Semester: Winter **Session:** 2024-25

Examination: VI B.Tech (Mining Engineering) End Semester

Subject: Mine Legislation and Safety **(MNC 304)**

Time: 2 hours **Full Marks:** 66

	PART- A ***Instruction: Answer any two questions.***	***Marks: 22***
Q. 1	State with schematic diagram, the statutory precautions need to be taken when fire exist in coal mines.	(11)
Q. 2	The depth of the shaft, height of headgear structure up to pulley shaft and diameter of the winding rope of a drum winder are 120 m, 32 m and 5 cm, respectively. The angle of contact of the rope with the pully sheeve is 120^0. The angle of the rope from pulley to driving drum with base is 60^0. Estimate with a schematic diagram, the length of a new winding rope used for man winding. State the provision that needs to be followed at each step while estimating such length. Assume the other data technically and/or statutorily if require.	(11)
Q. 3	State the statutory provisions required to be complied for adequately preparation and implementation of "Strata Control and Monitoring Plan" in an underground bord and pillar coal mine.	(11)

	PART- B ***Instruction:*** **Answer all questions.**	***Marks: 44***
Q. 4	As provided in the Coal Mines Regulation 2017, how do you define Safety Management Plan of a mine? Name and explain in details, the essential features (elements) of Safety Management Plan (SMP) of a mine.	(2+10)
Q. 5	According to CMR 2017, state the duties and responsibilities of Mine Owner for the development and effective implementation of Systematic Safety Management Plan for the mine(s) under his control.	(8)
Q. 6	a) State with schematic diagram, the statutory provisions required to be conformed while two or more auxiliary fans installed in the same ventilation circuit in a coal mines. b) With a schematic diagram, state the provisions need to be followed while working near boundary in an underground metalliferous mine.	(9+3)
Q. 7	a) Explain in brief the possible occupational hazards in an underground coal mine. b) As per I.E. Rules, 1956, state the sundry precaution for mines need to be taken?	(8+4)

Department of Mining Engineering
Indian Institute of Technology (Indian School of Mines) Dhanbad
Endsem Examination Winter Semester 2024-2025
Subject: Deep Coal Mining (Code: MND 412) (ME, MECH, EE, ECE, CSE, MME, CIV, AGL, MLMTE, EP, PE, CE)
Course for 3rd & 4th Year (6th & 8th Sem) B.Tech. (101 nos.)

Time: 120 minutes (08:00 AM – 10:00 AM) | **Venue:** NLHC LH 11-13 | **Date:** 23-04-2025| **Maximum Marks:** 50

*Instruction: Please mention your **Serial No.** on the top of answer sheet as per Attendance List*
*Answer **all** the questions of the **two** sections and **marks** are assigned against each section*

Section A: Numerical & Relational Proof Answer Type Questions – 25 marks
*Answer all the questions and **marks** are assigned against each question*

1. Suppose that the average vertical pillar stress is 26.7 MPa in a room and pillar mine and that a joint set is present with an average bearing of N45°W. If the joints obey a Mohr–Coulomb slip criterion and have a friction angle of 28° and a cohesion of 0.90 MPa, what range of joint dips is unsafe with respect to joint slip?

(3 marks)

2. Churcha RO coal mine, working at a depth of 500 m has an immediate sandstone roof of 50 m thickness with UCS of 500 kg/cm², average core length of 10 m and RQD 100%. Estimate the rated capacity of a 2-legged powered roof support (canopy 3.0 m x 1.5 m) using the following relationship assuming caving height as 10 times of the coal seam thickness (3 m) and web cut of 1.5 m:

$$I = \frac{\sigma l^n T^{0.5}}{5};\ P_e = \frac{h_c}{2} * \frac{I_{max}}{1000} + 31.66;\ P_r = 1.3 * P_e$$

Support capacity in tons $= P_r * W_c * (L_c + W_d + 0.3)$

(3 marks)

3. A circular concrete shaft liner has an inside diameter of 20 ft and an outside diameter of 24 ft. Determine the bond strength between concrete and rock such that liner weight does not accumulate. Assume specific weight of concrete is 140 pcf.

(2 marks)

4. Prove the following relationship to estimate safety factor and thickness for the liner in the shaft:

$$FS_c = \frac{C_o}{\sigma_c} = \frac{C_o}{Kp_b} = C_o\left[\frac{1-\left(\frac{a}{b}\right)^2}{2p_b}\right]$$

$$h = b\left[1-\sqrt{\left(\frac{C_o - 2p_b FS}{C_o}\right)}\right]$$

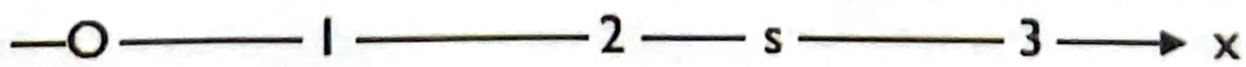
where symbols have their usual meanings.

OR

Consider a vertical shaft excavated in a stress field where $S_v = 1350\ psi$, $S_h\ (north) = 300\ psi$ and $S_H\ (east) = 1200\ psi$ and a joint set that strikes due north and dips 60° with cohesion $c_j = 135\ psi$ and friction angle $\phi_j = 35°$. For convenience, fix the x-axis due east parallel with S_H. Determine joint safety factors before excavation, after excavation and the improvement that a shaft bolting plan could achieve considering bolts are installed horizontally on a square pattern of three-foot centers and tensioned to 18,500 pounds force.

(4 marks)

5. Three geophone receivers on a line detect a seismic event that occurs between receivers 2 and 3. Determine the event location (x_s) and time (t_s) in terms of coordinates (x_1, x_2, x_3) and time (t_1, t_2, t_3).

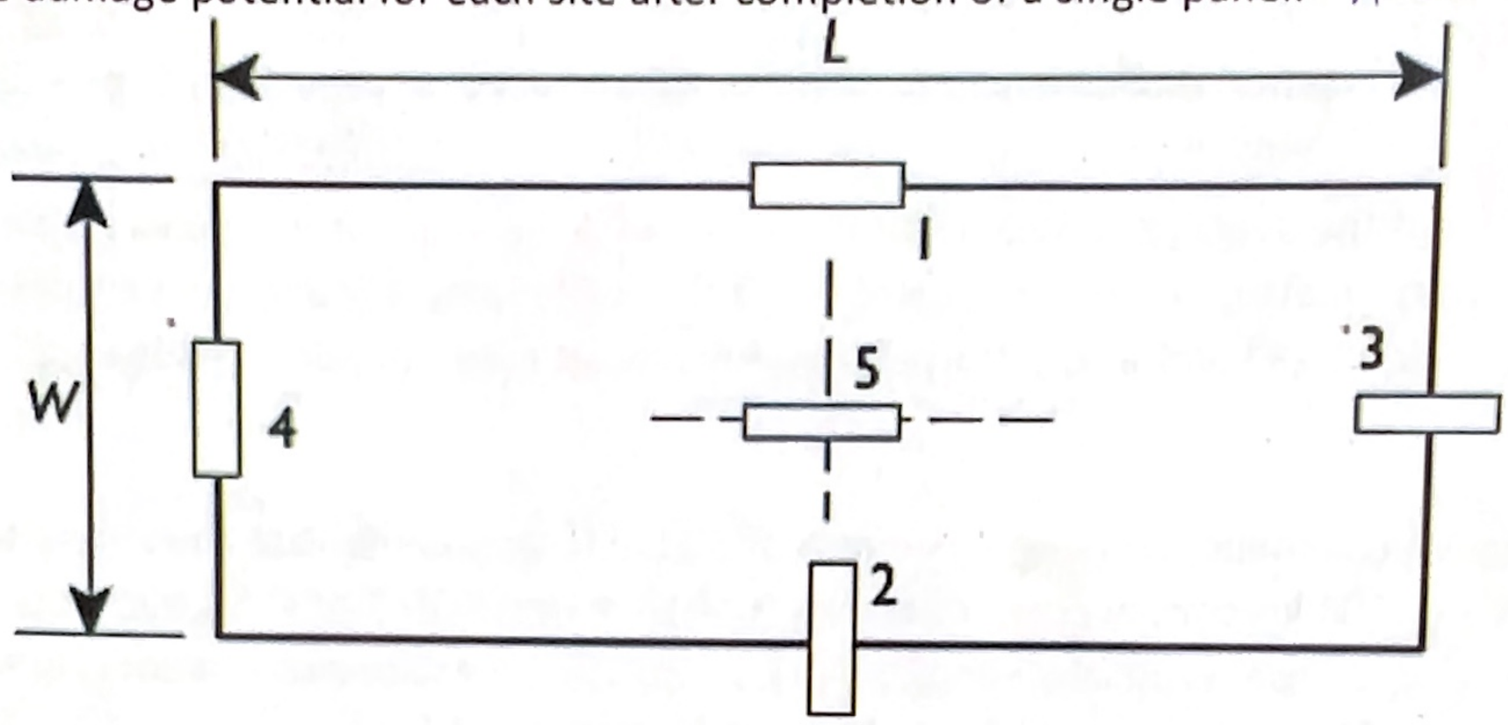


(4 marks)

6. A mine in a flat seam at a depth of 520 m excavates panels with a face width of 260 m and a length of 2500 m. Mining is full seam height at 4.2 m. Compare subsidence profiles by sketching trend on one side (left/right) from the centre of the panel when the angle of draw and subsidence factor are 37^0 and 0.9, respectively, with the case when they are 27^0 and 0.67.

(6 marks)

7. Structures that are shown in the sketch have rectangular foundations 50 ft × 125 ft. Panel width and length is 260 m and 2,500 m respectively. The angle of draw and subsidence factor are 27^0 and 0.67, respectively. Estimate the damage potential for each site after completion of a single panel. H= 520 m



(3 marks)

Section B: Short Descriptive Answer Type Question (Answer in 3-5 lines/pointwise) – 25 marks

*Answer **all** the questions and **marks** are assigned against each question*

8. **(a)** Draw a subsidence profile and show **(i)** angle of break, **(ii)** angle of draw, **(iii)** point of inflection (transition point) and **(iv)** zone of maximum damage on the surface

(b) Draw subsidence trough for **(i)** inclined coal seam **(ii)** multipanel side by side with superposed subsidence profiles **(iii)** multi-seam superposition of subsidence profiles and **(iv)** give an example of profile function with limits which describes the subsidence profile.

(c) Mention five factors affecting subsidence.

(d) Discuss the impacts of mine subsidence and their control and prevention techniques.

(e) Suppose the seam dips 8^0 and panels (face width is 260 m) are developed on strike so the face runs up and down dip. Show the location of the trough and shift of point of maximum subsidence in relation to the panel using the rule of the normal. Assume UK conditions and the panel is at a depth of 520 m.

(f) State the two limitations of estimating subsidence using Subsidence Engineers' Handbook (SHB) of National Coal Board (NCB), UK.

(g) With the increase of mining depth, the proportion of active stage of maximum subsidence point to total movement period decreases, the mining adequacy decreases, the range of mining influence increases, and the amount of mining influence decreases. Discuss this statement with respect to subsidence observed during working at 300 m and 1000 m using the terms surface subsidence volume, rock pressure relief expansion volume, overburden inner separation layer, and void volume.

(2 + 2 + 2 + 2 + 1 + 1 + 3 = 13 marks)

OR

(a) Differentiate: frame, chock, shield and chock-shield powered roof support.

(b) Differentiate between main weighting and periodic weighting in Longwall Mining Method.

(c) Why 2-legged powered roof supports are more popular than 4-legged? Explain.

(d) Describe a suitable underground coal mining method for extracting a 30-meter-thick coal seam. Support your explanation with an appropriate sketch.

(e) Discuss the uniqueness of Adriyala Longwall Project of Singareni Collieries Company Limited, Telangana.

(f) Discuss the various challenges encountered by the Adriyala Longwall Project of Singareni Collieries Company Limited, Telangana, and explain the strategies adopted to overcome them.

(2 + 2 + 2 + 2 + 2 + 3 = 13 marks)

9. (a) Discuss the five conditions necessary for occurrence of rock burst.

(b) Discuss the two serious problems caused due to depillaring or longwalling under hard massive roof strata.

(c) Discuss design of yield pillar technique with respect to stiffness.

(d) Discuss the measures to control hard roof strata in absence of stowing or backfilling.

(e) Discuss the different indices for predicting rock burst proneness and design of mine layout in such condition.

(f) Discuss the techniques to detect bursts and measures to control and combat rock bursts.

(2 + 2 + 2 + 2 + 2 + 2 = 12 marks)

OR

(a) Differentiate between cemented and uncemented backfill with example.

(b) What do you understand by plug in paste backfill?

(c) Discss the importance of Viscat Needle Apparatus with respect to paste backfill material.

(d) Discuss the importance of studying mineral composition and mesostructural characteristics of gangues/mill tailings in paste backfill.

(e) Draw a network of paste fill plant showing all the accessories required on the surface to the point of filling voids.

(f) Which coal seam is more prone to bursting: one with a W_{ET} value of 4.02 or one with a value of 1.44? Discuss.

(g) Discuss the effects of curing time, water and binder on strength of paste backfill material with suitable curve.

(h) Differentiate (i) rock burst and air blast (ii) ERR vs W_{ET}

(i) Draw a schematic diagram showing the concept of Continuous Mining and Continuous Backfilling (CMCB) using Roadheaders.

(1 + 1 + 1 + 1 + 1 + 1 + 2 + 2 + 2 = 12 marks)

********** END OF QUESTION PAPER **********

Table 1: Relationships may be found to be useful in solving numerical questions.

$\frac{S}{h} = a\left\{1 - e^{\left[-\frac{1}{2}\left(\frac{W/H}{a/2}\right)\right]^2}\right\}$	$\frac{S'}{S} = \left\{1 - e^{\left[-2.70\left(\frac{x}{H}\right)\right]^2}\right\}$	$x' = x\left(\frac{W'}{W_o}\right) = x\left[\frac{W + 2H\tan(\delta')}{W + 2H\tan(\delta)}\right]$	$s' = s\left(\frac{S'_f}{S_f}\right)$
$E_t = (E+)\left(\frac{S}{H}\right)$	$E_c = (E-)\left(\frac{S}{H}\right)$	$\frac{-e}{-E} = e^{\left[-4\left(\frac{W}{H}-0.5\right)^2\right]}$	
$\varepsilon_{rr} = A - \frac{B}{r^2}$	$\varepsilon_{\theta\theta} = A + \frac{B}{r^2}$		
$\sigma_{rr} = \frac{E}{(1+v)(1-2v)}[(1+v)\varepsilon_{rr} + v\varepsilon_{\theta\theta}]$	$\sigma_{\theta\theta} = \frac{E}{(1+v)(1-2v)}[(1+v)\varepsilon_{\theta\theta} + v\varepsilon_{rr}]$		
Bolted joint safety factor $FS = FS_j + \Delta FS_j$	$\Delta FS_j = \frac{N_b \tan(\phi_j) + T_b}{\tau_j(\text{stress})A_j}$	$\Delta FS_j = \frac{F_b \sin(\delta-\beta)\tan(\phi_j) + F_b\cos(\delta-\beta)}{\tau_j(\text{stress})A_j}$	
$\tau_j = \sigma_j \tan\varphi_j + c_j$	$S_n = \frac{S_x + S_y}{2} - \frac{S_x - S_y}{2}\cos 2\alpha + T_{xy}\sin 2\alpha$	$T_s = -\left(\frac{S_x - S_y}{2}\right)\sin 2\alpha + T_{xy}\cos 2\alpha$	
where symbols have their own meaning			

Table 2: Subsidence profile points at various width to depth ratios (from SHB, 1975)

s/S W/H	0.00	0.05	0.10	0.20	0.30	0.40	0.50 X/H	0.60	0.70	0.80	0.90	0.95	1.00
0.20	0.80	0.64	0.57	0.48	0.41	0.37	0.32	0.28	0.23	0.19	0.13	0.08	0.00
0.24	0.82	0.62	0.53	0.43	0.36	0.32	0.28	0.24	0.20	0.16	0.11	0.07	0.00
0.28	0.84	0.61	0.51	0.39	0.33	0.28	0.24	0.21	0.18	0.14	0.09	0.07	0.00
0.30	0.85	0.61	0.50	0.38	0.32	0.27	0.23	0.20	0.17	0.13	0.09	0.06	0.00
0.34	0.87	0.60	0.49	0.36	0.30	0.25	0.22	0.19	0.16	0.12	0.08	0.06	0.00
0.38	0.89	0.60	0.48	0.35	0.29	0.24	0.21	0.18	0.15	0.12	0.08	0.06	0.00
0.40	0.90	0.59	0.47	0.34	0.28	0.24	0.21	0.18	0.15	0.12	0.08	0.06	0.00
0.44	0.92	0.59	0.47	0.33	0.28	0.23	0.20	0.17	0.15	0.12	0.08	0.06	0.00
0.48	0.94	0.59	0.47	0.33	0.28	0.23	0.20	0.17	0.15	0.12	0.08	0.06	0.00
0.50	0.95	0.59	0.47	0.34	0.28	0.24	0.21	0.17	0.15	0.12	0.08	0.06	0.00
0.54	0.97	0.59	0.47	0.34	0.29	0.25	0.21	0.18	0.15	0.12	0.08	0.06	0.00
0.58	0.99	0.59	0.47	0.35	0.30	0.25	0.22	0.18	0.16	0.13	0.09	0.06	0.00
0.60	1.00	0.59	0.47	0.36	0.30	0.26	0.22	0.19	0.16	0.13	0.09	0.06	0.00
0.64	1.02	0.59	0.48	0.37	0.31	0.27	0.23	0.20	0.17	0.13	0.09	0.06	0.00
0.68	1.04	0.60	0.49	0.38	0.32	0.28	0.24	0.21	0.17	0.14	0.10	0.07	0.00
0.70	1.05	0.60	0.49	0.39	0.33	0.29	0.25	0.21	0.18	0.14	0.10	0.07	0.00
0.74	1.07	0.61	0.50	0.40	0.34	0.30	0.26	0.23	0.19	0.15	0.10	0.07	0.00
0.78	1.09	0.63	0.52	0.42	0.36	0.32	0.28	0.24	0.20	0.16	0.11	0.08	0.00
0.80	1.10	0.63	0.52	0.42	0.36	0.32	0.28	0.25	0.21	0.17	0.11	0.08	0.00
0.84	1.12	0.65	0.54	0.44	0.38	0.34	0.30	0.26	0.22	0.18	0.12	0.09	0.00
0.88	1.14	0.67	0.56	0.45	0.40	0.36	0.32	0.28	0.24	0.20	0.13	0.10	0.00
0.90	1.15	0.68	0.57	0.46	0.40	0.36	0.32	0.29	0.25	0.20	0.14	0.10	0.00
0.94	1.17	0.69	0.58	0.48	0.42	0.38	0.34	0.31	0.26	0.22	0.16	0.11	0.00
0.98	1.19	0.71	0.60	0.50	0.44	0.40	0.36	0.33	0.28	0.24	0.17	0.12	0.00
1.00	1.20	0.72	0.61	0.51	0.45	0.41	0.37	0.33	0.29	0.24	0.18	0.13	0.00
1.10	1.25	0.77	0.65	0.55	0.50	0.45	0.42	0.38	0.34	0.29	0.21	0.16	0.00
1.20	1.30	0.81	0.70	0.60	0.54	0.50	0.46	0.42	0.38	0.33	0.25	0.19	0.00
1.30	1.35	0.86	0.75	0.65	0.59	0.55	0.51	0.47	0.43	0.38	0.30	0.23	0.00
1.40	1.40	0.91	0.80	0.70	0.64	0.60	0.56	0.52	0.48	0.43	0.35	0.27	0.00
1.60	1.50	1.01	0.90	0.80	0.74	0.70	0.66	0.62	0.58	0.53	0.45	0.37	0.05
1.80	1.60	1.11	1.00	0.90	0.84	0.80	0.76	0.72	0.68	0.63	0.55	0.47	0.10
2.00	1.70	1.21	1.09	0.99	0.94	0.90	0.86	0.82	0.78	0.73	0.65	0.57	0.16
2.20	1.80	1.31	1.19	1.09	1.04	1.00	0.96	0.92	0.88	0.83	0.75	0.67	0.23
2.40	1.90	1.41	1.29	1.19	1.14	1.10	1.06	1.02	0.98	0.93	0.85	0.77	0.31
2.60	2.00	1.51	1.39	1.29	1.24	1.19	1.16	1.12	1.08	1.03	0.95	0.87	0.41

Table 3: Peak strain multipliers.

W/H	E+	E-
0.10	0.25	2.40
0.20	0.52	2.25
0.30	0.70	2.00
0.40	0.77	1.73
0.50	0.80	1.35
0.60	0.75	1.06
0.70	0.68	0.86
0.80	0.65	0.70
0.90	0.65	0.60
1.00	0.65	0.55
1.10	0.65	0.54
1.20	0.65	0.53
1.30	0.65	0.52
1.40	0.65	0.51

Note

a Tension (+),compression (–).

Table 4: Strain profile points at various width to depth ratios (from SHB, 1975)

e/E W/H	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.00	0.20 X/H	0.40	0.60	0.80	1.00	0.80	0.60	0.40	0.20	0.00
0.20	0.80	0.74	0.69	0.66	0.61	0.49	0.42	0.32	0.27	0.23	0.18	0.12	0.00	0.00	0	0	0	0
0.24	0.82	0.70	0.63	0.60	0.54	0.44	0.37	0.28	0.23	0.20	0.15	0.10	0.00	0.00	0	0	0	0
0.28	0.84	0.66	0.58	0.54	0.49	0.39	0.33	0.24	0.21	0.17	0.13	0.08	0.00	0.00	0	0	0	0
0.32	0.86	0.63	0.55	0.49	0.45	0.35	0.30	0.22	0.19	0.16	0.12	0.07	0.00	0.00	0	0	0	0
0.36	0.88	0.62	0.53	0.46	0.42	0.33	0.29	0.21	0.18	0.15	0.11	0.07	0.00	0.00	0	0	0	0
0.40	0.90	0.61	0.52	0.45	0.40	0.32	0.28	0.21	0.18	0.15	0.11	0.07	0.00	0.00	0	0	0	0
0.44	0.92	0.60	0.51	0.43	0.39	0.31	0.27	0.20	0.18	0.15	0.11	0.07	0.01	0.00	0	0	0	0
0.48	0.94	0.60	0.51	0.43	0.38	0.31	0.27	0.20	0.18	0.15	0.12	0.08	0.01	0.00	0	0	0	0
0.52	0.96	0.60	0.51	0.43	0.38	0.32	0.27	0.21	0.18	0.16	0.12	0.09	0.02	0.00	0	0	0	0
0.56	0.98	0.61	0.51	0.44	0.39	0.33	0.28	0.22	0.19	0.17	0.13	0.10	0.03	0.00	0	0	0	0
0.60	1.00	0.62	0.52	0.45	0.40	0.34	0.29	0.22	0.20	0.18	0.14	0.11	0.05	0.00	0	0	0	0
0.64	1.02	0.63	0.53	0.46	0.41	0.35	0.31	0.23	0.21	0.19	0.15	0.12	0.06	0.00	0	0	0	0
0.68	1.04	0.64	0.54	0.47	0.43	0.37	0.32	0.24	0.22	0.20	0.16	0.13	0.07	0.00	0	0	0	0
0.72	1.06	0.66	0.55	0.49	0.44	0.38	0.34	0.26	0.24	0.21	0.17	0.15	0.09	0.00	0	0	0	0
0.76	1.08	0.67	0.57	0.51	0.46	0.40	0.36	0.27	0.25	0.22	0.19	0.16	0.10	0.01	0	0	0	0
0.80	1.10	0.69	0.58	0.53	0.48	0.42	0.37	0.29	0.26	0.24	0.20	0.17	0.11	0.02	0	0	0	0
0.84	1.12	0.71	0.60	0.54	0.49	0.44	0.39	0.30	0.28	0.25	0.22	0.19	0.13	0.04	0	0	0	0
0.88	1.14	0.73	0.62	0.56	0.51	0.46	0.41	0.32	0.29	0.27	0.24	0.21	0.15	0.05	0.01	0	0	0
0.92	1.16	0.75	0.64	0.58	0.53	0.47	0.43	0.34	0.31	0.29	0.25	0.22	0.16	0.07	0.02	0	0	0
0.96	1.18	0.77	0.66	0.60	0.55	0.49	0.45	0.35	0.33	0.30	0.27	0.24	0.18	0.09	0.04	0	0	0
1.00	1.20	0.79	0.68	0.62	0.57	0.51	0.47	0.37	0.35	0.32	0.29	0.26	0.20	0.10	0.05	0	0	0
1.20	1.30	0.88	0.77	0.71	0.66	0.61	0.56	0.46	0.44	0.41	0.38	0.35	0.29	0.20	0.13	0.07	0.02	0
1.40	1.40	0.98	0.87	0.81	0.75	0.70	0.66	0.56	0.53	0.51	0.48	0.45	0.39	0.30	0.23	0.17	0.1	0
1.60	1.50	1.08	0.97	0.91	0.85	0.80	0.76	0.66	0.63	0.61	0.58	0.55	0.49	0.40	0.33	0.27	0.2	0.03
1.80	1.60	1.17	1.07	1.01	0.95	0.90	0.86	0.76	0.73	0.71	0.68	0.65	0.59	0.50	0.43	0.37	0.3	0.1
2.00	1.70	1.28	1.17	1.11	1.05	1.00	0.96	0.86	0.84	0.81	0.78	0.75	0.69	0.60	0.53	0.47	0.4	0.2
2.20	1.80	1.38	1.27	1.21	1.15	1.10	1.06	0.96	0.94	0.91	0.88	0.85	0.79	0.70	0.63	0.57	0.5	0.3
2.40	1.90	1.48	1.37	1.31	1.25	1.20	1.16	1.06	1.04	1.01	0.98	0.95	0.89	0.80	0.73	0.67	0.6	0.4
2.60	2.00	1.58	1.47	1.41	1.36	1.30	1.26	1.16	1.14	1.11	1.08	1.05	0.99	0.90	0.83	0.77	0.7	0.5

END-SEMESTER EXAMINATION

Examination: 6th Sem B.Tech (CHM, CIV,ESE, FMME, M&C, MNE, MME, EE, ECE, CSE, M&C, PHY, MLMTE, & PE)

Session: 2024-2025

Semester: Winter

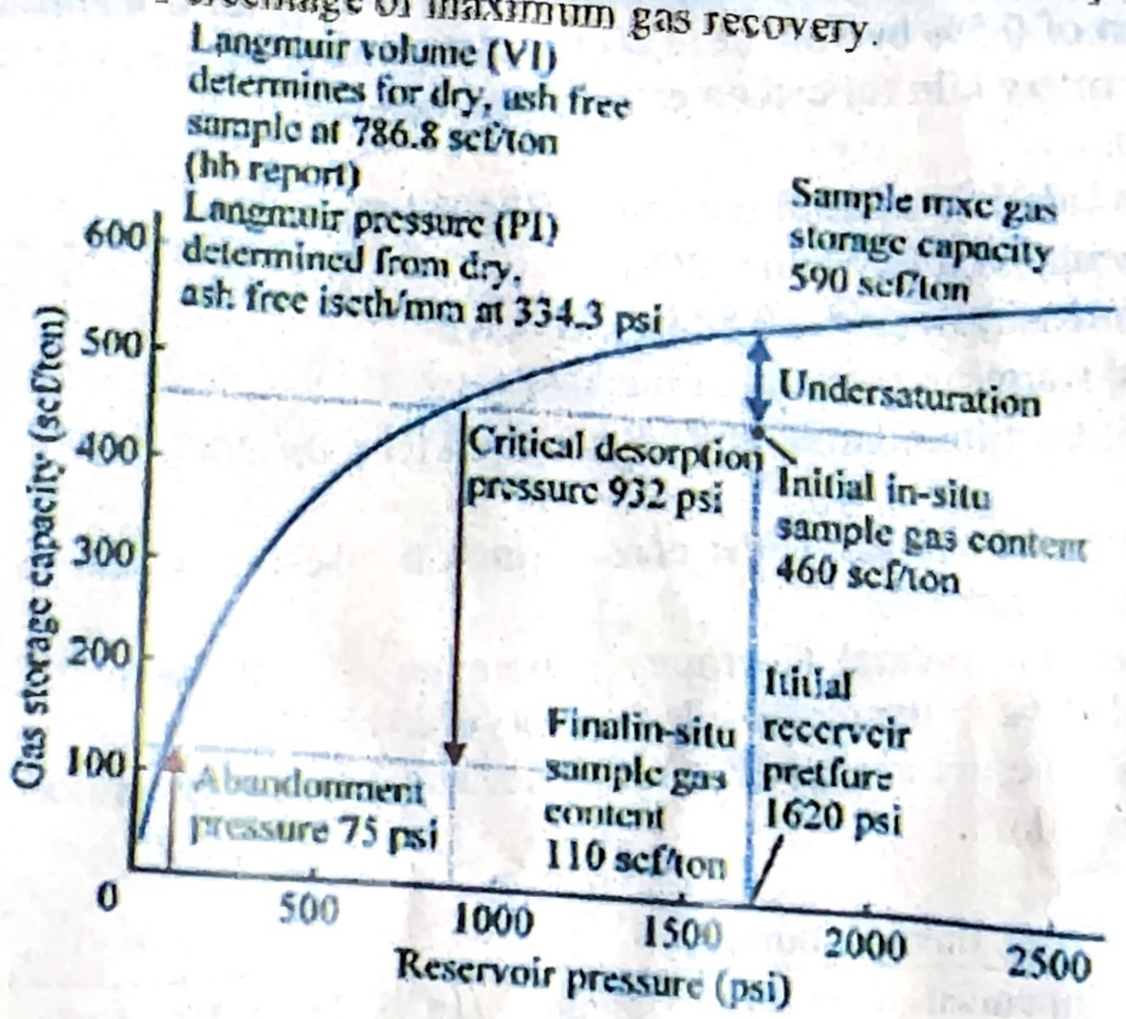
Subject: Coal Mine Methane Recovery and Utilization (MNO304)

Time: 2 hrs

Max. Mark: 50

Instructions: *Answer Any FIVE questions*

Q.No.	Question	Marks
1.	Describe the different primary technologies used to capture and utilize Ventilation Air Methane (VAM). What are the challenges associated with each?	6+4
2.	A coal mine emits 12,000 m^3/min of ventilation air with a methane concentration of 0.5% by volume. This ventilation air methane (VAM) is fed to one rotary kiln for carbon emission reduction. Assumptions: • Gross calorific value of methane = 33402 kJ/m^3 • Efficiency of rotary kiln = 26% • CO_2 intensity of grid = 0.82 kg CO_2/kWh • Global warming potential of methane = 28 • Rate of Certified Emission Reduction (CER) = Rs. 3000/- I. Calculate the annual VAM consumption by the rotary kiln in terms of tonnes/year II. Calculate the annual electricity generation possible with the available heat in the rotary kiln in terms of kWh/year. III. Calculate the net annual CO_2 reduction and revenue generated by rotary kiln. Assume other suitable data, if required.	2 3 3+2
3.	a) How does Enhanced Coalbed Methane (ECBM) differ from conventional Coalbed Methane (CBM) recovery? What are the main challenges associated with implementing ECBM recovery on a commercial scale? b) Evaluate the potential of ECBM as a viable climate mitigation strategy.	2+4
4.	a) How are methane emission factors developed, and what are the key methodologies involved? b) What are the limitations of using methane emission factors, and how can their accuracy be improved?	4 5 5

5.	Explain the various completion methods used in Coalbed Methane (CBM) production. Discuss the advantages, disadvantages, and criteria for selecting an appropriate method.	10
6.	a) Suppose P and V are the reservoir pressure in MPa and gas content in m^3/t of a coal seam. When an adsorption isotherm is plotted with P/V on Y-axis and P on X-axis, the following straight-line equation is obtained: $$P/V = 0.1641P + 0.1454$$ Calculate the maximum sorption capacity of coal and Langmuir pressure.	2
	b) The following figure shows the adsorption isotherm for the prediction of methane recovery in a coal seam. From the figure, calculate the following parameters: i. Percentage of undersaturation of initial reservoir pressure ii. Percentage of maximum gas recovery.  	2+2
	c) With the help of diagrams, explain the regulatory aspects of methane drainage of longwall panel by an overlying drainage heading.	4
7.	Why is pre-mining degasification important in underground coal mining? Explain the methods used for pre-mining degasification. Highlight their advantages and limitations.	2+4+4

END

FOUNDATIONS OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOR

COURSE CODE : MSO403

END SEMESTER EXAMINATION, 2024-2025

Date: 29 February, 2025

Total Marks – 50 Marks

Time Duration – 2 hours

Instructions:

Attempt all questions.

Read the questions carefully before answering.

Explain all key points in brief (two to three lines at least).

Add real-life/hypothetical examples wherever needed.

Underline important points, please.

Case I

Vikram had always dreamed of working for a top consulting firm. After months of rigorous interviews, he finally landed a job at Stellar Consulting with a starting salary of ₹12 LPA. Excited, he joined the company, ready to give his best.

However, within six months, Vikram started feeling overwhelmed. The long working hours, constant travel, and high-pressure environment took a toll on his health and personal life. Meanwhile, his friend Neha, who had accepted a job at a mid-sized firm with a ₹9 LPA package, seemed more satisfied. Her company provided flexible work hours, wellness benefits, and regular training programs.

One day, Vikram wondered, *"Did I make the right choice? Is compensation just about salary, or is there more to it?"*

1. Analyse different types of compensation factors (monetary as well as non-monetary) that Vikram should have considered before accepting the offer? Explain how each compensation factor is important. **(10 Marks)**

Case II

FreshBites is a growing company that delivers organic, fresh meals to customers' homes. The company has a large team of delivery personnel, most of whom are women, who operate scooters to deliver meals across the city. The company prides itself on its punctuality and

customer service. However, they are noticing that a few deliveries are delayed, and some customers have complained about the delivery experience, especially when it comes to food packaging, handling, and interacting with customers.

To improve the quality of delivery services, FreshBites HR team has decided to conduct a task analysis to assess the training requirements for new entry-level delivery personnel.

2. Identify specific areas where training would be necessary for an entry-level delivery person. Discuss the potential benefits of training for both the company and the employees. **(10 Marks)**

3. **Attempt any one of the following questions:**

   a. *"Employees' perception of fairness in the organization affect their job outcomes."*

   Discuss this statement with reference to equity theory of motivation. Provide relevant examples to support your arguments. **(5 Marks)**

   OR

   b. Discuss Maslow's Hierarchy of Needs and Herzberg's Two-Factor Theory of motivation. How can both be applied in a workplace setting? **(5 Marks)**

4. **Attempt any one of the following questions:**

   a. What is the difference between recruitment and selection? State with example. **(5 Marks)**

   OR

   b. Discuss the different types of training methods organizations can use to improve employee skills and knowledge. **(5 Marks)**

5. Assess the importance of communication at workplace? How does high emotional intelligence affect workplace communication and relationships? Provide real-life or hypothetical examples to support your answer. **(10 Marks)**

6. **Write short note on any two of the following:** **(5 Marks X 2 = 10 Marks)**

   1. Communication biases
   2. McClelland's theory of needs
   3. Antecedents/factors that can improve job satisfaction in organizations

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Indian Institute of Technology (Indian School of Mines), Dhanbad

End Semester – Winter Examination [2024-2025]

Program: B. Tech
Branch: Mining Engineering
Semester: 6 (Winter Semester)
Total Marks: 50
Course Name: Mine Automation and Data Analytics
Course Code: MNC305

Answer only five questions

Question 1

10 Marks

While calculating the coefficient of correlation between two variables x and y, the following results were obtained: $n = 25$, $\Sigma x = 125$, $\Sigma y = 100$, $\Sigma x^2 = 650$, $\Sigma y^2 = 460$, $\Sigma xy = 508$. It was however later discovered at the time of checking that two pairs of observation (x, y) were copied (6,14) and (8,6), while the correct values were (8,12) and (6,8) respectively. Determine the correct value of the coefficient of correlation.

Question 2

5x2=10 Marks

Section 1

Suppose you have two fair coins, one is red (R) and the other is blue (B). We want to calculate the conditional probability, joint probability, and marginal probability for the outcomes.

Section 2

A box containing 5 fair coins and 3 unfair coins ($P(H) = 1/3$; $P(T) = 2/3$). A coin is picked and tossed. Find the probability of getting a head from a picked coin.

Question 3

5x2=10 Marks

Section 1

Consider X as a discrete random variable with the following probability mass function. Calculate the Expectation of X.

X	0	1	2	3
$P(X = x_i)$	1/8	3/8	3/8	1/8

Section 2

In a series of 10-coin tosses, the expected number of heads is 6. What is the probability of obtaining 8 heads? Given E(X) = 6, we already know the probability of getting a fair head each in 10 independent coin tosses = ½, but we don't know whether it is a fair coin.

$np = 6$, $p = 0.6$, Bin (n =10, $p = 1/6$), P (X = 8)?

Question 4

10 Marks

Suppose a company claims that the average response time for their customer service hotline is no more than 3 minutes. You believe that the average response time is actually longer than that. To test this claim, you collect a sample of 40 calls to the hotline and find that the average response time is 3.5 minutes with a standard deviation of 0.8 minutes. You want to test whether the average response time is significantly greater than 3 minutes at a 5% significance level.

Question 5

10 Marks

What is the Chi-squared test? Explain the Chi-squared test of independence in detail. Also, discuss the key assumptions underlying the use of the Chi-squared test.

Question 6

10 Marks

What is RFID technology? Explain how RFID works and describe its major applications in the mining industry.

Question 7

5x2=10 Marks

Section 1

What is Virtual Reality (VR)? Explain the different types of VR and list possible applications where immersion is essential.

Section 2

What is SCADA? Explain the main components of a SCADA system and name the different communication protocols commonly used in SCADA.