MANIPAL INSTITUTE OF TECHNOLOGY
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MANIPAL INSTITUTE OF TECHNOLOGY
VI SEMESTER B.TECH. (CIVIL ENGINEERING)
END SEMESTER (Regular) EXAMINATION, APRIL-MAY 2024
RAILWAY AND AIRPORT ENGINEERING (CIE 3253)
(02 - 05 - 2024)

TIME: 3 HRS. **MAX. MARKS: 50**

Note: 1. Answer all questions.
2. Any missing data may be suitably assumed.
3. Use of Formula book is permitted

Q. NO	QUESTION	MARKS	CO	BL
1A	Illustrate the *Automatic Block System* and its working procedure with the help of a neat diagram. Discuss the advantages of this system over the *Absolute Block System.*	**5**	**5**	**2**
1B	Estimate the steepest gradient that a train of 20 wagons and a locomotive can negotiate given the following data: • weight of each wagon = 20 tonnes, • weight of locomotive = 150 tonnes, • tractive effort of locomotive =15 tonnes, • rolling resistance of locomotive = 3kg/tonnes, • rolling resistance of wagon = 2.5kg/tonnes, • speed of train = 60kmph.	**3**	**2**	**5**
1C	Describe the following: i) wind coverage, ii) wind rose	**2**	**4**	**2**
2A	Explain the objectives of providing super elevation in railway tracks. With a neat sketch, illustrate the relationship of superelevation, gauge, speed, and radius of the curve.	**5**	**3**	**3**
2B	Calculate the maximum permissible train load that can be pulled by a locomotive with four pairs of driving wheels with an axle load of 28.42 tonnes each on a BG track with a ruling gradient of 1 in 200 and a maximum curvature of 3 degrees, traveling at a speed of 48.3kmph. Take the coefficient of friction to be 0.2.	**3**	**2**	**4**
2C	Discuss the factors to be considered in the site selection for an airport.	**2**	**4**	**2**
3A	With the help of a neat sketch, construct the lift and drag forces acting on the wing of an aircraft.	**5**	**1**	**6**
3B	Discuss the terms given below related to railway engineering: a) Fouling mark; b) Scotch block; c) Triangle	**3**	**1**	**2**
3C	Discuss the following lighting systems provided in an airport: i) Approach lighting ii) Threshold lighting in an airport.	**2**	**4**	**2**

<table>
<tr><td>4A</td><td>Following is the average wind data for 10 years when wind intensity is above 6 km/h. An airport is to be designed for two runways. Evaluate the best runway orientation and assess the total wind coverage.
<table>
<tr><th rowspan="2">sector</th><th rowspan="2">True azimuth</th><th colspan="3">Duration of wind in percent</th></tr>
<tr><th>6.4-25 kmph</th><th>25-50 kmph</th><th>50-75 kmph</th></tr>
<tr><td>N</td><td>0.00</td><td>4.5</td><td>1.3</td><td>0.1</td></tr>
<tr><td>NNE</td><td>22.50</td><td>3.3</td><td>0.8</td><td>0</td></tr>
<tr><td>NE</td><td>45.00</td><td>1.8</td><td>0.1</td><td>0</td></tr>
<tr><td>ENE</td><td>67.50</td><td>2.7</td><td>0.3</td><td>0</td></tr>
<tr><td>E</td><td>90.00</td><td>2</td><td>0.4</td><td>0</td></tr>
<tr><td>ESE</td><td>112.50</td><td>5.3</td><td>0.1</td><td>0</td></tr>
<tr><td>SE</td><td>135.00</td><td>6.3</td><td>3.2</td><td>0.1</td></tr>
<tr><td>SSE</td><td>157.50</td><td>7.4</td><td>7.7</td><td>0.3</td></tr>
<tr><td>S</td><td>180.00</td><td>4.6</td><td>2.2</td><td>0.1</td></tr>
<tr><td>SSW</td><td>202.50</td><td>2.4</td><td>0.9</td><td>0</td></tr>
<tr><td>SW</td><td>225.00</td><td>1.1</td><td>0.1</td><td>0</td></tr>
<tr><td>WSW</td><td>247.50</td><td>3.6</td><td>0.4</td><td>0</td></tr>
<tr><td>W</td><td>270.00</td><td>1.8</td><td>0.3</td><td>0</td></tr>
<tr><td>WNW</td><td>292.50</td><td>5.9</td><td>2.6</td><td>0.2</td></tr>
<tr><td>NW</td><td>315.00</td><td>5.8</td><td>2.4</td><td>0.2</td></tr>
<tr><td>NNW</td><td>337.50</td><td>6.8</td><td>4.9</td><td>0.3</td></tr>
</table></td><td>5</td><td>4</td><td>5</td></tr>
<tr><td>4B</td><td>Discuss the wave theory to explain the creep of rails using a neat sketch.</td><td>3</td><td>1</td><td>4</td></tr>
<tr><td>4C</td><td>Illustrate different types of Aircraft parking systems in an airport with a neat sketch.</td><td>2</td><td>4</td><td>3</td></tr>
<tr><td>5A</td><td>The runway length required for landing at sea level in standard atmospheric conditions is 3000m. The runway length required for take-off at a level site at sea level in standard atmospheric conditions is 2500m. Aerodome reference temperature is 24˚C and aerodome elevation is 150m from MSL. If the effective runway gradient is 0.5%, Evaluate the runway length to be provided.</td><td>5</td><td>4</td><td>5</td></tr>
<tr><td>5B</td><td>Discuss the imaginary surfaces that cause obstruction to the path of an aircraft near the airport.</td><td>3</td><td>4</td><td>2</td></tr>
<tr><td>5C</td><td>The runway gradation map indicates that there is a rising gradient of 1.0% meeting a falling gradient of 0.6%. There is again an upgrade of 0.6%. Design the runway profile as per FAA specifications.</td><td>2</td><td>4</td><td>6</td></tr>
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