400 CONCEPTS TO CRACK GATE – 2016

ENGINEERING MATHEMATICS

1. Types of matrices: 2011, 2010, 2009
2. Eigen values of matrix: 2016, 2015, 2015, 2014, 2012, 2008, 2007, 2006
3. Eigen vectors of matrix
4. Matrix multiplication: 2014, 2013, 2008
5. Determinant of square matrix and its inverse: 2014, 2007
6. Rank of matrix: 2015, 2014
7. Consistency of non homogeneous equations: 2016, 2015, 2008, 2007, 2006
8. Consistency of homogeneous equations
9. Knowledge about different functions
10. Limit concept of single variables: 2015, 2014, 2014, 2010
11. Limit concept of two variables: 2016
12. Continuity concept: 2011
13. Differentiability concept
14. Angle between two curves: 2016, 2008
15. Mean value theorem
16. Improper integrals: 2016, 2007
17. Definite integrals: 2015, 2013, 2011, 2008
18. Partial derivatives: 2010
19. Taylor series approximation and maclaurin series: 2016, 2012
20. Maxima and minima of single variable : 2016, 2015, 2010
21. Maxima and minima of double variable
22. Area under curves: 2016, 2016, 2014, 2012, 2006
23. Gradient of scalar function: 2009
24. Directional derivative: 2015, 2009, 2006
25. Divergence of vector function
26. Curl of vector function: 2011
27. Greens theorem
28. Stokes theorem
29. Gauss theorem
30. Fourier series: 2016
31. Order and degree of D.E.: 2010, 2008

32. Differential equation by variable separable method, newtons law of cooling: 2009, 2008, 2007, 2007, 2006
33. Differential equations of homogeneous equations
34. Differential equations reducible to homogeneous
35. Leibnitz equation: 2014, 2012
36. Bernoulli equation
37. Integration factor for homogeneous equations
38. Integration factor for $f(xy)ydx + g(xy)xdy = 0$
39. Integration factors for other types in $Mdx + Ndy = 0$
40. Solution of exact D.E: 2015
41. Second order linear D.E.: 2015
42. Complementary function: 2016, 2010, 2008
43. Particular integral of e^{ax}
44. Particular integral of $\sin(ax + b)\ or\ \cos(ax + b)$
45. Particular integral of x^m: 2016
46. Particular integral of $e^{ax} f(x)$
47. Particular integral of $\frac{1}{D-a}\ (X)$
48. $solution\ of\ x^2 \frac{d^2y}{dx^2} + k_1\ x\ \frac{dy}{dx} +\ k_2\ y$ =X: 2006
49. Laplace transform of any function: 2009
50. Laplace transform first shifting property
51. Laplace transform of of periodic functions
52. Laplace transform of derivatives
53. Multiplication by t^n
54. Division by t
55. Laplace transform of integrals: 2016
56. Types of PDE: 2016
57. Heat equation : 2016
58. Wave equation,
59. Laplace equation: 2013
60. Probability problems: 2016, 2014, 2012, 2011, 2010, 2008, 2006
61. Normal distribution and probability: 2016, 2014, 2014, 2013, 2009, 2008
62. Normal distribution mean and variance: 2016, 2015, 2015
63. Mean, median, mode and variance , coefficient of variation:2016, 2007, 2006

64. Hypothesis testing error analysis: 2016
65. Binomial distribution
66. Bisection method
67. Regula falsi method
68. Gauss elimination method: 2009
69. Newton Raphson method: 2016, 2015, 2011, 2008
70. Secant method: 2015
71. Simpson's 1/3 rule: 2015, 2013, 2012, 2010
72. Trapezoidal rule: 2015, 2006
73. Euler's method: 2006
74. Runge Kutta method
75. Curve fitting by least squares: 2013, 2008
76. Central difference formula: 2012

ENGINEERING MECHANICS AND STRENGTH OF MATERIAL

77. Centroid: 2010
78. Resultant of forces: 2016
79. Moment of inertia, radius of gyration: 2009, 2006
80. Reaction of determinate beams
81. Shear force and bending moment in statically determinate structures: 2016, 2014, 2012, 2011, 2010, 2010, 2009, 2006
82. Stress, strain and elongation: 2015, 2014, 2008
83. Volumetric strain and poisson ratio: 2016, 2012
84. Relation between E, G, K and μ: 2010, 2007
85. Force in composite members: 2008, 2007
86. Thermal stress: 2007
87. Thermal stress in composite bars
88. Normal and shear stress in any plane: 2015, 2009, 2007
89. Principal stresses and mohr circles: 2016, 2015, 2014, 2013, 2012, 2011, 2010, 2006
90. Theory of simple bending: 2016, 2015, 2014, 2014, 2013, 2008
91. Force in any partial area due to bending: 2006, 2006
92. Shear stress distribution: 2013, 2007, 2006
93. Shear force at any partial area: 2006
94. Shear centre: 2014, 2009
95. Hoop stress, longitudinal stress and shear stress: 2009

96. Hoop strain, longitudinal strain and volumetric strain
97. Torsion problems, polar moment of inertia: 2014, 2010, 2009, 2008, 2007, 2006
98. Power transmitted by shaft
99. Shafts in series
100. Principal stress due to bending and torsion
101. Shear stress due to bending and torsion
102. Helical spring
103. Leaf spring
104. Column buckling: 2014, 2013, 2012, 2012, 2010, 2008, 2008, 2007, 2006
105. Rankine's formula
106. Combined stresses due to axial and bending: 2007

STRUCTURAL ANALYSIS

107. Method of joints, method of sections: 2016, 2016, 2016, 2016, 2015, 2014, 2014, 2013, 2010
108. Relative displacements by graphical methods: 2014
109. Horizontal reactions in two hinged and three hinged arches: 2010
110. Tension in cables, funicular arch: 2016, 2014, 2013, 2012, 2010
111. Slope and Deflection using moment area theorem: 2009, 2008, 2006
112. Conjugate beam method
113. Strain energy in members: 2015, 2008, 2007
114. Slope and Deflection by strain energy method, unit load method: 2016, 2013, 2012
115. Double integration method
116. Deflection in trusses: 2008, 2007
117. Propped cantilever, : 2015, 2015, 2015, 2015, 2014, 2011, 2006
118. Static indeterminacy: 2014, 2014, 2009, 2008
119. Kinematic indeterminacy: 2016
120. Inderminate forces by energy
121. Indermnate forces by compatability
122. Indereminate forces by using symmetry
123. Betti's theorem, Maxwell's reciprocal theorem: 2014
124. Reduction of structure by symmetry: 2016
125. Slope deflection method
126. Moment distribution method: 2014, 2013, 2007, 2006

127. Sway analysis of moment distribution
128. ILD for reaction,ILD for shear force,ILD for B.M.: 2014, 2013, 2008, 2007, 2006
129. Maximum B.M. and shear force due to rolling loads or udl: 2015
130. Absolute maximum B.M.
131. flexibility element
132. stiffness element: 2015, 2015, 2015, 2007

BUILDING MATERIALS

133. Bricks: 2016, 2016
134. Cement: 2016
135. Aggregate: 2011
136. Steel : 2011
137. Workabolity of concrete, slump, comfaction factor, veebee test: 2015, 2013, 2007
138. Resonant frequency test, rebound hammer test, split cylinder test: 2009
139. Air entrained concrete, air content: 2015, 2015

CONSTRUCTION MANAGEMENT

140. Floats: 2016
141. Critical Duration: 2016
142. PERT: 2016

REINFORCED CEMENT CONCRETE STRUCTURES

143. Modulus of elasticity of concrete, flexural strength, target mean strength: 2016, 2014, 2014, 2014, 2009, 2008, 2007, 2006
144. Partial safety factors and probability of failure: 2015, 2009
145. Load combinations: 2008
146. Creep: 2013
147. Stress block and strain in concrete beam: 2015
148. Neutral axis depth in singly reinforced beam: 2012
149. Moment of resistance of singly reinforced beam: 2015, 2012, 2006
150. Limiting depth of neutral axis: 2012, 2006
151. Limiting moment of resistance, limiting area of steel: 2007
152. M.R.of doubly reinforced beam: 2010
153. M.R. of T-beam

154. Shear reinforcement and spacing: 2016, 2016, 2014, 2011
155. Maximum and minimum reinforcement: 2016, 2014
156. Equivalent shear
157. Equivalent moment
158. Development length: 2015, 2013, 2011, 2008
159. Bearing strength of concrete: 2014, 2011
160. Load carrying capacity of axially loaded columns
161. Load carrying capacity of spiral reinforced columns
162. Minimum eccentricity of column: 2015
163. Stresses in pre-stressed: 2015, 2013, 2012, 2010, 2008
164. Losses in pre-stressed beam: 2012, 2009, 2007

STEEL STRUCTURES

165. Net area in tension member: 2016
166. Gross section yielding strength in tension member
167. Net section rupture strength in tension member: 2012
168. Block shear strength in tension member
169. Flexural strength of beam: 2016, 2014
170. Maximum force in rivet of bracket connection: 2015, 2014, 2007
171. Shear strength of bolt and Bearing strength of bolt: 2010, 2009, 2007
172. Prying force in bolt, stresses in bolt: 2015, 2008
173. Welding strength: 2016, 2012, 2011 2010
174. Slenderness ratio of different members, elastic critical stress: 2015, 2009
175. Plastic modulus, shape factor, plastic hinge, load factor: 2014, 2014, 2009, 2008
176. Plastic capacity of beams and collapse load: 2016, 2016, 2015, 2015, 2014, 2014, 2013, 2013, 2011, 2008, 2007
177. Plate girder elements: 2011

SOIL MECHANICS

178. Three phase system and inter relationships: 2016, 2015, 2015, 2014, 2013, 2010, 2009, 2007
179. Borrow pit and embankment: 2015
180. Relative density: 2014
181. Flow index
182. Plastic limit, liquid limit, shrinkage limit: 2008
183. Shrinkage index, plasticity index

184. Consistency index and liquidity index
185. Toughness index
186. Shrinkage ratio
187. Activity: 2015
188. Classification of soil: 2016, 2014, 2012, 2010, 2009, 2008, 2007
189. Clay minerals: 2014, 2009
190. Capillary pressure in soils: 2006
191. Constant head permeability
192. Falling head permeability: 2012, 2010
193. Darcy law, Seepage velocity and discharge velocity: 2016, 2015, 2013
194. Confined aquifer, Unconfined aquifer: 2010, 2006
195. Stratified soil permeability: 2016, 2016, 2015
196. Flownet problems: 2016, 2014, 2013, 2012
197. Anisotropic soil permeability: 2008
198. Non homogeneous soil permeability
199. Effective stress with water table: 2011
200. Effective stress with capillary saturation
201. Effective stress with seepage: 2016, 2014, 2012, 2007
202. Quick sand condition: 2016, 2011, 2010, 2006
203. Relation between change in void ratio and change in thickness
204. Compression index, Recompression index and expansion index
205. Normally consolidated and over consolidated soil: 2016, 2010
206. Coefficient of Volume change: 2014
207. Consolidated Settlement: 2016, 2015, 2015, 2009, 2007, 2006
208. Time factor and coefficient of consolidation: 2015, 2011, 2008
209. Basics of proctor test: 2016, 2013, 2012, 2008
210. Theoretical dry density in compaction: 2006
211. Relation between normal and shear stress
212. Angle of internal friction in shear box test: 2008
213. Vane shear test: 2014, 2011
214. Unconfined compressive strength: 2010
215. Triaxial shear test, CD, CU and UU tests: 2016, 2016, 2014, 2012, 2011, 2007, 2006
216. Stress and volume relationship: 2015
217. Pore pressure parameters: 2015

218. Stress path: 2015

FOUNDATION ENGINEERING

219. Area ratio, SPT, SCPT, pressure meter test: 2015, 2014, 2014, 2009, 2007
220. Immediate settlement in sand: 2014, 2013
221. Settlement of foundation in sand by plate load test: 2014, 2009, 2008
222. Active earth pressure in sandy and clayey soils: 2016, 2015, 2015, 2013, 2012, 2010, 2008, 2006
223. Passive earth pressure in sandy and clayey soils:
224. Stability of retaining wall: 2016
225. Depth of tension crack
226. Unsupported vertical cut: 2016
227. Stability of slopes: 2014, 2014, 2013, 2007
228. Rotational stability
229. Stability number
230. Friction circle method: 2015
231. Bearing capacity of strip, square and circular footings: 2016, 2016, 2015, 2015, 2013, 2012, 2011, 2010, 2009, 2007
232. Boussinesq's formula: 2010
233. Stress due to line load
234. Stress due to strip load: 2008
235. Stress due to circular load
236. Newmark chart, rectangular load: 2007
237. Stress under rigid and flexible foundations in clay and sand: 2014, 2013, 2011
238. Dynamic formula for pile capacity: 2009
239. Pile capacity in clay and sand: 2015, 2014, 2014, 2011, 2010, 2008
240. Pile group capacity: 2007, 2006
241. Settlement of pile group

FLUID MECHANICS

242. Types of fluids: 2016, 2014
243. Finding shear stress due to viscosity
244. Capillary rise
245. Pressure inside droplet, soap bubble and liquid jet
246. Continuity equation: 2015, 2014, 2014, 2012, 2006
247. Momentum equation

248. Energy equation: 2015, 2009, 2007
249. Jet propulsion problems
250. Shear stress at any radius in pipe laminar flow, friction factor: 2009
251. Relation between pressure difference and discharge
252. Velocity distribution in laminar flow: 2014
253. Hagen poisselli equation: 2007, 2006
254. Friction and minor losses: 2015, 2014, 2013
255. Pipe network problems: 2015, 2014, 2011
256. Equivalent pipe length
257. Displacement, momentum and energy thickness of boundary layer
258. Drag force
259. Momentum correction factor and energy correction factor
260. Thickness laminar boundary layer
261. Laminar sub layer thickness: 2008
262. Chezy's formula and Manning's formula: 2015
263. Most economical rectangular and trapezoidal sections: 2016, 2012, 2010
264. Critical depth condition: 2014, 2011, 2010, 2009, 2008
265. Alternate depths and specific energy, Froude number: 2012
266. Hump problems: 2016, 2011
267. Width constriction problems: 2014, 2010
268. Gradually varied flow concept, water slope: 2015, 2013, 2010
269. Direct step method: 2009
270. Different profiles: 2016, 2007, 2007, 2006
271. Sequent depths in hydraulic jump: 2016, 2015, 2011, 2008
272. Prejump velocity and post jump velocity: 2015
273. Energy loss in hydraulic jump: 2006
274. Total pressure on plane surfaces: 2015
275. Total pressure on curved surfaces: 2016
276. Centre of pressure
277. Buoyancy, Metacentric height: 2011
278. Manometers: 2014, 2010
279. Sharp crested weirs: 2013
280. Triangular weir: 2007
281. Trapezoidal weir and cipolletti weir
282. Broad crested weir

283. Submerged weir
284. Venturimeter and orifice meter: 2014, 2014, 2010
285. Pitot tube: 2014, 2010
286. Froude model law and Froude number: 2015, 2013, 2008, 2007
287. Raynolds model law and raynolds number: 2015, 2006
288. Acceleration: 2015, 2014
289. Angular velocity: 2015
290. Vorticity and circulation
291. Velocity potential and stream function: 2007
292. Discharge between two stream lines: 2013
293. Force on plate due to jet: 2016, 2014, 2014, 2007
294. Power generation in turbines: 2016
295. Specific speed of pump and turbine
296. Net Positive Suction Head

HYDROLOGY

297. Water budget: 2015
298. Missing rain gauge data estimation: 2015
299. Optimum number of rain gauges
300. Isoheital method: 2013
301. Flow duration curves: 2014
302. Currentmeter, two point method, anemometer: 2012, 2010
303. Theissen polygon method
304. ∅ −index: 2013, 2007
305. Hortons equation: 2012, 2010, 2006
306. Evapotranspiration: 2012, 2010
307. Probability of flood: 2013, 2012
308. Relation between catchment area and hydrograph area: 2016, 2014, 2014, 2012, 2011, 2011, 2010, 2009, 2007
309. Derivation of storm hydrograph from Unit hydrograph: 2016, 2012, 2011, 2009
310. Superposition principle to derive UH: 2007
311. S-hydrograph and its uses: 2015, 2006
312. Dickens and Ryves formula
313. Types of flood routing: 2016, 2008
314. Muskingum equation: 2014, 2010

315. Specific yield, specific retention and porosity: 2016, 2015, 2011, 2009, 2008

IRRIGATION

316. Duty, delta and base period: 2016, 2013, 2009
317. Duty, discharge and catchment area: 2015, 2012, 2008, 2007
318. Field capacity, wilting point and depth of water, frequency of irrigation : 2014, 2010, 2007
319. Anemometer, hygrometer, tensiometer: 2014
320. irrigation efficiencies
321. Manning's, chezy,s, Boundary shear stress: 2007
322. Lacey's formulae and kennedy: 2009, 2008, 2007
323. Khosla uplift pressures at different points: 2016
324. Piping failure: 2006
325. Flour thickness required to overcome uplift
326. Kosla critical exit gradient: 2008
327. Uplift force under dam: 2016, 2008

ENVIRONMENTAL ENGINEERING

328. Water treatment processes: 2014, 2011
329. Total dissolved solids, toxic metals: 2015, 2014, 2006
330. Ph of water: 2016, 2012, 2008
331. Alkalinity: 2013
332. Hardness: 2016, 2014, 2010, 2009, 2007, 2007, 2006
333. Nitrates, kjedhal nitrogen: 2015
334. Settling velocity, surface overflow rate and design: 2016, 2014, 2013, 2012, 2011
335. Efficiency of sedimentation tank, dia of particles: 2015, 2015, 2009, 2007
336. Alum dose and alkalinity requirement: 2014
337. Velocity gradient and power required in coagulation mixing tank
338. Sand filters: 2015, 2013
339. Lime and soda requirements
340. Ion Exchange process and bypass flow ratio: 2016
341. Disinfectin, proportion of Hocl and ocl ions: 2014, 2014, 2011, 2011
342. COD test: 2012
343. BOD determination: 2006

344. BOD at different temperatures and different times: 2016, 2016, 2015, 2014, 2013, 2010
345. Efficiency of trickling filter
346. Efficiency of high rate trickling filter
347. Activated sludge process: 2016, 2014, 2009
348. Rising of sludge: 2016
349. Nitrification: 2016
350. Biological nitrogen removal: 2016
351. CO_2 production, methane production: 2014, 2009
352. Food to micro organism ratio, Sludge age (MCRT), HRT, SVI: 2012, 2007
353. Sludge recirculation ratio
354. Sludge volume reduction, Sludge solids unit weight, moisture content and density of sludge: 2011
355. Dilution
356. Critical time in river
357. Critical deficit
358. Deficit at any time
359. Sewer lines, pipes, slope, discharge, corrosion: 2016, 2012
360. Density of MSW: 2015, 2015, 2010, 2008, 2007, 2006
361. Primary and secondary air pollutants: 2016, 2015, 2011, 2008
362. Environmental meteorology: 2016, 2013, 2010, 2009, 2007
363. Concentration conversion: 2015, 2006
364. Fabric filter design: 2016, 2014, 2011, 2009
365. ESP design: 2016, 2007
366. Measurement of sound pressure level: 2016, 2009
367. Addition of two sounds
368. Averaging of sounds
369. Equivalent noise level
370. Ln concept: 2006
371. Reduction of sound level with distance: 2016
372. Noise level standards: 2010

TRANSPORTATION ENGINEERING

373. Stopping sight distance: 2016, 2015, 2014, 2011, 2007, 2006
374. Overtaking sight distance: 2015
375. Bump integrator: 2012

376. Super Elevation: 2015, 2015, 2009
377. Ruling minimum radius of curve: 2014
378. Extra widening at curves: 2016, 2010, 2007
379. Length of transition curve: 2011, 2006
380. Shift of curve
381. Set back distance: 2012
382. Grade compensation: 2007
383. Length of summit curve: 2010, 2009
384. Length of valley curve: 2013
385. Properties and tests of bitumen: 2015, 2008, 2007
386. Properties and tests of aggregates: 2015, 2008, 2007, 2006
387. CBR test: 2009, 2006
388. Marshal mix design parameters and curves: 2016, 2015, 2014, 2013, 2011
389. Cumulative standard axles: 2014, 2012, 2007, 2006
390. Radius of relative stiffness: 2016
391. IRC -37 code provisions : 2016
392. IRC- 58 code provisions: 2013
393. Equivalent radius of resisting section
394. Frictional stress
395. Thermal stress: 2014, 2010, 2009
396. Load stresses: 2009, 2006
397. Critical Load combinations
398. Design of expansion joint: 2007
399. Design of contraction joint
400. Design of dowel bar
401. Design of tie bar
402. Poisson distribution: 2014, 2014, 2011
403. Exponential distribution: 2013
404. Flow and headway, spacing and density: 2016, 2014
405. Traffic studies: 2006
406. Traffic density, phf: 2014
407. Moving car method: 2016, 2014
408. Speed density , flow density relationships: 2015, 2015, 2014, 2014, 2012, 2011, 2009, 2006
409. Capacity of lane: 2008

410. Capacity of rotary, intersections, conflicts: 2015, 2013, 2012, 2009, 2007
411. Webster optimal signal time, green splitting:2016 2014, 2014, 2007, 2006
412. Total delay and average delay at signal: 2011
413. Traffic signs: 2010, 2008

GEOMATICS

414. Types of surveying: 2014, 2008
415. Shape of earth, MSL, plumb line , time: 2015, 2010
416. Scales: 2007
417. Curvature, refraction and combined correction: 2015, 2013, 2011, 2009
418. WCB to QB: 2009
419. Declination, local attraction: 2015, 2013, 2009, 2007,2006
420. Latitudes and departures in traverse and Bowditch rule: 2016, 2015, 2015, 2013, 2007
421. Missing measurement: 2011
422. Height of instrument, Rise and fall method: 2015
423. Contours: 2014
424. Reciprocal leveling: 2015, 2012, 2007
425. Determination height of tower from two angles: 2016, 2012
426. Staff held inverted: 2016, 2014, 2010, 2006
427. Tacheometer problems: 2014
428. Tacheometer tangential method
429. Errors in measurements
430. Weights and precision: 2015
431. Elements of simple curve: 2016, 2014, 2007
432. Photogrametry no. of photographs required and laps: 2016
433. Relief displacement and tower height: 2016
434. Remote Sensing: 2016
435. GIS
436. GPS: 2016