1
		ii) Immersed corrosion / Electrochemical corrosion / Wet corrosion	
	(f)	**Name the metal oxide film which is more protective. Explain.**	**2**
		Stable -non – porous oxide film.	1
		Explanation:	
		Metals like Al forms Al_2O_3 whose volume is greater than the volume of metal (Al). An extremely tightly adhering, non- porous oxide layers is formed. Due to absence of any pores in the oxide film it forms a barrier for further action and hence the rate of oxidation of metal rapidly decreases.	1
	(g)	**Give reason galvanized containers are not used for storing food stuffs.**	**2**
		Galvanized container contains zinc coating. Since Zn is more active metal it readily reacts with the acids present in the food stuffs forming Zn compounds which are highly poisonous & it may poison the food stuffs. Therefore galvanized containers can not be used for storing food stuff.	2
	(h)	**Write the two functions of extenders.**	**2**
		Function of extenders:-	
		1) They reduce the cost of paint.	1mark each
		2) They increase durability of paint	
		3) They help to reduce the cracking of dry paint.	
		4) They acts as carriers for pigmented colour.	
		(Consider any two functions)	

WINTER– 2019 EXAMINATION

Model Answer

17203

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	(i)	**Write any four characteristics of good fuel.** **Characteristics:** 1) It should have moderate ignition temperature. 2) It should have high calorific value. 3) It should possess moderate velocity of combustion. 4) It should have low contents of non-combustible matter. 5) It should have low moisture content. 6) Its products of combustion should not be harmful. 7) It should be available in bulk at low cost. 8) It should be easy to store and transport. 9) It combustion should be easily controllable. 10) It should not undergo spontaneous combustion. 11) It should burn in air with efficiency.	**2** 1mark each
	(j)	**Write any two applications of bio-diesel** 1. It is an alternative fuel formulated exclusively for diesel engines with little or no modificatio engines. 2. It is also used as a heating fuel in domestic & commercial boilers. 3. It is used in rocket fuels. **(Consider any two applications)**	**2** 1mark each
	(k)	**Define fuel. Give its types.** **Fuel:** A fuel can be defined as any combustible substance which during combustion gives large amount of heat energy. **Types:** 1) Solid Fuels 2) Liquid Fuels 3) Gaseous Fuels.	**2** 1 1

WINTER– 2019 EXAMINATION

17203

Model Answer

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	**(l)**	**Define lubricants. Gives its types.** **Lubricant**:- Any substance introduced between two moving or sliding surfaces to reduce the frictional resistance between them is known as a lubricant. **Types of Lubricant**:- i) Solid lubricant ii) Semi-solid lubricant iii) Liquid lubricant. ----------	**2** 1 1
2		**Attempt any FOUR of the following**	**16**
	(a)	**Write chemical reactions taking place in zone of reduction of blast furnace.** i) $3Fe_2O_3 + CO \rightarrow 2Fe_3O_4 + CO_2$ ii) $Fe_3O_4 + CO \rightarrow 3FeO + CO_2$ iii) $FeO + CO \rightarrow Fe + CO_2$ iv) $CaCO_3 \rightarrow CaO + CO_2$ v) $2Fe + 3CO \rightarrow Fe_2O_3 + 3C$ vi) $3Fe + 4CO \rightarrow Fe_3O_4 + 4C$ **(Consider any four reactions)**	**4** 1mark each
	(b)	**Explain: i) Normalizing ii) Tempering** **Normalizing:-** It is similar to annealing. The process consists of heating the steel to a definite temperature about 50^0C above the critical temperature. Then it is allowed to cool freely in air. The cooling rate is generally about 5^0C per second. **Purpose:-** i) To minimize internal stresses which may be caused by working. ii) To remove coarse grained structure. iii) To given ductility & toughness. iv) To improve mechanical properties of steel. In this, steel is heated to slightly higher than annealing. Since, steel is cooled in air, the rate of cooling is faster as compared to annealing, It has some advantages over annealing – i) Mechanical properties of steel are improved. ii) Time required for normalizing is less than annealing. iii) In annealing consumption of fuel is greater than normalizing.	**4** 1 1

WINTER– 2019 EXAMINATION

17203

Model Answer

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	b)	**Tempering:-** Steel which is taken out of quenching medium becomes very hard & brittle & has unequally distributed stresses. To minimize it, tempering is done.	1
		Purpose:- i) To reduce hardness produced during hardening. ii) To improve ductility of metal. iii) To reduce brittleness & improves tensile strength, iv) To relive the internal stress & strain created & stabilize the structure.	1
		Tempering is the process of reheating the hardened or quenched steel to a definite temperature (200 – 600^{0}C) & then cooling it at a suitable rate.	
	(c)	**Write composition of steel. Explain its classification based on percentage of carbon**.	**4**
		Composition: Iron(Fe) – 98.5 to 99.95, Carbon(C) - 0.05 to 1.5 OR Steel consists Iron and Carbon	1
		Classification:	
		1) Mild or low carbon steel – (0.05-0.3%) - The variety of plain carbon steel, which consists of 0.05 to 0.3% of carbon is known as low carbon steel.	1
		2. Medium carbon steel (0.3 - 0.6) – The variety of carbon steel, which consists of 0.3 to 0.6% of carbon is known as medium carbon steel.	1
		3. High carbon steel (0.6 – 1.5%) – The variety of plane carbon steel, which consists of 0.6-1.5% of carbon, is known as high carbon steel.	1
	(d)	**Write any four advantages and disadvantages of gaseous fuel.**	**4**
		Advantages:- 1) They have higher calorific value as compared to solid & liquid fuels. 2) They are easy to ignite & extinguish. 3) There combustion can readily controlled by the use of regulator. 4) They are ash less & smokeless. 5) They have high thermal efficiency. 6) They require only slight excess air for complete combustion. 7) They can be used in I.C. engines. 8) They undergo complete combustion without polluting the environment.	2
		(Consider any four advantages) .	

WINTER– 2019 EXAMINATION

17203

Model Answer

Q. No.	Sub Q.N.	Answer	Marking Scheme
2	d)	**Disadvantages:-** 1) They are more costly as compared to solid & liquid fuels. 2) They are highly inflammable & the chances of explosion are more & a fire risk is more. 3) They require a very large storage tanks are needed for them, hence storage becomes costl 4) They have very low ignition temp. Hence dangerous in storing & transporting	2
	(e)	**Explain proximate analysis of coal.**	**4**
		Proximate Analysis:- "The analysis of a coal sample in which the moisture content, volatile matter, ash content & carbon content are found / determined is known as proximate analysis."	1
		1) Percentage of Moisture:- i) About 1 gm of finely powdered air dried coal sample is weighed (1gm) in a crucible. ii) The crucible is placed in an electric hot oven for 1 hour at 105^0C iii) Cool it to room temp in a desiccator & weighed it again (W_1 gm) iv) Loss in weight ($W - W_1$ gm) is due to loss of moisture from the coal. $\%\ of\ moisture = \frac{Loss\ in\ weight}{Weight\ of\ coal\ sample} \times 100$ $= \frac{(W - W_1)}{W} \times 100$	1
		2) Percentage of Volatile Matter (V.M.):- i) The above sample of moisture free coal left in crucible (W_1g) is covered with a lid. ii) Then placed in a muffle furnace at 925^0C for 7 minutes. iii) Cool it in desiccator to room temp & weigh it again. (W_2g) (Without lid) $\%\ of\ Volatile\ matter = \frac{Loss\ in\ weight}{Weight\ of\ coal\ sample} \times 100$ $= \frac{W_1 - W_2}{W} \times 100$	1

WINTER– 2019 EXAMINATION

Model Answer

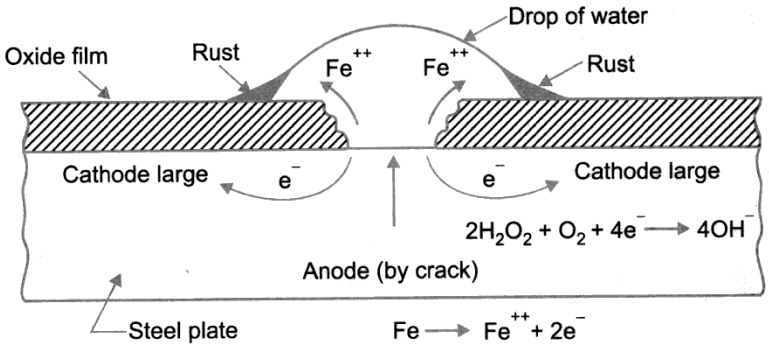
17203

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	**(e)**	**3) Percentage of Ash:-** i) Take some quantity of moisture free coal sample in the crucible & weight it (Wg) ii) Burn the sample at 750 – 800^{0}C in a muffle furnace for half an hour, cool & weigh it a (W_3g) $\% \ of \ Ash = \frac{Weight \ of \ ash}{Weight \ of \ coal \ sample} \times 100$ $= \frac{W_3}{W} \times 100$ **4) Percentage of fixed Carbon:-** Percentage of fixed carbon is calculated as below $\% \ of \ fixed \ carbon = 100 - (\% \ of \ moisture + \% \ of \ Valatile \ matter + \% \ of \ Ash)$ **(Consider any three)**	1 1
	f)	**Give chemical composition of Bio-gas. Write its two uses.** **The average composition of biogas is:** CH_4 (methane) = 50 – 60% (Combustible gas) CO_2 (carbon dioxide) = 30 – 40% (non – combustible gas) H_2 (hydrogen) = 5 – 10% (Combustible gas) N_2 (nitrogen) = 2-6% (non – combustible gas) H_2S (Hydrogen Sulphide) = traces (Combustible gas) **Applications:-** a) It is used as an efficient fuel. b) It is used for cooking food. c) It is used as an illuminant in villages. d) To run engines (generators). **(Consider any two)**	**4** 2 2

WINTER– 2019 EXAMINATION

Model Answer

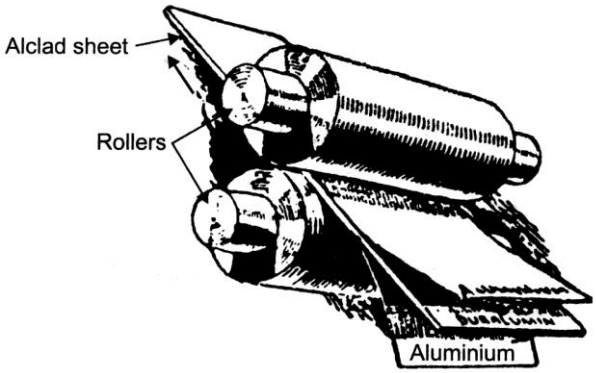
17203

Q. No.	Sub Q. N.	Answer	Marking Scheme
3		**Attempt any FOUR of the following**	**16**
	(a)	**Explain oxygen absorption method with labeled diagram.**	**4**
		Anode: - By crack **Cathode :-** Coated metal part  **Process:** i) The surface of iron is usually coated with a thin film of iron oxide. However if this iron oxide film develops some cracks, anodic areas are created on the surface while the coated metal part acts as cathode. **At Anode:-** $Fe \longrightarrow Fe^{++} + 2e^-$ The liberated electrons flow from anode to cathode areas. The electrons are reacting with water and dissolved O_2. **At Cathode:-** $2H_2O + O_2 + 4e^- \longrightarrow 4OH^-$ The Fe^{2+} ions at anode and OH^- ions at cathode diffuse and when they meet $Fe(OH)_2$ is precipitated. $Fe^{2+} + 2(OH)^- \longrightarrow Fe(OH)_2$	2 2
	(b)	**Explain metal cladding with labeled diagram.** **Method :** Metal cladding **Process :** i) Base metal is sandwiched or cladded between the two sheets of coating metal. ii) This sandwich is then passed through two heavy rollers maintained at high temp & pressure. iii) Cladded metal is cathodic with respect to the base metal so that electrolytic protection is provided metals like Cu, Ni, Ag , Pb, Pt & alloys like stainless steel, Ni alloys, Cu & pb alloys & Pb alloys are used as cladding materials.	**4** 2

WINTER– 2019 EXAMINATION

17203

Model Answer

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	**(b)**		2
	(c)	**Distinguish between Galvanizing and tinning.**	**4**

Sr. No.	Galvanizing	Tinning
i)	A process of covering iron or steel with a thin coat of **Zinc** to prevent it from rusting.	A process of covering iron or steel with a thin coat of **Tin** to prevent it from corrosion.
ii)	In galvanizing, zinc protects the iron as it is more electropositive than iron. It does not allow iron to pass into solution.	Tin protects base metal iron from corrosion, as it is less electropositive than iron and higher corrosion resistance.
iii)	In galvanizing Zn continues to protect the metal by galvanic cell action, even if coating of Zn is broken.	In tinning, tin protects the iron, till the coating is perfect. Any break in coating causes rapid corrosion.
iv)	Galvanized containers cannot be used for storing acidic food stuff, since Zn reacts with food acids forming Zn compounds which are highly toxic i.e. poisonous.	Tin coated containers and utensils can be used for storing any food stuff since Tin is nontoxic and protects the metal from corrosion and does not causes food poisoning.

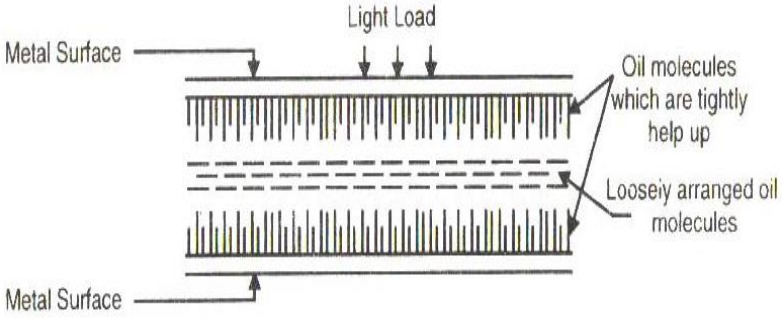
1mark each

	(d)	**Explain fluid - film lubrication with diagram.** **Fluid film lubrication:** i) It is carried out by introducing the liquid lubricants in between the moving or sliding surface. The lubricant film covers the irregularities of the sliding or moving surface & forms a thin layer in between them. This thin layer of lubricant avoids metal to metal contact & reduces wear & friction.	**4**

WINTER– 2019 EXAMINATION

17203

Model Answer

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	**(d)**	ii) The resistance to movement of moving parts is only due to the internal resistance between the particles of the lubricant moving over each other. iii) In fluid film lubrication, the lubricant chosen should have the minimum viscosity under working condition & at the same time it should remain in place & separate the surfaces. **Examples:** This type of lubrication is provided in case of delicate instrument and light machines like watches, clocks, guns, sewing machines, scientific instrument etc. **Diagram**  	2 2
	(e)	**Define following:** **i) Oiliness ii) Volatility iii) Cloud point iv)Pour point** **i) Oiliness:** -It is defined as the power of an oil to maintain a continuous film under pressure while used a lubricant. **ii) Volatility:** - "Volatility of oil is its tendency to vaporize with the increase in temperature." **iii) Cloud point:** It is defined as the temperature at which the oil becomes cloudy or hazy in appearance (due to separation of wax). **iv) Pour point:** It is defined as the temperature at which oil ceases to flow or pour on cooling	**4** 1 Mark each

WINTER– 2019 EXAMINATION

17203

Model Answer

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	**(f)**	**Explain following:** **i) Saponification ii) Emulsification.**	**4**
		i) Saponification:- **It is the number of milligrams of KOH required to saponify 1 gm of oil.** A good lubricant should have moderate saponification value.	2
		ii) Emulsification:- **Certain oils have the tendency to mix with water to form an intermediate & stable mixture called emulsion & the process is known as 'emulsification.'** The emulsion has the property of absorbing dust particles & the other foreign matter present in the surroundings. The solid particles present in the emulsion cause abrasion of the metals in contact & hence the lubricating action of oil is spoiled. A good lubricant is that which does not form any emulsion & if it is formed, it should not remain for long time & should break quickly. This property of an oil to separate itself, as soon as emulsification is formed, is known as de-emulsification.' The lubricant should be used in the refined form because in that case, the chances, of emulsion formation would be minimum.	2