

Department of Mining Engineering  
IIT(ISM), Dhanbad  
VI B.Tech. Mining Engineering (Winter End-Semester Exam)

Subject: Sea Bed Mining and Asteroid Mining (MNO 203)  
Time: 3 hours

Session: 2021-22  
Full Marks: 100

1. Use separate Answer Sheets for Section A and Section B.
2. Attempt any 13 questions in Section A and 7 questions from Section B.
3. Be brief and to the point. Explain with suitable sketches.

### Section # A (Seabed Mining)

(Marks (65))

Q. No.	Questions	Marks
1	Draw a neat sketch of the failure modes as well as the failure curve and explain briefly the failure of rock that occur simultaneously while hyperbaric mechanical cutting of SMS.	5
2	Tabulate the different techniques for extraction methods of various kinds of sea bed deposits, their basic principles and their technological level of readiness.	5
3	Draw a neat sketch of schematics of sea floor mining of Manganese nodules and define the terms "Strip mining", "mine plan", "mine site"	5
4	Draw a neat sketch depicting the various territorial jurisdiction of nations and also the water columns beyond the national jurisdictions from the territorial base line of sea.	5
5	Describe any two causes and its deleterious effects of Deep Sea Bed Mining.	5
6	(a) What major parameters are required to be characterised from well log data for delineation of the reservoir in Seabed mining operation? (b) How conventional active sources will work during the acquisition of marine seismic data acquisition in deep water mining operations?	2  3
7	(a) Define continental slope shelf and rise. (b) What is EEZ?	4  1
8	Discuss the method for the extraction of gold from Sea-bed Massive Sulphides (SMS), with the freshly recovered ore as the starting point.	5
9	For the International Nickel Company (INCO) Process for the treatment of poly metallic nodules, highlight the following. a) Major steps involved b) Reactions which involve slag of any type	3  2
10	Name at least 3 beach placer minerals and their industrial usages Discuss the beach placer mining and reclamation methodology naming the specific operations with equipment and typical environmental impacts that can be addressed.	1.5  3.5
11	State any one environmental impact assessment methodology for mining projects and translate the key issues applicable to seabed mining and dredging projects. How drum cutters help alleviating the issues.	5

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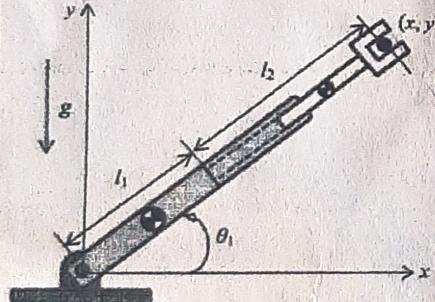
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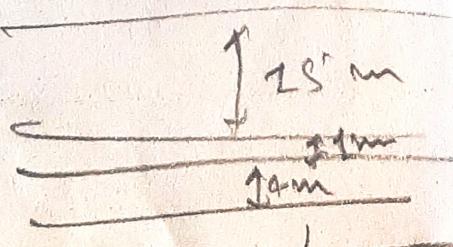
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**Questions**

<b>Q. No.</b>	<b>Questions</b>	<b>Marks</b>
12	<p>Specify the geotechnical parameters relevant to seabed or demolition blast design.          Design an underwater seabed blast for the following case:          Water cover: 15 m; Sediment thickness: 1m; rock depth to be excavated: 4 m          Distance of marine structure : 50 m from blast location; Allowable Peak particle velocity: 20 mm/s; RQD: 40%; Uniaxial compressive strength: 80 MPa          A back hoe dredger of 5 cu.m. bucket capacity is engaged for dredging the rock.          Assume other missing data, design (i) Hole dia and Explosive dia (ii) Type of Explosive and Initiation System (iii) Burden and Spacing (iv) Linear charge concentration and Specific charge</p>	1 4
13	State the environmental impacts of drilling, blasting, mechanical cutting and dredging operations during seabed blasting and measures to control them.	2.5+ 2.5
14	For the robot manipulator shown in the figure with Revolute-Prismatic joints in series, establish the forward and inverse kinematic relations for the end-effector position $(x, y)$ and joint variables of $(\theta_1, l_2)$ .	5
15	 <p>Discuss two argument arc-tangent, atan2( ) solutions and its significance to inverse kinematics.</p>	5



  
 50m  
 20mm/s  
 R&D - 40%  
 UCS = 80 MPa

1 # B (Asteroid Mining)-Answer any seven questions

Marks (35)

Q.No.	Question	Marks
1	Write a short note on the types of Asteroids, their chemical compositions, and the resources found on them.	5
2	Explain the Tsiolkovsky rocket equation. Define the variables that must be evaluated for targeting the Asteroids for mining?	5
3	Briefly describe the Asteroid Re-direct Mission (ARM) of NASA and its potential benefits.	5
4	What is Outer Space Treaty (OST) and its origin? Briefly explain Article I of the OST with a couple of key comments from expert commentators.	2+3
5	Define the Jacobian of a Serial Robot. Derive the Jacobian matrix for a 2 Link planar arm with revolute joints.	1+4
6	(i) Write the name of the planet which has the retrograde rotation. (ii) Using Bode's law compute the distance in the astronomical unit (AU) of the asteroid belt from the Sun. (iii) What is emissivity? (iv) State Stefan Boltzmann's law in black body radiation.	1 2 1 1
7	(i) Write the spectral band of AVHRR (Advanced very high-resolution radiometer) useful for snow and ice detection. (ii) Briefly highlight thermal remote sensing technique for geological mapping in asteroids.	1 4
8	Define meteoroid, meteor and meteorites. Among meteoroids, meteors, and meteorites, which one is mineable?	4+1

Final Semester Examination, Winter 2021-22  
BTech (Mining Engineering), 6th Semester  
**Course Name: Mine Automation and Data Analytics (MNC305)**  
Examination Date: 20-04-2022  
Full Marks: 100 and Time: 3 Hours

Answer any five questions

1. A) A mining machinery company claimed that at least 90% of the spare parts and components which they supplied, conformed to technical specifications. A random sample of 200 components showed that only 164 were meeting the standard. Test their claim at 1% level of significance. (Critical region at 1% level is  $z \leq -2.33$ ) [8]  
B) Prove that the correlation coefficient  $r$  lies between -1 and +1 [8]  
C) Why median is resistant to outliers? Explain with examples. [4]

2. A) Consider accidents in an underground coal mine occur randomly at an average rate of 3.5 accidents per year. What is the probability of observing more than or equal to 7 accidents in a given year in the coal mine? (consider Poisson Distribution) [10]

- B) The life time of electric bulbs for a random sample of 10 from a large consignment gave the following data:  
Life in thousand hours: 4.2, 4.6, 4.1, 3.9, 5.2, 3.8, 3.9, 4.3, 4.4, 5.6.  
Can we accept the hypothesis that the average life time of bulbs is 4000 hours?  
Consider at 5% level of significance. [10]

3. A) The marks of 500 mining engineering students in GATE examination are normally distributed with a mean of 45 marks and standard deviation of 20 marks. If 20% of the students obtain a distinction by scoring  $x$  marks or more, estimate the value of  $x$ . [10]

- B) If the perceptron algorithm is run on a linearly separable training set  $D_N$ , the number of mistakes made on  $D_N$  is at most  $1/\gamma^2$ . In other words, the perceptron algorithm will terminate after at most  $[1/\gamma^2]$  updates and return a hyperplane that perfectly separates  $D_N$ . [10]

4. Discuss an automation strategy and arrangements in terms of both hardware and software requirements and their setup and synchronisation to monitor the health of conveyor belt in a mine. Use appropriate sketch and logic and also discuss the suitable fault detection algorithm in the proposed system. [20]

5. How machine learning can be utilised for the prediction of deformation of tailings dam embankments in a metal mine? Discuss all arrangements in terms of hardware and software required to undertake this study. Use appropriate figures. [20]

6. How virtual reality may be used for enhancing the efficiency of drilling operator in a mine. Discuss the methods and elaborate the logical sequence of virtual training for the drilling operator. Use of suitable sketch, flow chart and hypothetical scheme of showing efficiency of the system is mandatory. [20]

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**VI Semester B.Tech (Mining Engineering)**  
**End-Semester Examination**  
**Session 2021-22**  
**Subject: Mine Legislation and Safety**  
**Subject Code - MNC 304**

**Time – 3 hour**

**Full marks - 100**

**Instruction:** Attempt any three questions from Qn. No. 1 to 4, any three questions from Qn. No. 11 to 15 and rest questions are compulsory

<b>Qn. No.</b>	<b>Questions</b>	<b>Marks</b>
1.	<p>Define any two of the following:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> a. Serious bodily injury;</li> <li>b. Flameproof enclosure</li> <li><input checked="" type="checkbox"/> c. Intrinsically safe apparatus</li> <li>d. Onsetter</li> </ul>	2 x 3
2.	<p>Explain in brief the functions of the Committee constituted under Section 12 of the Mines Act, 1952.</p>	6
3.	<p>(a) As provided in the Mines Act, 1952, in the event of any contravention related to safety issues in a mine by any person whatsoever of any of the provisions of this Act or of the regulations; rules, bye-laws or orders made thereunder, besides the person who contravenes, who shall also be deemed to be guilty?</p> <p>(b) In which conditions he / she may not be proceeded against and how to prove themselves of not being guilty of such contraventions?</p>	2 + 4
4.	<p>(a) Mentioning the statutory norms, calculate the minimum number of workmen's Inspector required to be appointed in a mine producing 3 million tonne of coal per annum with 2255 persons ordinarily employed in the mine?</p> <p>(b) Describe in brief the duties of Workmen's Inspector in mines as required under the Mines Rules, 1955?</p>	2+4

Qn. No.	Questions	Marks
5.	<p>As per the requirement of the Mines Act, 1952, under which conditions, how and to whom the Chief Inspector or the Inspector of Mines may issue</p> <p>(a) an order to prohibit the extraction or reduction of pillars or blocks of minerals in any mine or part thereof?</p> <p>(b) an order to prohibit the employment in or about the mine or any part thereof?</p>	5+3
6.	<p>(a) Why and when bye-laws are framed the Mines Act, 1952? Who shall frame a bye-law and to whom it shall be submitted?</p> <p>(b) State in brief the process of approval of a bye-law and the actions to be taken after approval of such bye-laws.</p>	4+6
7.	<p>State in brief the statutory provisions under CEAR 2010 in relation to length of cable, type of connector and anchoring while using of trailing cable with an electric shuttle car in an underground coal mine being operated at 1.1 kV and a dragline in an opencast coal mine operated at 22 kV.</p>	4
8.	<p>(a) Describe in brief the duties of Rescue Station Superintendent under the Mines Rescue Rules, 1985</p> <p>(b) How many rescue trained persons are to be employed in a below ground mine where 2500 persons are ordinarily employed?</p>	8+2
9.	<p>(a) What do you understand by Safety Management Plan (SMP) of a mine under the Coal Mines Regulation, 2017?</p> <p>(b) Describe in brief the statutory requirement for identification of hazards, assessment and controlling risk of identified hazards in a coal mine.</p> <p>(c) Explain the different basic elements that the SMP of a mine shall contain including requirement of reviewing SMP?</p>	2+4+8
10.	<p>State in brief the statutory actions to be taken under the Coal Mines Regulation, 2017 in case of a fatal accident regarding quarantining the place of accident.</p>	6

Qn. No.	Questions	Marks
11.	What precautions under the Coal Mines Regulation, 2017, the Shotfirer will take before firing shots in coal mines regarding taking shelter and preventing persons being hit by fly-rocks or projectiles?	10
12.	Where electric energy is used in any ventilating district in a belowground mine, state the statutory provisions under the Coal Mines Regulation, 2017, regarding determination of percentage of inflammable gas and of environmental conditions including location, frequency and manner of determination.	10
13.	Explain in brief the standards of ventilation required to be maintained in an underground coalmine under the Coal Mines Regulation, 2017? What actions are required for ensuring compliance with the provisions of standard of ventilation?	10
14.	Describe in brief the statutory requirement of depillaring operations in an underground coal mine under the Coal Mines Regulation, 2017?	10
15.	Describe in brief the duties of manager of a coal mine under the Coal Mines Regulation, 2017 related to inspections of workings, supply of materials, assigning duties to competent persons and inquiry into fatal accidents.	10

INDIAN INSTITUTE OF TECHNOLOGY (INDIAN SCHOOL OF MINES), DHANBAD  
DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

End Semester Examination (Winter Semester) 2021-22

VI SEM B. Tech

SUBJECT: INTRODUCTION TO WOMEN'S AND GENDER STUDIES (HSE302)

M.MARKS: 100

TIME: 3HRS

- ~~I.~~ Answer ALL the questions:  $(20*3= 60)$
- ✓ 1. What is the scope of studying gender studies for the students in STEM?
  - ✓ 2. Analyse any film of your choice from gender perspective.
  - ✓ 3. Gendered spaces are propagated by cartoon serials. Explain
- ~~II.~~ Answer the Short question:  $(10*1=10)$
- ✓ 1. Is gender a performance? If so, how often do we do our gender?
- ~~III.~~ Write notes on ANY TWO:  $(5*2=10)$
- ✓ 1. Queer Spaces
  - ✓ 2. Gender Binary
  - ✓ 3. Heteronormativity
- ~~IV.~~ The sentences given below depict gender stereotypes. Elucidate.  $(5*4= 20)$
- ✓ 1. Boys don't cry.
  - ✓ 2. Pink is for girls.
  - ✓ 3. Boys are naughty, girls are sweet.
  - ✓ 4. Man with the sword and with the needle She.
  - ✓ 5. Don't be such a girl.

भारतीय प्रौद्योगिकी संस्थान ( भारतीय खनि विद्यापीठ ), धनबाद  
Indian Institute of Technology (Indian School of Mines), Dhanbad  
**DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES**

**End Semester - Winter Examination [2021-2022]**

**Course Name: Technology, Culture and Society**

**Course Code: HSO503**

**Date: 30-04-2022**

**Time: 09:00 AM**

**Duration: 3 hours**

**Full marks: 100**

**Answer any five questions**

1. What are the functions of technology? Describe how technology affects 'self' with reference to the instance of personality assessment tools. [20]
2. With proper examples, discuss how technology is affecting family relationship. [20]
3. Discuss with appropriate examples the role of technology, including Biotechnology, in conservation of both plant and animal species. [20]
4. Technology or artifacts have politics (political qualities), discuss with appropriate cases/examples. [20]

5. Discuss the concept of 'Cyborg'. Describe with examples, how technology is affecting people with disability and old age. [20]

6. Answer the following questions [10 X 2 = 20]

(i) What are the developments occurred during Neolithic revolution?

(ii) Describe the social shaping of technology, with specific reference to the development of Dicycle

7. Describe the following, in details [10 X 2 = 20]

(i) Feminist theory of technology

(ii) Ethical issues of smart healthcare

8. Write short notes on the following: [5 X 4 = 20]

(i) The broad technological dilemmas

(ii) The Nehru-Mahalanobis model of development

(iii) The looking-glass self theory

(iv) Positive effects of Green Revolution