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APPSC – 2019 (AEE)

SCREENING TEST (SET – D)

QUESTIONS WITH DETAILED ANSWERS

CIVIL & MECHANICAL ENGINEERING

Date of Examination : 17.02.2019

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PART A
GENERAL STUDIES AND MENTAL ABILITY

01. Consider the following statements in respect to financial emergency under Article 360 of the Constitution of India:

(a) A proclamation of financial emergency issued, shall cease to operate at the expiration of two months, unless before the expiration of that period it has been approved by the resolutions of both Houses of Parliament.

(b) If any proclamation of financial emergency is in operation, it is competent for the President of India to issue directions for the reduction of salaries and allowances of all or any class of persons serving in connection with the affairs of the Union but excluding the Judges of the Supreme Court and the High Courts.

Which of the statements given above is/are correct?

(1) Only a (2) Only b
(3) Both a and b (4) Neither a nor b

01. Ans: (1)

Sol: Article 360 contains Provisions as to financial emergency.

Article 360 (2)(c) financial emergency shall cease to operate at the expiration of two months unless before the expiration of that period it has been approved by resolutions of both Houses of Parliament.

Article 360 (4)(b) It shall be competent for the President during financial emergency to issue directions for the reduction of salaries and allowances of all or any class of persons serving in connection with the affairs of the Union including the Judges of the Supreme Court and the High Courts.

02. Which one of the following statements correctly describes the Fourth Schedule of the Constitution of India?

(1) It contains the scheme of the distribution of powers between the Union and the States
(2) It contains the languages listed in the Constitution
(3) It contains the provisions regarding the administration of tribal areas
(4) It allocates seats in the Council of States

02. Ans: (4)

Sol:

FIRST SCHEDULE

I. —The States.

II. —The Union territories.

SECOND SCHEDULE

PART A – Provisions as to the President and the Governors of States.

PART B – [Repealed.]

PART C – Provisions as to the Speaker and the Deputy Speaker of the House of the People and the Chairman and the Deputy Chairman of the Council of States and the Speaker and the Deputy Speaker of the Legislative Assembly and the Chairman and the Deputy Chairman of the Legislative Council of a Sta te.

PART D – Provisions as to the Judges of the Supreme Court and of the High Courts.

PART E – Provisions as to the Comptroller and Auditor-General of India.

THIRD SCHEDULE – Forms of Oaths or Affirmations.

FOURTH SCHEDULE – Allocation of seats in the Council of States.

FIFTH SCHEDULE – Provisions as to the Administration and Control of Scheduled Areas and Scheduled Tribes
PART A – General.
PART B – Administration and Control of Scheduled Areas and Scheduled Tribes.
PART C – Scheduled Areas.
PART D – Amendment of the Schedule.

SIXTH SCHEDULE – Provisions as to the Administration of Tribal Areas in the States of Assam, Meghalaya, Tripura and Mizoram.

SEVENTH SCHEDULE – List I — Union List. List II— State List. List III— Concurrent List.

EIGHTH SCHEDULE – Languages.

NINTH SCHEDULE – Validation of certain Acts and Regulations.

TENTH SCHEDULE – Provisions as to disqualification on ground of defection.

ELEVENTH SCHEDULE – Powers, authority and responsibilities of Panchayats.

TWELETH SCHEDULE – Powers, authority and responsibilities of Municipalities, etc.

03. Which of the following districts of Andhra Pradesh has the highest number of Mandals?
(1) Anantapur (2) East Godavari
(3) Chittoor (4) Guntur

03. Ans: (3)

Sol:

Andhrapradesh mandals district wise

Ananthapur	- 63
Chittoor	- 66
Kadapa	- 51
East Godavari	- 64
Guntur	- 57
Krishna	- 53
Kurnool	- 54
Nellore	- 46
Prakasham	-56
Srikakulam	- 38
Vishakapatnam	- 46
Vizayanagaram	- 34
West Godavari	- 48

04. The Planning Commission of India was set up in March, 1950 by
(1) An amendment to the Constitution of India
(2) Passing an ordinance in the Upper House of Parliament only
(3) Passing an ordinance in the Lower House of Parliament only
(4) A resolution of the Government of India

04. Ans: (4)

Sol:

The Planning Commission was set up by a Resolution of the Government of India in March 1950

05. Which of the following programmes was announced on 1st July, 1975 as part of Fifth Five Year Plan?
(1) A programme to stop import of wheat from America
(2) 20-Point Economic Programme
(3) A programme to cut down oil imports from Russia
(4) 14-Point Economic Programme

05. Ans: (2)

Sol: The 20-Point Economic Programme was announced by the Prime Minister on 1st July, 1975.

06. In partnership with the Government of Andhra Pradesh, which of the following has created a dashboard for monitoring the real time progress of the districts?
(1) Planning Commission
(2) Central Technology Mission
(3) NITI Aayog
(4) POSHAN Abhiyaan

06. Ans: (3)

Sol: The Aspirational Districts Programme is a product of collective effort in which States are the main drivers. At Government of India level, programme is anchored by NITI Aayog. For Real-time monitoring & ranking 49 Key performance indicators (81 data points) have been identifed across 5 themes, in consultation with Ministries. The dashboard is designed, developed, and maintained by the Planning Department of the Government of Andhra Pradesh.

07. According to the UNDP Report on Human Development Index-2018, the HDI rank of India, out of 189 countries, is,
(1) 127 (2) 136
(3) 120 (4) 130

07. Ans: (4)

Sol: India ranked 130 out of 189 countries in the latest human development rankings released by the United Nations Development Programme (UNDP). India's Human Development Index (HDI) value for 2017 is 0.640, which put the country in the medium human development category. Norway, Switzerland, Australia, Ireland and Germany lead the ranking,The HDI was introduced in the first Human Development Report in 1990.

08. The Central Pollution Control Board (CPCB) was constituted in September 1974 under
(1) The Water (Prevention and Control of Pollution) Act, 1974
(2) The Air (Prevention and Control of Pollution) Act, 1968
(3) The Environment Protection Act, 1972
(4) The Forest Protection Act, 1964

08. Ans: (1)

Sol:

The Central Pollution Control Board (CPCB), statutory organisation, was constituted in September, 1974 under the Water (Prevention and Control of Pollution) Act, 1974.

CPCB was entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.

09. In the Union Budget 2016-17, *tax on coal* was renamed as
(1) Sugamya Bharat Abhiyan Cess
(2) Clean Environment Cess
(3) Green India Mission
(4) Accessible India Cess

09. Ans: (2)

Sol: Clean Energy Cess' levied on coal, lignite and peat renamed to 'Clean Environment Cess

Accessible India Campaign (AIC) is the nationwide flagship campaign of the Department of Empowerment of Persons with Disabilities (DEPwD), Ministry of Social Justice and Empowerment. The aim of the Campaign is to make a barrier free and conducive environment for Divyangjans all over the country. It was launched by the Prime Minister Shri Narendra Modi on International Day of Persons with Disabilities on 3rd December, 2015.

The National Mission for Green India (GIM) is one of the eight Missions outlined under the National Action Plan on Climate Change (NAPCC).

Mission Goals

- To increase forest/tree cover to the extent of 5 million hectares (mha) and improve quality of forest/tree cover on another 5 mha of forest/ non-forest lands;
- To improve/enhance eco-system services like carbon sequestration and storage (in forests and other ecosystems), hydrological services and biodiversity; along with provisioning services like fuel, fodder, and timber and non-timber forest produces (NTFPs); and
- To increase forest based livelihood income of about 3 million households.

10. What is the "Population Ratio" of successor states of Andhra Pradesh and Telangana as per 2011 CENSUS?
(1) 58.32:41.68 (2) 58:42
(3) 58.31:41.69 (4) 56:44

10. Ans: (1)

Sol:

Andhra Pradesh Reorganisation Act, 2014 , section 2(h) defines - population ratio in relation to the States of Andhra Pradesh and Telangana, means the ratio of 58.32 : 41.68 as per 2011 Census .

11. When was the Andhra Pradesh Reorganization Bill passed in the Lok Sabha?
(1) 18th March, 2014
(2) 20th February, 2014
(3) 18th February, 2014
(4) 19th March, 2014

11. Ans: (3)

Sol: Andhra Pradesh Reorganisation bill was passed by loksabha on feb18th 2014 and rajya sabha on feb20th 2014 , received the assent of the President on the 1st March, 2014.

12. When was APCRDA formed?
(1) 30th December, 2014
(2) 15th October, 2015
(3) 20th October, 2015
(4) 29th December, 2014

12. Ans: (1)

Sol:

- A.P capital region development authority was set up on 30th Dec - 2014.
- It is an urban planning agency
- It was set up according to capital region development authority act - 2014.
- C.M Acts as a Chairman.

13. In which of the following cities is the Saha Institute of Nuclear Physics situated?
(1) Pune (2) Bengaluru
(3) Ahmedabad (4) Kolkata

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13. Ans: (4)

Sol: The Saha Institute of nuclear physics is an Institution of basic Research and Training in physical and Biophysical sciences located in Bidhannagar Kolkata. It is named after the famous Indian physicist Meghnad Saha.

14. Which of following is/are correct?
    (a) ASTROSAT is India's first astronomical satellite
    (b) GSAT-6 is the 25th geostationary communication satellite of India built by DRDO
    (c) Kepler is a space observatory launched by ISRO
    (1) Only a (2) Only b
    (3) a and b (4) a, b and c

14. Ans: (1)

Sol: ASTROSAT is India's first dedicated multi wavelength observatory.
It was launched on 28th sep 2015 by PSLV-XL C30 by ISRO.
G-SAT-6 → is the 25th Geostationery communication satellite of India built by ISRO.
Kepler → it is a retired space Telescope launched by NASA. It was launched an March 7, 2009 removed from service oct - 30-2018.

15. Recently India has funded for Public Library in which of the following countries?
    (1) Bhutan (2) Afghanistan
    (3) Bangladesh (4) South Africa

15. Ans: (2)

Sol: India funded public library for Afghanistan ,recently US President Donald Trump made mocking comments on Prime Minister Narendra Modi for funding a library in Afghanistan

16. Which of following countries hosted the 13th G-20 Summit?
    (1) Argentina (2) France
    (3) Russia (4) USA

16. Ans: (1)

Sol: The 13th G20 summit, under the theme of Building Consensus for Fair and Sustainable Development was held in Buenos Aires, Argentina, India will host the G20 summit in 2022, to coincide with the 75th year of its Independence.

17. Which of the following statements is/are correct about United Nations?
    (a) The name 'United Nations' was devised by Franklin D. Roosevelt
    (b) All the member states meet once after every two years in General Assembly Hall, New York
    (c) It is the General Assembly which elects all the 54 members for Economic and Social Council
    (d) Judges of the International Court of Justice are elected for 8 years
    (1) a and b (2) b and c
    (3) c and d (4) a and c

17. Ans: (4)

Sol: The name "United Nations", coined by United States President Franklin D. Roosevelt,

Each year, in September, the full UN membership meets in the General Assembly Hall in New York for the annual General Assembly session,

Economic and social council has 54 Members elected by the General Assembly for overlapping three-year terms.

The International Court of justice is composed of 15 judges, who are elected for terms of office of nine years by the United Nations General Assembly and the Security Council.

18. When was Asia-Pacific Economic Cooperation (APEC) established?
(1) 1981 (2) 1984
(3) 1987 (4) 1989

18. Ans: (4)

Sol: APEC was established in 1989 in response to the growing interdependence of Asia-Pacific economies and the advent of regional trade blocs in other parts of the world .

19. 'Operation Greens' is related with which of the following Ministries?
(1) Ministry of Agriculture and Farmers' Welfare
(2) Ministry of Food Processing Industries
(3) Ministry of Environment
(4) Ministry of Mines

19. Ans: (2)

Sol: Operation Greens was announced in the Budget speech of 2018-19 with an outlay of Rs 500 crores to stabilize the supply of Tomato, Onion and Potato(TOP) crops and to ensure availability of TOP crops throughout the country round the year without price volatility. Ministry of Food Processing Industries(MoFPI) under Union Minister Smt Harsimrat Kaur Badal has approved the operationalisation strategy for Operation Greens

20. Match the following List (I) Year with List (II) Chief Guest:

List (I) ***(Republic Day Year***	**List(II)** ***(Chief Guest)***
a. January 26, 2014	I. Francois Hollande
b. January 26, 2015	II. Mohammed bin Zayed Al-Nahyan
c. January 26, 2016	III. Shinzo Abe
d. January 26, 2017	IV. Barack Obama

Select the code for the correct answer from the options given below:

	a	**b**	**c**	**d**
(1)	I	II	III	IV
(2)	III	IV	I	II
(3)	III	II	I	IV
(4)	IV	I	III	II

20. Ans: (2)

21. Which city of India hosted the 'Owl Festival'?
(1) Pune (2) Bengaluru
(3) Chandigarh (4) Patna

21. Ans: (1)

Sol: The Indian owl festival was held in pune, Maharashtra ,the event was organised by Ela foundation.

22. Which of the following cities of Andhra Pradesh are the part of 'Ease of Living Index 2018'?
(a) Vijayawada
(b) Warangal
(c) Nellore
(d) Kakinada

(1) a, b and c (2) a, b and d
(3) a and d (4) c and d

22. Ans: (3)

Sol: Of the 111 Cities covered under Ease of Living Index -2018 , Andhrpradesh has 4 cities included Kakinada ,vishakpatnam, tirupathi , Vijayawada . Two cities Tirupathi (4) ,Vijayawada (9) are included in top ten .

Ranking: Ease of Living Index-2018

Top ten cities

1. Pune
2. Navi Mumbai
3. Greater Mumbai
4. Tirupati
5. Chandigarh
5. Thane
7. Raipur
8. Indore
9. Vijaywada
10. Bhopal

23. Which of the following States has topped the 'Ease of Doing Business Ranking-2018'?

(1) Haryana (2) Telangana
(3) Andhra Pradesh (4) Gujarat

23. Ans: (3)

Sol: Andhra Pradesh, with a score of 98.42 per cent, topped the 'ease of doing business' ranking among states prepared by World Bank and the Department of Industrial Policy and Promotion(DIPP) .

24. In which year did the Election Commission of India introduce NOTA on EVMs?

(1) 2011 (2) 2012
(3) 2013 (4) 2014

24. Ans: (3)

Sol: The None of The Above (NOTA) option was introduced by Election Commission of India in electronic voting machines (EVMs) in 2013 .

25. Which of the following is/are correct about East Asia Summit?

a. 13th East Asia Summit was held in Singapore
b. It is an ASEAN-Centered Forum
c. It can only be chaired by an ASEAN member
d. East Asia Summit comprises of the ten member states of the ASEAN

(1) a, b and c (2) a, b and d
(3) c, d and a (4) All of the above

25. Ans: (1)

Sol: The East Asia Summit (EAS) is a meeting of 18 regional leaders

The EAS comprises the ten member states of the Association of Southeast Asian Nations (ASEAN) – Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam – along with 8 other countries Australia, China, Japan, India, New Zealand, the Republic of Korea, Russia and the United States.

The EAS is an ASEAN-centred forum; it can only be chaired by an ASEAN member

The Thirteenth East Asia Summit was held in Singapore on November 14–15, 2018 .

26. 'Blue Economy' is related with

(1) Ocean Resources
(2) Sky Resources
(3) Agriculture Resources
(4) Loan Defaulters

26. Ans: (1)

Sol: Blue economy is sustainable use of ocean resources for economic growth, improved livelihood and jobs and ocean ecosystem health.

Blue economy encompasses.

1. Renewable energy
2. Fisheries
3. Marine transport
4. Tourism
5. Climate change
6. Waste management

27. Which was the first State to be re-organized on the basis of language?

(1) Karnataka (2) Tamil Nadu
(3) Kerala (4) Andhra Pradesh

27. Ans: (4)

Sol: In 1953, the government created first linguistic state of Andhra Pradesh after death of Potti Sriramulu after a hunger strike of 56 days.

28. Which of the following Articles enables High Courts to issue writs?

(1) Article 226 (2) Article 213
(3) Article 249 (4) Article 262

28. Ans: (1)

Sol: Article 226 - High Court shall have powers, throughout the territories to issue writs in the nature of habeas corpus, mandamus, prohibitions, quo warranto and certiorari, or any of them, for the enforcement of any of the rights conferred by Part III (Fundamental rights) and for any other purpose .

29. Which of the following statements is/are correct about the Governor?

(a) He can nominate one member to the State Legislative Assembly from the Anglo-Indian Community
(b) He can seek any information relating to the administration of the affairs of the State and proposals for legislation from the Chief Minister
(c) A person who has completed the age of 30 years can be appointed as Governor
(d) The Governor acts as an agent of the Central Government

(1) a and b (2) b and c
(3) Only a (4) a, b and d

29. Ans: (4)

Sol:

Article 157 - Qualifications for appointment as Governor.—No person shall be eligible for appointment as Governor unless he is a citizen of India and has completed the age of thirty-five years

Article 167 (a) It is Duty of Chief Minister to communicate to the Governor of the State all decisions of the Council of Ministers relating to the administration of the affairs of the State and proposals for legislation .

Article 333 - the Governor of a State may, if he is of opinion that the Anglo-Indian community needs representation in the Legislative Assembly of the State and is not adequately represented therein, nominate one member of that community to the Assembly.

Governor is appointed by President , he acts as an agent of Central Goverment

30. Who among the following has ***not*** been the Governor of Andhra Pradesh?

(1) N. D. Tiwari (2) Rameshwar Thakur
(3) Nikil Kumar (4) Sushil Kumar Shinde

30. Ans: (3)

Sol:

Nikhil kumar did not work as governor of Andhra Pradesh

31. Who among the following has served as a very short-term Chief Minister of Andhra Pradesh?
(1) Shri Bhavanam Venkatarami Reddy
(2) N. T. Rama Rao
(3) N. Bhaskara Rao
(4) Dr. Marri Chenna Reddy

31. Ans: (3)

Sol: Nadendla Bhaskar rao served for shortest term as chief minister of united Andhra Pradesh for 31 days. Nara chandrababu naidu is longest served chief minister of united Andhra Pradesh for 3178 days.

32. Which of the following statements is/are ***incorrect*** about the Election Commission of India?
(a) The Election Commission of India conducts elections for Lok Sabha, Vidhan Sabha and Gram Sabha
(b) The Election Commission of India conducts elections only for Lok Sabha
(c) The Election Commision of India conducts elections only for Vidhan Sabha
(d) The Election Commission of India conducts only for Lok Sabha and Vidhan Sabha
(1) a and c
(2) a, b and c
(3) c and d
(4) Only a

32. Ans: (*)

Sol: Article 324 (1) The superintendence, direction and control of the preparation of the electoral rolls for, and the conduct of, all elections to Parliament and to the Legislature of every State and of elections to the offices of President and Vice President held under this Constitution shall be vested in Election Commission .

33. Which of the following statements is/are correct about NITI Aayog?
(a) NITI Aayog was introduced by Government of India in 2014
(b) Vice-Chairperson of NITI Aayog is appointed by the President of India
(c) It has a Governing Council comprising of the Chief Ministers of all the States and Lt. Governors of the Union Territories
(d) Regional Councils of NITI Aayog are formed for specified tenure
(1) a and b (2) b and c
(3) c and d (4) d and a

33. Ans: (3)

Sol:

The Government on 1st January 2015 has replaced Planning Commission with a new institution named NITI Aayog through cabinet Resolution .

Vice-Chairperson -To be appointed by the Prime Minister

Governing Council comprises of the Chief Ministers of all the States and Lt. Governors of Union Territories

Regional Councils will be formed to address specific issues and contingencies impacting more than one state or a region. These will be formed for a specified tenure

34. In which year did the Telugu language get the classical status?
(1) 2005 (2) 2006
(3) 2007 (4) 2008

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34. Ans: (4)

Sol: Six languages i.e. Tamil (2004) Sanskrit (2005) Telugu (2008) Kannada (2008) Malayalam (2013) odiya (2014) have been given status of classical languages. Tamil is the first language to get the status of classical language .

The Criteria adopted by the Government to determine the eligibility of a language for granting classical language status are:

i. High antiquity of its early texts/ recorded history over a period of 1500-2000 years;

ii. A body of ancient literature/ texts, which is considered a valuable heritage by generations of speakers;

iii. The literary tradition be original and not borrowed from another speech community;

iv. The classical language and literature being distinct from modern, there may also be a discontinuity between the classical language and its later forms or its offshoots.

35. Which of the following statements regarding 'Stupa' are correct?

(a) They are pre-Buddhist structures

(b) They are built on the relics of Buddha

(c) They are built as objects of devotion by Buddhist monasteries

(d) They are built to commemorate important events in Buddha's life

Select the correct code from the following:

(1) All of the above (2) b, c and d

(3) a, b and c (4) a, b and d

35. Ans: (1)

Sol: Stupa, Buddhist commemorative monument usually housing sacred relics associated with the Buddha or other saintly persons.

The hemispherical form of the stupa appears to have derived from pre-Buddhist burial mounds in India.

36. On demand for exams in India, Lord Dufferin appointed Aitchison Commission in 1886. It suggested

(a) To recruit young men from high class families and social positions

(b) Simultaneous exams in London and India

(c) To strengthen the provincial services

(d) To establish imperial, provincial and subordinate Civil Services

Select the correct answer using the code given below:

(1) a, b and d (2) b and d

(3) c and d (4) a, b and c

36. Ans: (3)

Sol: The Aitchison Commission (Public Service Commission) was set up in 1886 under the chairmanship of Sir Charles Umpherston Aitchison , It made the following recommendations

1. The two-tier classification of civil services into covenanted and uncovenanted should be replaced by a three-tier classification-Imperial, provincial and subordinate civil services.
2. The maximum age for entry into civil services should be 23 years.
3. The statutory civil service system of recruitment should be abolished.
4. The competitive exam should not be held simultaneously in England and India
5. Certain percentage of posts in the imperial civil service should be filled by promotion of the members of provincial civil service

37. Which of the following statements is ***not*** correct?
(1) The moderate and militant nationalists (extremists) cooperated with one another during the course of Swadeshi Movement
(2) The purpose of boycott during Swadeshi Movement was to bring pressure upon the British industries and public by the pecuniary loss
(3) The Swadeshi Movement was exclusively a political movement which remained aloof from the cultural sphere
(4) A prominent part in the Swadeshi agitation was played by the students of Bengal

37. Ans: (1)

Sol:

Moderate and Extremists did not cooperate during swadeshi movement of 1905, the differences between the two groups led to surat split in 1907 .

38. Consider the following statements:
(a) Individual Satyagraha was launched by Congress in 1940 to oppose the August Declaration
(b) Vinoba Bhave was the first to offer Individual Satyagraha in 1940

Which of the statements given above is/are correct?
(1) Only a (2) Only b
(3) Both a and b (4) Neither a nor b

38. Ans: (2)

Sol: Individul satyagraha was launched by congress to oppose August offer , Vinoba bhave was first to offer individual satyagraha , second was Jawahar lal Nehru , third was Brahma Dutt .

39. Consider the following statements:
(a) Lord Mountbatten came to India as Viceroy in 1945
(b) In February 1947, Clement Attlee, British Premier, declared that the British would quit India by June 1948.

Which of the above statements is/are correct?
(1) Only a
(2) Only b
(3) Both a and b
(4) Neither a nor b

39. Ans: (2)

Sol: Prime Minister Clement R. Attlee told the House of Commons on February 20th 1947 that the government intends to hand India over to the Indians not later than June, 1948. Attlee told the House that Viceroy Viscount Wavell has resigned and that Lord Louis Mountbatten has been named to succeed him. Lord Louis Mountbatten came to India in 1947 .

40. Which of the following statements is/are ***incorrect*** regarding the Dual system of administration prevalent in Bengal in the 18th century?
(a) The Nawab controlled the defence of Bengal, while the East India Company controlled its finances
(b) The system was advantageous to the East India Company as it had power without responsibility
(c) The weaivng industry of Bengal mostly suffered due to the dual system of administration
(d) The separation of power resulted in efficient administration and checked the drain of wealth

Select the correct answer using the code given below:
(1) Only d (2) a and d
(3) a, b and c (4) a, c and d

40. Ans: (1)

Sol: Under the dual system administration of Bengal was divided in to Diwani and Nizamat.

Diwani – right to collect revenue was given to East India company

Nizamat (Administrative responsibility i.e., Law and order, Military power and criminal justice) remained with Nawab.

East India company had power without responsibility. This system led to inefficient administration, fall in agriculture, Handloom industry etc.,

41. Amaravati, the designated capital of Andhra Pradesh, was the historical capital of

(1) Satavahana Dynasty

(2) Krishna Dynasty

(3) Buddhist Dynasty

(4) Champakam Dynasty

41. Ans: (1)

Sol: Amaravathi: It was a capital of Satavahana Kingdom.

Amaravathi is popular for Amara lingeshwara swamy (lord shiva)

42. Andhra Pradesh comes under which earthquake classified zone?

(1) Zone 1 and Zone 2

(2) Zone 2 and Zone 3

(3) Zone 3 and Zone 4

(4) Zone 4

42. Ans: (2)

Sol: Old earthquake zones as per IS 1893 (Part – 1)

(I) No risk (II) Low risk

(III) Medium risk (IV) High risk

(V) Vulnerable

New earthquake zones as per IS 1893-2002 (Part – 1)

(II) Low risk

(III) Medium risk

(IV) High risk

(V) Vulnerable

Most areas of India located in IIIrd zone

Where as Andhra Pradesh comes under II & III zone.

43. Which of the following pairs is/are correctly matched?

Indian State		**Founder**
a. Hyderabad	:	Nizam-ul-Mulk
b. Bengal	:	Saadat Ali Khan
c. Awadh	:	Murshid Quli Khan

(1) Only a (2) a and c

(3) b and c (4) None of the above

43. Ans: (1)

Sol: Hyderabad → Nizam-ul-Mulk

Awadh → Saadat Ali khan

Bengal → Murshid Qulikhan

44. With reference to the first Factories Act, 1881, consider the following statements:

(a) The Act tried to limit the working hours for children and also fix a minimum age limit for employment in a factory

(b) The Act got wide support from early nationalists, especially moderates

Which of the statements given above is/are correct?

(1) Only a (2) Only b

(3) Both a and b (4) Neither a nor b

44. Ans: (3)

The first factories act was passed by Lord Rippon it basically dealt with problem of children in factories. The act fixed working hours for children, prohibited children below age of seven.

The act was supported by early nationalists.

45. Consider the following statements regarding the role of the Reserve Bank of India (RBI):

(a) The RBI manages the public debt on behalf of the Central and State governments in India

(b) The RBI acts as a banker to various State governments in India

Which of the statements given above is/are ***incorrect***?

(1) Only a (2) Only b

(3) Both a and b (4) Neither a nor b

45. Ans: (4)

Sol: RBI acts banker and public debt manager to both central and state governments.

46. Which of the following States does ***not*** share a boundary with Andhra Pradesh?

(1) Odisha (2) Tamil Nadu

(3) Karnataka (4) Madhya Pradesh

46. Ans: (4)

Sol: Andhra Pradesh boundary States

North → Chattishgarh

North East → Odisha

North West → Telangana

West → Karnataka

South → Tamilnadu

Madhya Pradesh doesnot have boundary with Andhra Pradesh

47. Which of the following is a part of a Union Territory located within Andhra Pradesh?

(1) Mahe (2) Yanam

(3) Karaikal (4) Daman

47. Ans: (2)

Sol: The union Territory of Puducherry in spread across Tamilnadu (Puducherry and Karaikal) Mahe (Kerala), Yanam (Andhra Pradesh). Puducherry is a former French enclave.

48. Which of the following is the smallest ocean?

(1) Atlantic Ocean

(2) Arctic Ocean

(3) Indian Ocean

(4) Pacific Ocean

48. Ans: (2)

Sol: Pacific Ocean → Largest

Arctic Ocean → Smallest

49. Kaziranga National Park is situated in which of the following States?

(1) Sikkim (2) Manipur

(3) Assam (4) Meghalaya

49. Ans: (3)

Sol: Khaziranga national park is a popular in India, located in Assam popular for one horned Rhinoceros recognized by UNESCO.

50. Tawa Project is associated with which of the following States?

(1) Madhya Pradesh (2) Jharkhand

(3) Uttarakhand (4) Karnataka

50. Ans: (1)

Sol: Tawa Project is located in Madhya Pradesh on the river Tawa. Tawa is a tributary of narmada river.

ACE

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ESE 2018 RANKERS

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AIR 1  CHIRAG JHA EE

AIR 1  VINAY PRAKASH CE

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AIR 2  PUNIT SINGH CE

AIR 2  CHIRAG SINGLA ME

AIR 3  RAMESH KAMULLA E&T

AIR 3  SRIJAN VARMA EE

AIR 3  PRAVEEN KUMAR CE

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AIR 5  RISHABH DUTT CE

AIR 5  VITTHAL PANDEY ME

AIR 6  KUMUD JINDAL E&T

AIR 6  RATIPALLI NAGESWAR EE

AIR 7  KARTIKEYA DUTTA E&T

AIR 7  TEKCHAND DESHWAL EE

AIR 7  ROHIT KUMAR CE

AIR 8  SURYASH GAUTAM E&T

AIR 8  RAVI TEJA MANNE EE

AIR 8  VIJAYA NANDAN CE

AIR 8  ROHIT BANSAL ME

AIR 9  SHANAVAS CP E&T

AIR 9  SOUVIK DEB ROY EE

AIR 9  ROOPESH MITTAL CE

AIR 10  PRATHAMESH E&T

AIR 10  MILAN KRISHNA EE

AIR 10  SRICHAND POONIYA CE

TOTAL SELECTIONS in Top 10	34

	TOP 10
E&T	10
EE	10
CE	8
ME	6

and many more...

PART B
CIVIL AND MECHANICAL ENGINEERING

51. If H is the unit head, the unit power of the turbine is proportional to
(1) H (2) H^{-2}
(3) $H^{-(1/2)}$ (4) $H^{-(3/2)}$

51. Ans: (4)

Sol: The unit power is given by $P_u = \frac{P}{H^{3/2}}$

$\propto H^{-3/2}$

52. If a turbine generates 10000 kW under the head of 10 m at the speed 100rpm, the specific speed of the turbine is
(1) 177.8 rpm (2) 562.3 rpm
(3) 1052 rpm (4) 2056 rpm

52. Ans: (2)

Sol: $N_s = \frac{N\sqrt{P}}{H^{5/4}} = \frac{100\sqrt{10000}}{10^{5/4}}$

$= 562.3$

53. If V_w and u are the whirl and tangential velocity at the impeller, work done by the impeller on the water per second per unit weight of water striking per second is
(1) $V_w u/g$ (2) $V_w u$
(3) $\rho Q V_w u$ (4) $\rho Q V_w V_r$

53. Ans: (1)

Sol: Work done by impeller per unit weight per unit time is represent by Euler's head which is given as

$$H_e = \frac{V_{w_1} u_1}{g} \left\{ \text{Assuming } V_{w_2} = 0 \right\}$$

54. Net positive suction head is
(1) pressure head + kinetic head
(2) pressure head + vapour pressure head+kinetic head
(3) pressure head − vapour pressure head + kinetic head
(4) pressure head− vapour presure head −kinetic head

54. Ans: (3)

Sol: The net positive suction head is defined as

$$NPSH = \frac{\left(P_{stag}\right)_{\text{inlet (or) suction}} - P_v}{\rho g}$$

$$= \left(\frac{P}{\rho g} + \frac{V^2}{2g}\right)_{\text{inlet}} - \frac{P_v}{\rho g}$$

55. The major drag force experienced by the body at very small velocity is due to
(1) pressure drag (2) skin friction drag
(3) both (1) and (2) (4) wakes

55. Ans: (2)

Sol: When velocity is very small the flow falls into stokes regime i.e creeping flow (Re < 1)
In creeping flow, there is no flow separation and pressure drag is less as compared to frictional drag.

56. A diffuser blade in the centrifugal pump is used to
(1) convert mechanical energy to kinetic energy
(2) convert kinetic energy to pressure energy
(3) convert pressure energy to kinetic energy
(4) convert potential energy to kinetic energy

56. Ans: (2)

Sol: In diffuser, flow area increases, velocity decreases and as per Bernoulli's equation pressure increases.

57. Pumps are connected in parallel to increase the
(1) velocity head
(2) pressure head
(3) total head
(4) discharge

57. Ans: (4)

Sol: When pumps are connected in parallel, head across the pumps is same but discharge is sum of discharges of two pumps.

i.e $H_p = H_1 = H_2$

& $Q_P = Q_1 + Q_2$

58. If the bulk modulus of elasticity of the water is 2.2×10^6 kN/m^2, the speed of pressure wave is given by
(1) 22000 m/s (2) 1483.2m/s
(3) 3561.2 m/s (4) 500.3m/s

58. Ans: (2)

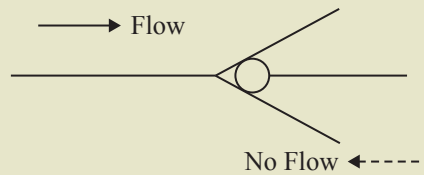
Sol: The speed of pressure wave (or sonic speed) is given by

$$v = \sqrt{\frac{K}{\rho}} = \sqrt{\frac{2.2 \times 10^9}{1000}} = 1483.2 \text{ m/s}$$

59. Check valve allows the fluid flow
(1) Only in one direction
(2) In both the directions
(3) To change the direction
(4) To stop

59. Ans: (1)

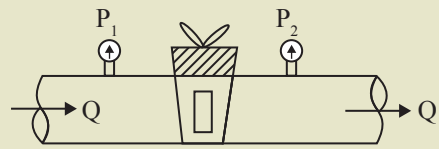
Sol: A check valve used in hydraulic circuits. It allows hydraulic liquid flow in one direction and prevents reversible (i.e. back flow) when the liquid in the line reverse direction. It is a non-return (or) one-way valve pressurised liquid passing through a line opens the valve while, reversal of flow will close the valve represented as follows



60. A pressure-relief valve has a pressure setting of 200 bar. The power loss across the valve if all the pump flow of 120 L/min flows back to the reservoir is
(1) 40 W (2) 40 kW
(3) 400 kW (4) 1000 kW

60. Ans: (2)

Sol:



Power lost across pressure relief Valve = (ΔP). Q

$$= (200 \times 10^5) \text{ N/m}^2 \left(\frac{120}{1000 \times 60}\right) \text{m}^3/\text{sec} \times \frac{1}{1000} (\text{Kw})$$

$$= 40 \text{ kW}$$

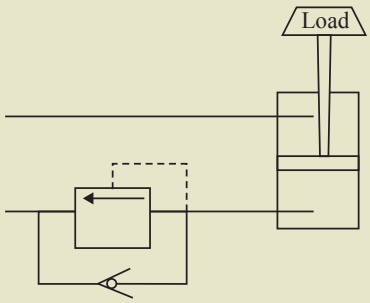
61. The valve used to control as vertical cylinder to prevent it from descending due to external load is
(1) Pressure relief valve
(2) Counterbalance valve
(3) Pressure compensated valve
(4) Directional control valve

61. Ans: (2)

Sol: Counter Balance PCV: It is called holding valve, is used to prevent load (weight) from falling unwantedly.

Ex: In crane load lifting operation, vertical presses lift trucks where position (or) hold suspended loads. It is placed in between actuating cylinder and DCV.

It consists feed back check valve to sense load sudden fall and works against it, not allow hydraulic oil flow back.



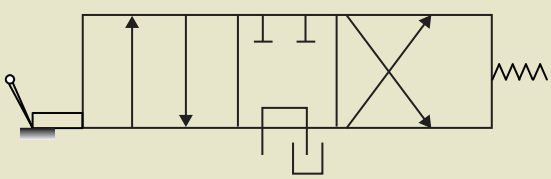
Counter Balance Valve

It creates holding pressure in the cylinder to prevent over slide of the external load while falling.

62. The flow direction to and from double acting cylinder is typically controlled by a
(1) 1 way DCV valve
(2) 2 way DCV valve
(3) 3 way DCV valve
(4) 4 way DCV valve

62. Ans: (4)

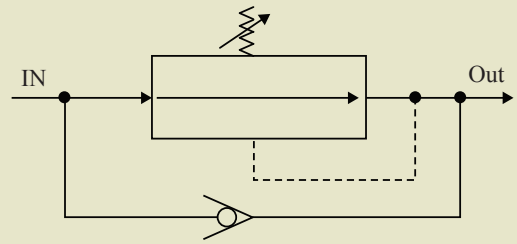
Sol: Flow direction to and fro from a double acting cylinder is typically controlled by
4 way/3 Position valve



63. Pressure-reducing valve is actuated by the fluid pressure at
(1) Upstream (2) Downstream
(3) Within the valve (4) Drain line

63. Ans: (2)

Sol: Pressure reducing valve is actuated by the fluid pressure at down stream. It is normally an open type 2-way valve that allows the liquid pressurised system to flow through it until a required/desired set pressure is reached down stream.



It controls pressure pipe line at its outlet i.e down stream pressure only. It is a pressure regulating at downstream of line

64. Kaplan turbine is used for
(1) low heads (2) medium heads
(3) high heads (4) very high heads

64. Ans: (1)

Sol: Kaplan turbine is suitable for low head ,high discharge and it has high specific speed.

65. The unit power of the reaction turbine
(1) Increases with the unit speed
(2) Decreases with the unit speed
(3) Decreases and increases with the unit speed
(4) Increases and decreases with the unit speed

65. Ans: (4)

Sol: From characteristic curve of reaction turbine (both Francis and Kaplan) unit power first increases and then decreases with respect unit speed.

66. A single jet impulse turbine of 10 MW capacity works with a head of 500 m. If the specific speed of the turbine is 10, the actual speed of the turbine is
(1) 106.9 rpm (2) 236.4 rpm
(3) 392.5 rpm (4) 50 rpm

66. Ans: (2)

Sol:

$$N_s = \frac{N\sqrt{P}}{H^{5/4}}$$

$$10 = \frac{N\sqrt{10 \times 10^3}}{500^{5/4}}$$

$$\Rightarrow N = 236.4$$

Note: Power is consider in kw to calculate specific speed.

67. Basic method to measure the flow rates in hydro power plants is
(1) velocity integration method
(2) Pitot-tube method
(3) Pressure-time method
(4) Notch method

67. Ans: (3)

Sol: One of the common method used in flow rate measurement in hydro power plant is pressure time method also called Gibson method. This method is based on water hammer principle.

68. A centrifugal pump driven by a directly coupled 3 kW motor of 1450 rpm speed is proposed to be connected to another motor of 2900 rpm. The power of the motor should be
(1) 24 kW (2) 18 W (3) 12 kW (4) 6 kW

68. Ans: (1)

Sol: $P \propto D^2 H^{3/2}$

& $ND \propto \sqrt{H}$

$\therefore P \propto D^2 (ND)^3$

$\propto D^5 N^3$

$$\therefore \frac{P_2}{P_1} = \left(\frac{D_2}{D_1}\right)^5 \times \left(\frac{N_2}{N_1}\right)^3$$

$$\frac{P_2}{3} = 1^5 \times \left(\frac{2900}{1450}\right)^3$$

$P_2 = 2^3 \times 3 = 24$ kW

69. A minimum Net Positive Suction Head (NPSH) is required for a hydraulic pump to
(1) increase the delivery head
(2) increase the suction head
(3) prevent the cavitation
(4) increase the efficiency

69. Ans: (3)

Sol: NPSH is used to study possibility cavitation in centrifugal pump.

To avoid cavitation $NPSH > (NPSH)_{min}$

70. Euler equation of water turbine is derived on the basis of
(1) conservation of mass
(2) rate of change of linear momentum
(3) rate of change of angular momentum
(4) rate of change of velocity

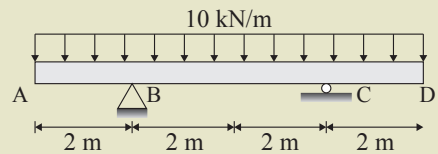
70. Ans: (3)

Sol: Euler's equation for turbine is derived from Newton's second law related to angular momentum.

i.e $T = \frac{d}{dt}(\vec{r} \times m\vec{v})$

Or $T = \rho Q \left[V_{w_1} r_1 \pm V_{w_2} r_2\right]$

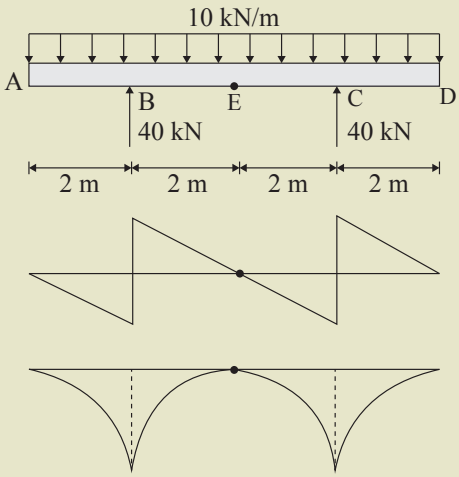
71. Calculate the shear force and bending moment at the mid point of the beam



(1) 0 kN, 0 kN-m
(2) − 20 kN, −20 kN-m
(3) 20 kN, −20 kN-m
(4) 20 kN, 0 kN-m

71. Ans: (1)

Sol:



Due to symmetry, R_B (or)R_C

$$= \frac{\text{Total load}}{2} = \frac{10 \times 8}{2} = 40 \text{ kN}$$

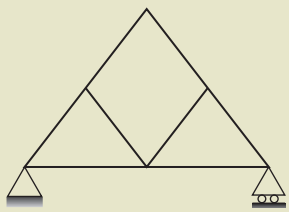
At mid span

$SF_E = 10\times 4 - 40 = 0$

$BM_E = 40\,(2) - 10 \times 4 \times 2 = 0$

SF and BM both will be zero at mid point.

72. Choose the correct combination of the stability and indeterminacy of the truss given.



(1) Statically indeterminate and stable

(2) Statically determinate and stable

(3) Unstable

(4) Statically determine

72. Ans: (3 & 4)

Sol: No of member, m = 8

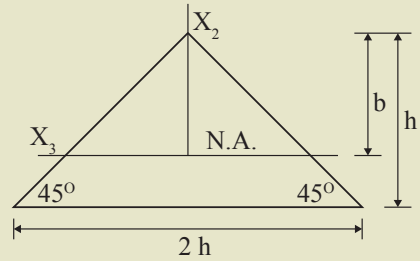
No of joints, j = 6

$m < 2j - 3$

$\therefore$ The truss is internally unstable but determinate

$\therefore$ Both the options (3) and (4) are correct

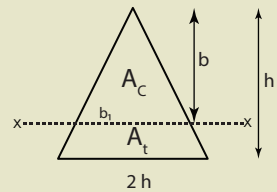
73. The beam of triangular cross-section as shown in the figure below, is subjected to pure bending. If a plastic hinge develops at a section, determine the location of neutral axis (distance b from top) at that section. The beam material is elastic-perfectly plastic (i.e., yield stress is constant)



(1) $\frac{h}{\sqrt{3}}$ (2) $\frac{h}{2}$ (3) $\frac{h}{\sqrt{2}}$ (4) $\frac{h}{3}$

73. Ans: (3)

Sol:



$A_C = A_t$

$$\frac{1}{2} \times b \times b_1 = \frac{1}{2}\left[\frac{1}{2} \times 2h \times h\right]$$

$$b_1 = \frac{h^2}{b}$$

from similar triangles

$b \rightarrow b_1$

$h \rightarrow 2h$

$b \times 2h = b_1 h$

$$b = \frac{b_1}{2}$$

$$b = \frac{h^2}{b \times 2}$$

$$b^2 = \frac{h^2}{2}$$

$$b = \frac{h}{\sqrt{2}}$$

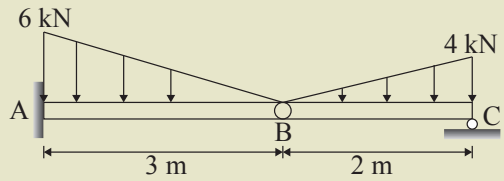
74. In 3-dimension, how many degrees of freedom does a fixed support have?

(1) 0 (2) 2 (3) 3 (4) 6

74. Ans: (1)

Sol: For a fixed support DOF = 0

75. Calculate the shear force and bending moment at point B for the beam AB subjected to linearly varying load as shown in the figure. The value of the linearly varying load at the point is 6 kN/m and 4 kN/m, respectively. Point B is an internal hinge.

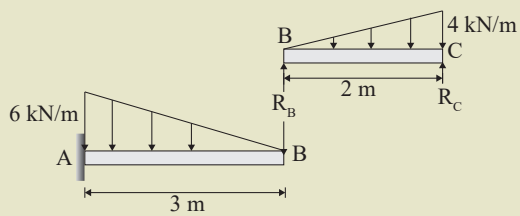


(1) 2.67 kN and 0 kN-m (2) 4 kN and 0 kN-m

(3) 4 kN and 1.33 kN-m (4) 1.33 kN and 0 kN-m

75. Ans: (4)

Sol:

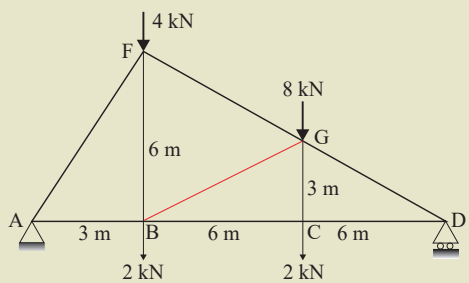


Consider BC part

$$SF_B = R_B = \frac{(4)(2)}{6} = 1.33 \text{ kN}$$

$BM_B = 0$ (@ hinge moment is zero)

76. Determine the force in the member BG in the given truss



(1) 11.18 kN Tension

(2) 14.4 kN tension

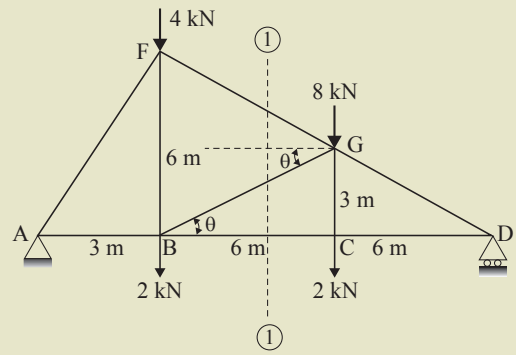
(3) 11.18 kN Compression

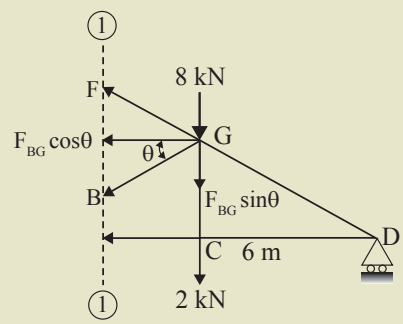
(4) 14.40 kN compression

76. Ans: (3)

Sol: Take section 1 - 1 as shown in figure.

To find the force in BG, consider the right part of section (1) - (1) and take moment about 'D'





$$\cos\theta = \frac{6}{3\sqrt{5}} = \frac{2}{\sqrt{5}}$$

$$\sin\theta = \frac{3}{3\sqrt{5}} = \frac{1}{\sqrt{5}}$$

$\Sigma M_D = 0$ $\curvearrowright$ + ve $\curvearrowleft$ − ve

$$-F_{BG}\cos\theta \times 3 - F_{BG}\sin\theta \times 6 - 2 \times 6 - 8 \times 6 = 0$$

$$-F_{BG} \times \frac{6}{\sqrt{5}} \times F_{BG} \times \frac{6}{\sqrt{5}} - 60 = 0$$

$$-2\left[F_{BG} \times \frac{6}{\sqrt{5}}\right] = 60$$

$$F_{BG} = -5\sqrt{5} \text{ kN (compressive)}$$

$$F_{BG} = 11.18 \text{ kN (compressive)}$$

ESE – 2019

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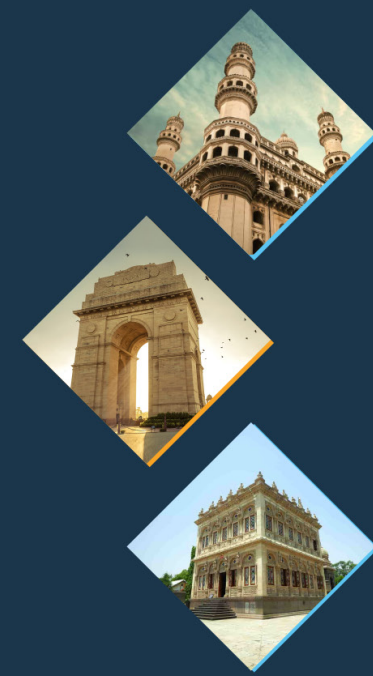

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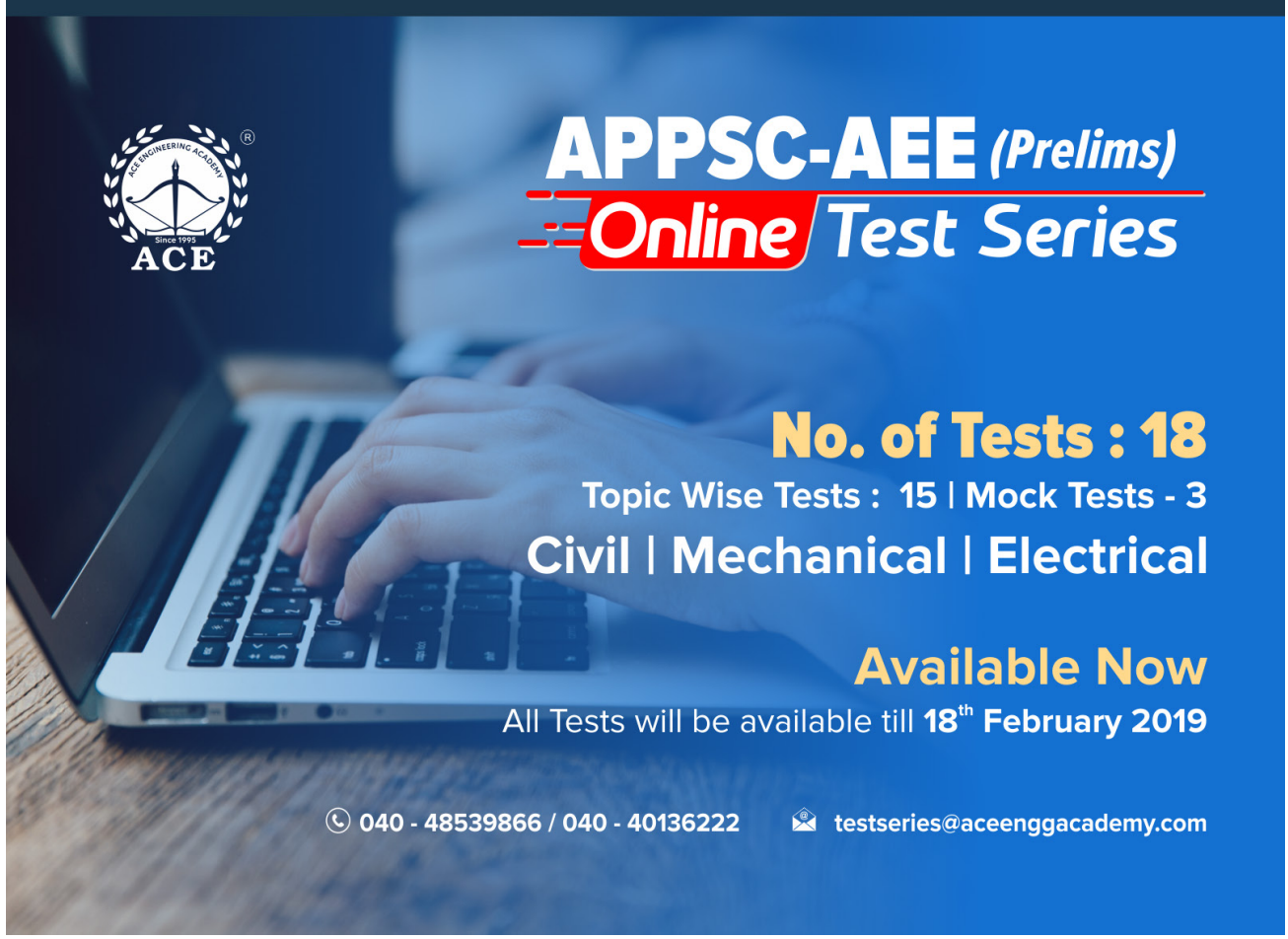

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77. Consider the following:
(a) Bending moment is a moment about the longitudinal axis of a beam.
(b) A structural component cannot have axial force and shear force together.
(1) Only a is correct (2) Only b is correct
(3) Both a and b are correct
(4) Both a and b are incorrect

77. Ans: (4)

Sol:
- Bending moment is the moment about neutral axis, but not about longitudinal axis.
- Structural components can have axial forces, shear forces together when inclined loads are acting, on a beam.

78. A beam of rectangular section 200 mm × 300 mm carries certain loads such that bending moment at a section A is M and at another section B it is (M + ΔM). The distance between section A and B is 1 m and there are no external loads acting between A and B. If ΔM is 20 kNm, maximum shear stress in the beam section is
(1) 0.5 MPa (2) 1.0 MPa
(3) 1.5 MPa (4) 2.0MPa

78. Ans: (1)

Sol: $\frac{dM}{dx} = F$

$\frac{20\ kN\text{-}m}{1\ m} = F$

$F = 20\ kN$

For rectangular cross section

$\tau_{max} = \frac{3}{2}[\tau_{avg}]$

$\tau_{max} = \frac{3}{2}\left[\frac{F}{bd}\right]$

$= \frac{3}{2}\left[\frac{20 \times 10^3}{200 \times 300}\right] = 0.5\ MPa$

79. A mild steel flat of width 100 mm and thickness 12 mm is bent into an arc of a circle of radius of 10 m by applying a pure moment M. If Young's modulus E = 200 GPa, then the magnitude of M is
(1) 72 Nm (2) 144 Nm
(3) 216 Nm (4) 288 Nm

79. Ans: (4)

Sol: Radius of curvature (R) = 10,000 mm

Modulus of elasticity (E) = 200×10^3 MPa

Thickness (t) = 12 mm

From bending equation

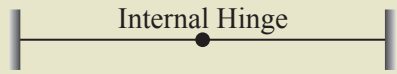
$\frac{M}{I} = \frac{E}{R}$

$\frac{M}{\left[\frac{100 \times 12^3}{12}\right]} = \frac{200 \times 10^3}{10,000}$

M = 288000 N-mm

= 288 N-m

80. Find out the Static indeterminacy of the beam in the figure below



(1) 0 (2) 2 (3) 3 (4) 6

80. Ans: (2)

Sol: If not given in a problem consider general loading on a beam

The beam is indeterminate by = 2 degree

81. At the point of contraflexure
(1) bending moment changes sign
(2) bending moment is maximum
(3) shear force is maximum
(4) None of the above

81. Ans: (1)

Sol: The point at which bending moment changes its sign (from +ve to –ve and vice-versa) is known as point of contra flexure.

82. Consider the following:

(a) In addition to equilibrium equations, compatibility equations are also required for solving indeterminate structure.

(b) A fixed beam (two ends are fixed) is a kinematically determinate structure.

(1) Both a and b are correct

(2) Both a and b are wrong

(3) Only a is correct

(4) Only b is correct

82. Ans: (1)

Sol: For analysing statically indeterminate structures both equilibrium and compatibility equations are required.

Fixed beam has no degree of freedom

$\therefore$ It is kinematically determinate beam

83. Regarding the stability of a truss, the condition $m + r > 2j$ is

(1) Necessary

(2) Sufficient

(3) Necessary and Sufficient

(4) Sufficient but not Necessary

83. Ans: (4)

Sol: Given condition

$m + r > 2j$

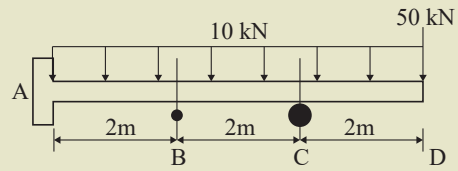
$m > 2j - r$

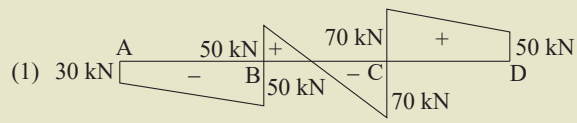
$\therefore$ The member is structurally stable but not necessarily have $m > 2j - r$. It is just sufficient to have

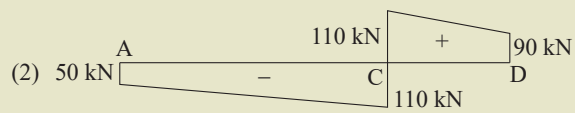
$m = 2j - r$

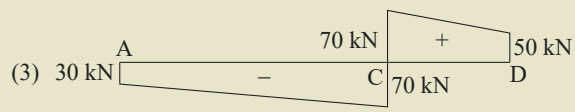
84. Out of the options given below, which one is the correct shear force diagram?

B is an internal hinge



(1)


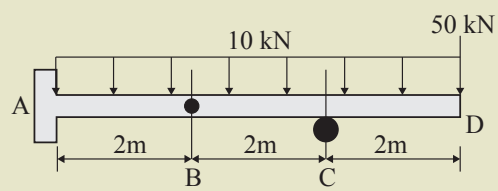
(2)


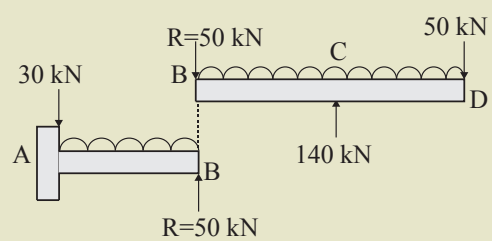
(3)


(4) None of the above

84. Ans: (3)

Sol:





SFD

85. A shaft turns at 200 rpm under a torque of 1800 Nm. The power transmitted is

(1) 6π kW (2) 12π kW

(3) 24π kW (4) 36π kW

85. Ans: (2)

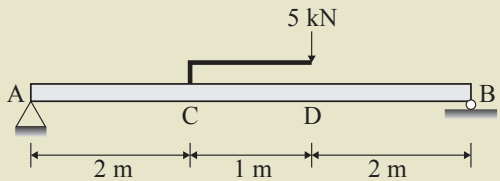
Sol: $P = \frac{2\pi NT}{60}$

$= \frac{2\pi(200)(1800)}{60}$

$= 12000\ (\pi)$

$= (12\ \pi)$ kW

86. For the beam shown below, the vertical reactions at A and B are respectively



(1) 2 kN, 3 kN

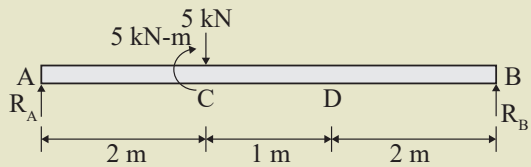
(2) 3 kN , 2 kN

(3) −1 kN, 1 kN

(4) 1 kN, −1 kN

86. Ans: (1)

Sol:



$\Sigma F_y = 0$

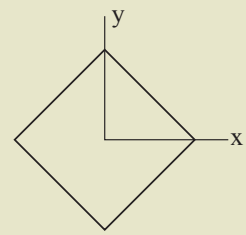
$R_A + R_B = 5$ kN

$\Sigma M_A = 0$

$R_B(5) = 5 \times 2 + 5$

$\therefore R_B = 3$ kN and $R_A = 2$ kN

87. A square section of side a is oriented as shown in the figure. Determine the section modulus of the following section?

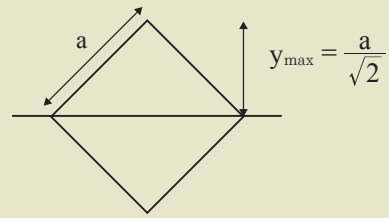


(1) $\frac{a^4}{12\sqrt{2}}$ (b) $\frac{a^3}{12\sqrt{2}}$

(c) $\frac{a^4}{6\sqrt{2}}$ (d) $\frac{a^3}{6\sqrt{2}}$

87. Ans: (4)

Sol:



The section modulus is

$$Z = \frac{I}{y_{max}} = \frac{\left[\frac{a.a^3}{12}\right]}{\left[\frac{a}{\sqrt{2}}\right]} = \frac{a^3}{6\sqrt{2}}$$

88. A rectangular beam section with depth 400 mm and width 300 mm is subjected to a bending moment of 60 kN/m. The maximum bending stress in the section is

(1) 7.50 MPa (2) 2.50 MPa

(3) 1.56 MPa (4) 0.42 MPa

88. Ans: (1)

Sol: Maximum bending stress in the beam

$$f_{max} = \frac{M}{Z} = \frac{M}{\left[\frac{bd^2}{6}\right]} = \frac{60 \times 10^6}{\left[\frac{300 \times 400^2}{6}\right]} = 7.5 \text{ MPa}$$

89. In case of pure bending, the beam will bend into an arc of a/an
(1) parabola (2) hyperbola
(3) circle (4) ellipse

89. Ans: (3)

Sol: If a beam is subjected to pure bending the elastic curve is a circular arc with constant radius.

90. For ductile material, the suitable failure theory is
(1) Maximum shear strain energy theory
(2) Maximum shear stress theory
(3) Both (1) and (2)
(4) None of the above

90. Ans: (3)

91. For a conservative force, the work done is independent of
(1) path (2) time
(3) distance (4) All of the above

91. Ans: (4)

92. Virtual work means
(a) work done by real forces due to virtual displacement
(b) work done by virtual forces during real displacement
(1) Both a and b are correct
(2) Both a and b are wrong
(3) a is correct and b is wrong
(4) b is correct and a is wrong

92. Ans: (1)

Sol: Virtual work = virtual force× real displacement (or) virtual displacement × real force

93. A member in a truss can take
(1) axial force and bending moment
(2) only axial force
(3) only bending moment
(4) bending moment and shear force

93. Ans: (2)

Sol: Truss members take only axial forces (tension or compression). They can not take shear force, bending moment and torsion.

94. Radius of gyration of a circular section with diameter D is
(1) $\frac{D}{2}$ (2) $\frac{D}{4}$ (3) $\frac{D}{3}$ (4) $\frac{D}{\sqrt{3}}$

94. Ans: (2)

Sol:

For circular section $I = \frac{\pi}{64}d^4$, $A = \frac{\pi}{4}d^2$

Radius of gyration = $k = \sqrt{\frac{I}{A}} = \sqrt{\frac{\frac{\pi}{64}d^4}{\frac{\pi}{4}d^2}} = \frac{d}{4}$

95. A cylindrical rod with length L, cross-sectional area A and Young's modulus E is rigidly fixed at its upper end and hangs vertically. The elongation of the rod due to its self weight W is
(1) $\frac{WL}{3AE}$ (2) $\frac{WL}{2AE}$
(3) $\frac{2WL}{3AE}$ (4) $\frac{WL}{AE}$

95. Ans: (2)

Sol: Self weight = W = weight density x volume

$$= \gamma \times A \times L \Rightarrow \gamma = \frac{W}{AL}$$

and self weight elongation = $\delta\ell_{sw} = \frac{\gamma L^2}{2E}$

$$= \frac{\frac{W}{AL}.L^2}{2E} = \frac{WL}{2AE}$$

96. A metal sphere of diameter D is subjected to a uniform increase in temperature ΔT. E, ν and α are the Young's modulus, Poisson's ratio and Coefficient of thermal expansion respectively. If the ball is free to expand, the hydrostatic stress developed within the ball due to temperature change is

(1) 0 (2) $\frac{\alpha\Delta TE}{1-2\nu}$

(3) $-\frac{\alpha\Delta TE}{1-2\nu}$ (4) $\frac{\alpha\Delta TE}{3(1-2\nu)}$

96. Ans: (1)

Sol: The hydrostatic stress developed within the ball due to temperature change is zero as the ball is free to expand.

97. A helical spring is subjected to an axial load W and corresponding deflection in the spring is δ. Now if the mean diameter of the spring is made half of its initial diameter keeping the material, number of turns and wire cross-section same, the deflection will be

(1) $\frac{\delta}{2}$ (2) $\frac{\delta}{8}$ (3) $\frac{\delta}{4}$ (4) 2δ

97. Ans: (2)

Sol: Deflection in spring = $\delta = \frac{8WD^3n}{Gd^4} \Rightarrow \delta \propto D^3$

$$\therefore \frac{\delta_2}{\delta_1} = \left(\frac{D_2}{D_1}\right)^3$$

$$\frac{\delta_2}{\delta} = \left(\frac{\frac{D}{2}}{D}\right)^3 \qquad \therefore \delta_2 = \frac{\delta}{8}$$

98. If for a given material, E = 2G (E is modulus of elasticity, G is the shear modulus), then the bulk modulus K will be

(1) $\frac{E}{2}$ (2) $\frac{E}{3}$ (3) E (4) $\frac{E}{4}$

98. Ans: (2)

Sol: E = 2G (given)

We have E = 2G (1+ μ)

2G = 2G (1+μ)

μ = 0

and E = 3K (1-2μ)

E = 3K (1-2(0)

E = 3K

$\Rightarrow K = \frac{E}{3}$

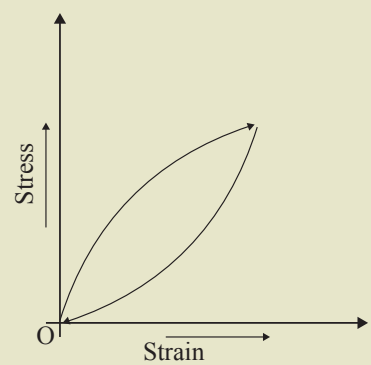
99. If a material has identical properties in all the directions, it is said to be

(1) elastic (2) homogeneous

(3) isotropic (4) orthotropic

99. Ans: (3)

100. The following diagram is a stress-strain diagram of any material. Which kind of material is it?



(1) Plastic (2) Linear Elastic

(3) Non-linear Elastic (4) Visco-elastic

100. Ans: (4)

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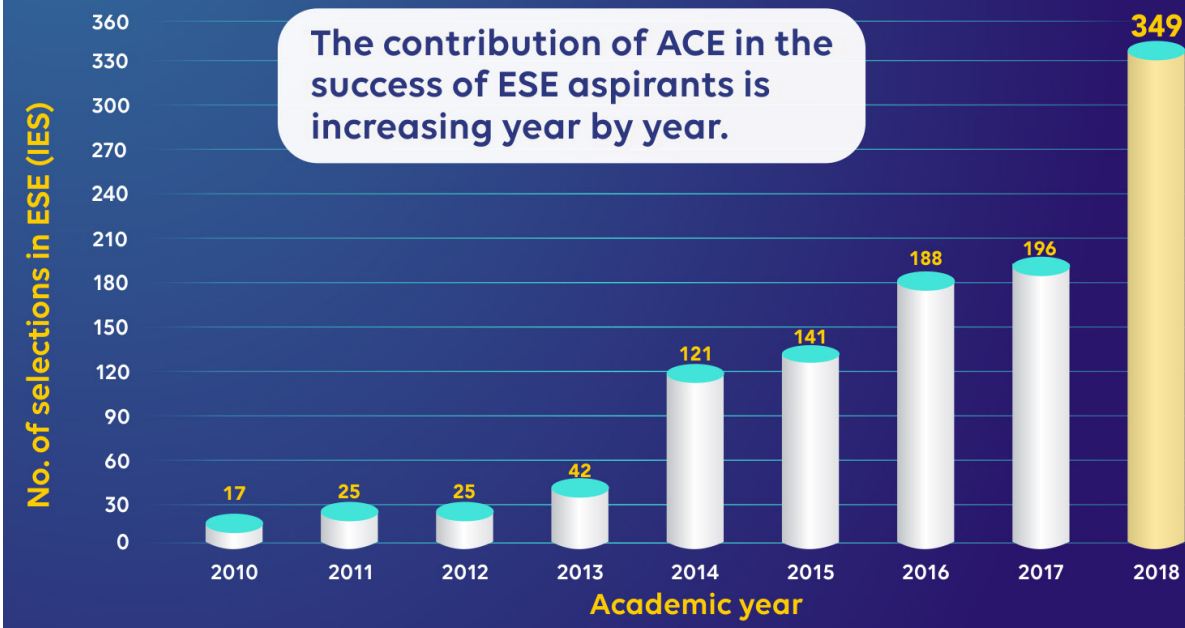

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101. In case of a torsional problem the assumption- *"Plane sections perpendicular to longitudinal axis before deformation remain plane and perpendicular to the longitudinal axis after deformation"* holds true for a shaft having
(1) circular cross-section
(2) elliptical cross-section
(3) circular and elliptical cross-section
(4) any cross-section

101. Ans: (1)

Sol: In case of a torsional problem the assumption- "Plane sections perpendicular to longitudinal axis before deformation remain plane and perpendicular to the longitudinal axis after deformation" holds true for a shaft having circular cross-section only. It is not valid for other shape of cross section.

102. Which of the following statements is correct?
(1) Euler buckling load increases with increase in effective length.
(2) Buckling load of a column does not depend on its cross-section.
(3) If free end of a cantilever column is propped then the buckling load increases.
(4) Two geometrically identical columns made of different material have same buckling load.

102. Ans: (3)

Sol: If the free end is supported by a prop, the effective length of column decreases. The load carrying capacity increase.

103. Rankine-Gordon formula is applicable for
(1) Short columns
(2) Long columns
(3) Both (1) and (2)
(4) None of the above

103. Ans: (3)

Sol: Rankine - Gordon Formula accounts both direct load effect and buckling effect.
$\therefore$ Applicable for both short and long columns.

104. Find out the Lame constants (λ and μ) for an isotropic material having modulus of elasticity (E) and Poisson's ratio (ν) as 200 GPa and 0.2, respectively.
(1) 80 GPa, 80 GPa
(2) 35.71 GPa, 166.6 GPa
(3) 55.55 GPa, 83.33 GPa
(4) 73.33 GPa, 66.66 GPa

104. Ans: (3)

Sol: E = 200 GPa
Poission's ratio $\nu = 0.2$

Lame constant $\lambda = \dfrac{E\nu}{(1+\mu)(1-2\mu)}$

$$\lambda = \frac{200 \times 0.2}{(1+0.2)(1-2(0.2))} = 55.55\text{GPa}$$

$$\mu = \frac{2E\nu}{(1+\mu)(1-\mu)} = \frac{2 \times 200 \times 0.2}{(1+0.2)(1-0.2)} = 83.33 \text{ GPa}$$

105. Consider the state of stress at any point as σ_{xx} = 250 MPa, σ_{yy} = 0 MPa, σ_{zz} = 250 MPa, The Young's modulus and Poisson's ratio of the material is considered as 2 GPa and 0.18 respectively. Determine the ε_{zz} at the point.
(1) − 0.125 (2) 0.103
(3) − 0.103 (4) 0.125

105. Ans: (2)

Sol: $\sigma_{xx} = 250$ MPa
$\sigma_{yy} = 0$
$\sigma_{zz} = 250$ MPa
$E = 2 \times 10^9$ Pa
$\mu = 0.18$

$$\varepsilon_{zz} = \frac{\sigma_{zz}}{E} - \mu\frac{\sigma_{yy}}{E} - \mu\frac{\sigma_{xx}}{E}$$

$$= \frac{\sigma_{zz}}{E} - \mu\frac{\sigma_{xx}}{E}$$

$$= \frac{\sigma_{xx}}{E}(1-\mu) \qquad (\because \sigma_{xx} = \sigma_{zz})$$

$$= \frac{250\times10^6}{2\times10^9}(1-0.18)$$

$$= 0.1025 = 0.103$$

106. What is the number of non-zero strain components for a plane stress problem?

(1) 6 (2) 4 (3) 3 (4) 2

106. Ans: (3)

Sol:

In a plane stress (2D) problem the number of non-zero strain components are ε_x, ε_y and ϕ_{xy}

Totally three numbers.

The 2D tensor is $\begin{bmatrix} \varepsilon_x & \phi_{xy} \\ \phi_{xy} & \varepsilon_y \end{bmatrix}$

107. At a material point the principal stresses are $\sigma_1 = 100$ MPa and $\sigma_2 = 20$ MPa. If the elastic limit is 200 MPa, what is the factor of safety based on maximum shear stress theory?

(1) 1.5 (2) 2 (3) 2.5 (4) 3

107. Ans: (2)

Sol: $\sigma_1 = 100$ MPa

$\sigma_2 = 20$ MPa

$\sigma_3 = 0$ (Minimum principal stress)

$\sigma_y = 200$ MPa

According to Maximum Shear Stress theory

$$\tau_{max} = \frac{\sigma_y}{2FOS}$$

$$\Rightarrow \frac{\sigma_1 - \sigma_3}{2} = \frac{\sigma_y}{2\,FOS}$$

$$\Rightarrow \sigma_1 - \sigma_3 = \frac{\sigma_y}{FOC}$$

$$\Rightarrow 100 - 0 = \frac{200}{FOS} \qquad FOS = \frac{200}{100} = 2$$

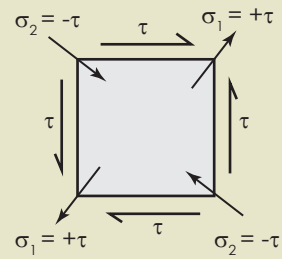
108. A solid circular shaft of length L, cross-section A, second polar moment of area J and shear modulus G has one end fixed. A torsion T is applied at the other end. The volumetric strain at an arbitrary point on the surface will be

(1) 0 (2) $\frac{T}{(GJ)}$

(3) $\frac{TL}{(GJ)}$ (4) $\frac{T}{(AL)}$

108. Ans: (1)

Sol: Element on a shaft subjected to torsion is



From figure principal stresses

$\sigma_1 = +\tau$

$\sigma_2 = -\tau$

$\sigma_3 = 0$

Volumetric strain, $\varepsilon_v = \frac{\sigma_1+\sigma_2+\sigma_3}{E}(1-2\mu)$

$$= \frac{(+\tau)+(-\tau)+(0)}{E}(1-2\mu)$$

$$\varepsilon_v = 0$$

109. If two springs of stiffness k_1 and k_2 are connected in series, the stiffness of the combined spring is

(1) $\frac{(k_1+k_2)}{k_1k_2}$ (2) $\frac{k_1k_2}{(k_1+k_2)}$

(3) k_1k_2 (4) $k_1 + k_2$

109. Ans: (2)

Sol: Given springs are connected in series.

$$\frac{1}{k_{eq}} = \frac{1}{k_1} + \frac{1}{k_2}$$

$$\therefore k_{eq} = \frac{k_1k_2}{k_1+k_2}$$

110. A cantilever beam with rectangular cross-section is subjected to uniformly distributed load. The deflection at the tip is δ_1. If the width and depth of the beam are doubled then deflection at tip is δ_2. Then $\frac{\delta_2}{\delta_1}$ is

(1) 0.0625 (2) 16

(3) 0.5 (4) 2

110. Ans: (1)

Sol: Deflection $\propto \frac{1}{I}$

$$\therefore \frac{\delta_2}{\delta_1} = \frac{I_1}{I_2} = \frac{\left(\frac{bd^3}{12}\right)}{\frac{(2b)(2d)^3}{12}} = \frac{1}{16} = 0.0625$$

111. Modulus of rigidity is the ratio of

(1) longitudinal stress and lateral strain

(2) shear stress and shear strain

(3) longitudinal stress and longitudinal strain

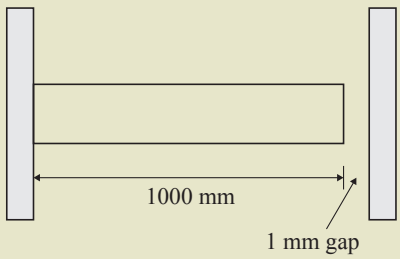
(4) shear strain and shear stress

111. Ans: (2)

Sol: Modulus of rigidity $G = \frac{\text{Shear Stress}}{\text{Shear Strain}}$

112. A 1 m long rod is fixed at one end. There is a rigid wall at a distance 1 mm from the free end of the rod as depicted in the figure. What is the thermal stress generated in the rod if its temperature is increased by 100°C?

Take E = 200 GPa and $\alpha = 12\times 10^{-6}$ /°C



(1) 40 MPa (2) 80 MPa

(3) 120 MPa (4) 240 MPa

112. Ans: (1)

Sol: Free expansion $= \ell\ \alpha\ \Delta T$

$= (1000)\ (12\times10^{-6})(100) = 1.2$ mm

Expansion prevented = 1.2 - 1 = 0.2 mm

$$0.2 = \frac{P\ell}{AE} \quad \left(\because \sigma = \frac{P}{A}\right)$$

$$\frac{2}{10} = \frac{(\sigma)(1000)}{200\times 10^3}$$

$\sigma = 40$ MPa

113. If a material is heated up, its Elastic modulus

(1) decreases (2) increases

(3) remains constant (4) None of the above

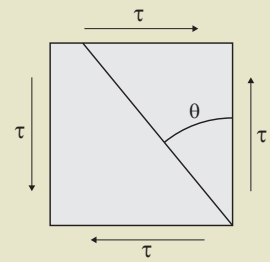
113. Ans: (1)

Sol:

As the material is heated up, it becomes soft. It undergoes more strain for a given stress

$\left(\because E = \frac{\sigma}{\varepsilon}\right)$ The modulus of elasticity decreases.

114. The state of stress at a point is shown below. θ represents the principal plane corresponding to principal stresses σ_1 and σ_2 ($\sigma_1 > \sigma_2$). Values of θ, σ_1 and σ_2 are



(1) 0°, 90°, τ and −τ

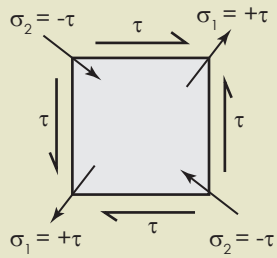
(2) 30°, 120°, τ and −τ

(3) 45°, 135°, τ and −τ

(4) 45°, 135°, $\frac{\tau}{2}$ and $-\frac{\tau}{2}$

114. Ans: (3)

Sol:



Due to pure shear diagonal tension ($\sigma_1 = +\tau$) and diagonal compression ($\sigma_2 = -\tau$) develops.

The angle between principal planes is 90°.

$\therefore \theta_1 = 45°, \theta_2 = 135°, \sigma_1 = \tau, \sigma_2 = -\tau$

115. A thin cylindrical shell of internal diameter D and thickness t is subjected to internal pressure p, E and ν are respectively the Elastic modulus and Poisson's ratio. The change in diameter is

(1) $\frac{pD^2}{4tE}(1 - 2\nu)$

(2) $\frac{pD^2}{4tE}(2 - \nu)$

(3) $\frac{pt^2}{4DE}(2 - \nu)$

(4) $\frac{pt^2}{4DE}(1 - 2\nu)$

115. Ans: (2)

Sol: Circumferential strain in thin cylinder

$$\varepsilon_h = \frac{\sigma_h}{E}\left(1 - \frac{\mu}{2}\right)$$

$$\left(\text{where } \sigma_h = \frac{PD}{2t}\right)$$

$$\therefore \frac{\delta D}{D} = \frac{PD}{2tE}\left(\frac{2 - \mu}{2}\right)$$

$$\therefore \delta D = \frac{PD^2}{4tE}(2 - \mu)$$

116. Let σ_1, σ_2 and σ_3 are the principal stresses at a material point. If the yield stress of the material is σ_y, then according to von Mises theory yielding will not occur if

(1) $(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2 < 2(\sigma_y)^2$

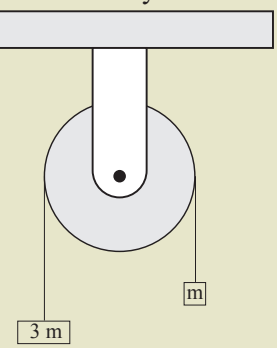
(2) $\max[(\sigma_1 - \sigma_2), (\sigma_2 - \sigma_3), (\sigma_3 - \sigma_1)] < \sigma_y$

(3) $(\sigma_1)^2 + (\sigma_2)^2 + (\sigma_3)^2 < (\sigma_y)^2$

(4) $(\sigma_1)^2 + (\sigma_2)^2 + (\sigma_3)^2 - 2\nu(\sigma_1\sigma_2 + \sigma_2\sigma_3 + \sigma_3\sigma_1) < (\sigma_y)^2$

116. Ans: (1)

117. What is the minimum coefficient (μ) of friction between the rope and the fixed shaft which will prevent the unbalanced cylinder from moving?

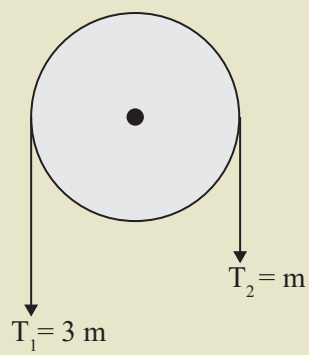


(1) $\mu = 0.333$ (2) $\mu = 0.350$

(3) $\mu = 0.253$ (4) $\mu = 0.372$

117. Ans: (2)

Sol:



$$\frac{T_1}{T_2} = e^{-\alpha(T)}$$

α is angle of contact between rope and cylinder

$\alpha = \pi$ radian

$$\frac{3m}{m} = e^{-(\mu)(\pi)}$$

$$3 = e^{-\mu(\pi)}$$

$$1.098 = -\mu(\pi)$$

$$\mu = 0.349$$

$$\approx 0.35$$

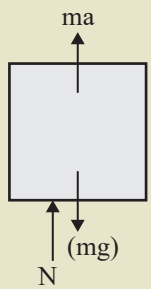
118. A body exerts a force of 1 kN on the floor of the lift which moves upward with a retardation of 1.5 m/s^2. What is the mass of the body, in kg, carried in the lift?

(1) 120.33 (2) 101.94

(3) 88.42 (4) 77.32

118. Ans: (1)

Sol: FBD of mass in the lift



N = normal reaction between lift & mass

$\sum F_y = 0$

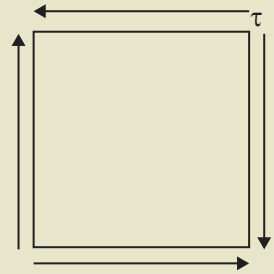
$(N - mg) = m(-a)$ ($-a$ = retardation)

$1\times10^3 = m\,(g-a)$

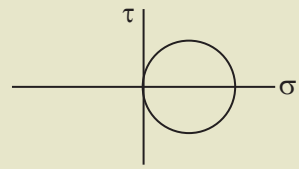
$1\times10^3 = m\,(9.81 - 1.5)$

$$m = \frac{1\times10^3}{(9.81 - 1.5)} = 120.33 \text{ kg}$$

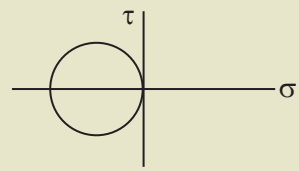
119. Which of the following represents the Mohr's circle for the state of stress shown below?



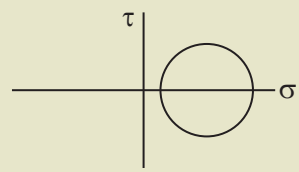
(1)



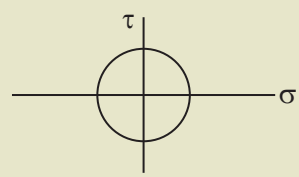
(2)



(3)



(4)



119. Ans: (4)

Sol: Under pure shear condition, centre of Mohr's circle coincides with origin.

120. According to the maximum principal stress theory, the yield locus is a/an

(1) square (2) circle

(3) hexagon (4) ellipse

ESE / GATE / PSUs - 2020
ADMISSIONS OPEN

CENTER	COURSE	BATCH TYPE	DATE
HYDERABAD - DSNR	GATE + PSUS – 2020	Regular Batches	26th April, 11th, 25th May, 09th, 24th June, 8th July 2019
HYDERABAD - DSNR	ESE + GATE + PSUs - 2020	Regular Batches	21st March, 26th April, 11th, 25th May, 09th, 24th June, 8th July 2019
HYDERABAD - DSNR	GATE + PSUs - 2020	Short Term Batches	29th April, 6th, 11th, 18th May 26th May, 2nd June, 2019
HYDERABAD - DSNR	GATE + PSUs - 2020	Morning/Evening Batch	24th February 2019
HYDERABAD - DSNR	ESE – 2019 STAGE-II (MAINS)	Regular Batch	17th Feb 2019
HYDERABAD - Abids	GATE + PSUS – 2020	Regular Batches	26th April, 11th, 25th May, 09th, 24th June, 8th July 2019
HYDERABAD - Abids	GATE + PSUs - 2020	Short Term Batches	29th April, 6th, 11th, 18th May 26th May, 2nd June, 2019
HYDERABAD - Abids	ESE + GATE + PSUs - 2020	Morning Batch	24th February 2019
HYDERABAD - Abids	ESE – 2019 STAGE-II (MAINS)	Regular Batch	17th Feb 2019
HYDERABAD - Abids	GATE + PSUs - 2020	Weekend Batch	24th February 2019
HYDERABAD - Abids	ESE+GATE + PSUs - 2020	Spark Batches	11th May, 09th June 2019
HYDERABAD - Kukatpally	GATE + PSUs - 2020	Morning/Evening Batch	24th February 2019
HYDERABAD - Kukatpally	GATE + PSUS – 2020	Regular Batches	17th May, 1st, 16th June, 1st July 2019
HYDERABAD - Kukatpally	GATE + PSUs - 2020	Short Term Batches	29th April, 6th, 11th, 18th May 26th May, 2nd June, 2019
HYDERABAD - Kothapet	ESE + GATE + PSUS – 2020	Regular Batches	21st March, 26th April, 11th, 25th May, 09th, 24th June, 8th July 2019
HYDERABAD - Kothapet	ESE+GATE + PSUs - 2020	Spark Batches	11th May, 09th June 2019
DELHI	ESE+GATE+PSUs - 2020	Weekend Batches	9th Mar 2019
DELHI	ESE+GATE+PSUs - 2020	Regular Evening Batch	18th Feb 2019
DELHI	ESE+GATE+PSUs - 2020	Regular Day Batch	11th May 2019
DELHI	ESE+GATE+PSUs - 2020	Spark Batch	11th May 2019
DELHI	GATE+PSUs - 2020	Short Term Batches	11th, 23rd May 2019
BHOPAL	ESE+GATE+PSUs - 2020	Regular Day Batch	01st Week of June 2019
BHUBANESWAR	GATE+PSUs - 2020	Weekend Batch	16th Feb 2019
BHUBANESWAR	GATE+PSUs - 2020	Regular Batch	02nd Week of May 2019
CHENNAI	GATE+PSUs - 2020 & 21	Weekend Batch	16th Feb 2019
CHENNAI	GATE+PSUs - 2020	Regular Batch	02nd Week of May 2019
BANGALORE	GATE+PSUs - 2020 & 21	Weekend Batch	23rd Feb 2019
BANGALORE	GATE+PSUs - 2020	Regular Batch	17th June 2019

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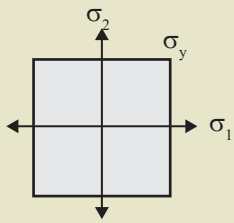
120. Ans: (1)

Sol: As per Maximum principal stress theory



yielding locus is a square

121. In Newtonian fluids, the shear stress is
(1) directly proportional to the viscosity
(2) inversely proportional to the viscosity
(3) directly proportional to the deformation rate
(4) directly proportional to the shear strain

121. Ans: (3)

Sol: As per Newton's law of viscosity, shear stress is directly proportional to rate of shear strain or deformation rate.

122. The specific gravity of mercury is
(1) 1360 (2) 13600
(3) 1.36 (4) 13.6

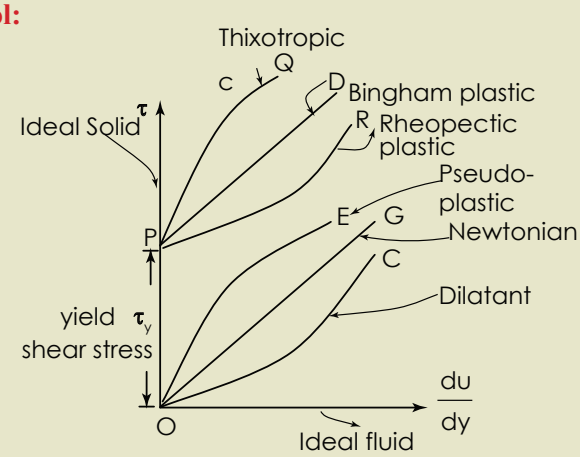
122. Ans: (4)

Sol: $S_m = \frac{\rho_m}{\rho_w} = \frac{13600}{1000} = 13.6$

123. For pseudoplastic non-Newtonian fluids, the apparent viscosity
(1) increases with increasing deformation rate
(2) decreases with increasing deformation rate
(3) is independent of the deformation rate
(4) decreases with time

123. Ans: (2)

Sol:



Pseudo plastic fluid: (represented by line OE).

- $\tau_y = 0$ and $n < 1$
- The apparent viscosity decreases with the rate of deformation or shear rate. Hence, Pseudo plastic fluids are also called Shear *thinning* fluids.

  e.g: Blood, milk, Paper Pulp, Polymeric solutions such as rubber, suspension paints.

124. If σ is the surface tension and R is the cylinder radius, the pressure increase (ΔP) in the interior of a liquid cylinder is given by
(1) $\frac{\sigma}{R}$ (2) $\frac{2\sigma}{R}$
(3) $\frac{3\sigma}{R}$ (4) $\frac{4\sigma}{R}$

124. Ans: (1)

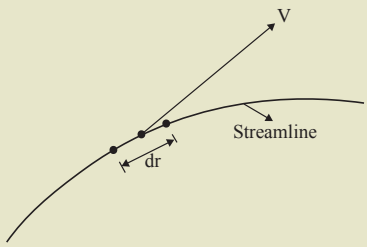
Sol: The pressure rise across cylindrical liquid jet is given by

$$\Delta P = \frac{2\sigma}{D} = \frac{\sigma}{R}$$

125. If *dr* is a directed fluid element, the equation, $dr \times V = 0$ refers to a
(1) Pathline (2)Timeline
(3) Streakline (4) Streamline

125. Ans: (4)

Sol: As per definition of streamline velocity is tangential to it. Hence $\vec{V}$ and $d\vec{r}$ are parallel to each other. If two vectors are parallel then their cross product is zero.



126. A water lake has a maximum depth of 100 m. If the atmospheric pressure is 101 kPa, the absolute pressure at this depth is

(1) 1082 kPa (2) 881 kPa

(3) 900 kPa (4) 678 kPa

126. Ans: (1)

Sol: $P = P_{atm} + \rho gh$

$= 101 \times 10^3 + 1000 \times 9.81 \times 100$

$= 1082$ kPa

127. A floating body is said to be unstable if the metacentre (M) is

(1) Equal to the centre of mass of the body

(2) Above the centre of mass of the body

(3) Below the centre of mass of the body

(4) Outside the body

127. Ans: (3)

Sol: For stability of floating object, centre of gravity should be below metacentre.

128. If a dye is constantly injected into the flow field at a single point, the curve formed by the dye in the flow field is a

(1) Streamline (2) Timeline

(3) Pathline (4) Streakline

128. Ans: (4)

Sol: Dye injected in flow represents streakline. As per definition of streakline, it is line obtained by joining positions of all particles which have passed sequentially through a fixed point in the flow.

129. Velocity field can be related to stream function as

(1) $u = \frac{\partial \psi}{\partial y}; v = -\frac{\partial \psi}{\partial x}$ (2) $u = -\frac{\partial \psi}{\partial y}; v = -\frac{\partial \psi}{\partial x}$

(3) $u = -\frac{\partial \psi}{\partial y}; v = \frac{\partial \psi}{\partial x}$ (4) $u = \frac{\partial \psi}{\partial y}; v = \frac{\partial \psi}{\partial x}$

129. Ans: (1 & 3)

Sol: Stream function is defined as

$$u = \frac{-\partial \psi}{\partial y}, \quad v = \frac{\partial \psi}{\partial x}$$

Note: Some authors define it as $u = \frac{\partial \psi}{\partial y}, \quad v = \frac{-\partial \psi}{\partial x}$

Both the definitions are correct as velocity components defined in above manner satisfy two dimensional continuity equation for incompressible flow.

For example $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = \frac{\partial}{\partial x}\left(\frac{-\partial \psi}{\partial y}\right) + \frac{\partial}{\partial y}\left(\frac{\partial \psi}{\partial x}\right) = 0$

130. If the flow field is steady, the fluid particle will undergo only a

(1) Convective acceleration

(2) Local acceleration

(3) Total acceleration

(4) All of the above

130. Ans: (1)

Sol: Total acceleration is sum of local and convective acceleration. If flow is steady then local acceleration is zero. Hence only convective acceleration can be present.

131. Resultant pressure of the liquid in case of an immersed body acts through the
(1) Metacentre (2) Centre of gravity
(3) Centre of pressure (4) Centre of buoyancy

131. Ans: (4)

Sol: The point through which buoyancy force passes is called centre of buoyancy. The buoyancy force is result of pressure distribution on the surface of object. The centre of pressure is point through which resultant pressure force passes. The term centre of pressure is used for thin surfaces. When thin surface is completely immersed in liquid the resultant force is zero. Hence centre of buoyancy is more appropriate answer.

132. If a mercury-oil differential manometer shows a 20 cm difference of mercury level, the difference in the pressure head is (consider the specific gravity of oil = 0.8)
(1) 2.0 m of oil (2) 2.5 m of oil
(3) 3.2 m of oil (4) 4.2 m of oil

132. Ans: (3)

Sol: $h = x\left(\frac{\rho_m}{\rho_o} - 1\right) = 0.2\left(\frac{13600}{800} - 1\right)$

$= 3.2$ m of oil

133. In a "free-vortex", velocity potential line (ϕ) is a function of
(1) angle (2) radius
(3) angle and radius (4) velocity

133. Ans: (1)

Sol: The velocity potential for free vortex is given by $\phi = \frac{\Gamma}{2\pi}\theta$

134. In the category of flow meters, head loss is the least for
(1) orifice meter (2) nozzle flow meter
(3) venturi meter (4) manometer

134. Ans: (3)

Sol: Venturi meter does not have flow separation due to gradual expansion hence head loss is minimum.

135. If A is the cross-sectional area and P is the wetted perimeter of a non-circular duct, the hydraulic diameter is defined as

(1) $\frac{2A}{P}$ (2) $\frac{4A}{P}$

(3) $\frac{2P}{A}$ (4) $\frac{4P}{A}$

135. Ans: (2)

Sol: The hydraulic diameter is defined as

$$D_h = \frac{4A}{P}$$

Where A = wetted area

P = wetted perimeter

136. In an incompressible fluid flow, the density of the medium is
(1) Zero (2) Infinity
(3) Constant (4) Unity

136. Ans: (3)

Sol: For incompressible flow

ρ = constant

137. Major losses in the pipe are due to the
(1) Entrance effects (2) Frictional effects
(3) Valve and fittings (4) Pipe bends

137. Ans: (2)

Sol: Loss due to friction is called major loss because its magnitude is generally high as compared to other losses.

138. For a fluid flow over a flat plate with zero pressure gradient, the boundary layer thickness $\left(\frac{\delta}{x}\right)$ is proportional to

(1) $\sqrt{Re_x}$ (2) $\frac{1}{\sqrt{Re_x}}$

(3) Re_x (4) $\frac{1}{Re_x}$

138. Ans: (2)

Sol: $\delta(x) = \frac{5x}{\sqrt{Re_x}}$ for laminar boundary layer

i.e. $\frac{\delta(x)}{x} \propto \frac{1}{\sqrt{Re_x}}$

139. Which object generates less drag when subjected to a flow field?

(1) Cylinder (2) Sphere

(3) Airfoil (4) Square

139. Ans: (3)

Sol: Aerofoil does not have pressure drag as flow doesn't separate on aerofoil.

Pressure drag is the dominant drag at moderate Reynolds number Hence, aerofoil has least drag as compared to other blunt objects.

140. A body of volume 3.0 m^3 weighs 2 kN in water. The body's weight in air is

(1) 6.0 kN (2) 20.4 kN

(3) 5.0 kN (4) 31.4 kN

140. Ans: (4)

Sol: $W_{water} = W_{air} - F_B$

$W_{air} = W_{water} + F_B$

$= 2 \times 10^3 + 1000 \times 9.81 \times 3$

$= 31.4$ kN

141. Navier-Stokes equation in fluid mechanics is derived from the

(1) Newton's first law of motion

(2) Newton's second law of motion

(3) Newton's third law of motion

(4) Newton's law of viscosity

141. Ans: (2)

Sol: Navier - stokes equation is application of Newton's second law to the motion of fluid element.

142. For an ideal and steady flow, "the total energy of a fluid at a point is constant" is the statement of

(1) Euler's equation

(2) Pascal's law

(3) Navier-Stokes equation

(4) Bernoulli's theorem

142. Ans: (4)

Sol: As per Bernoulli's equation sum of pressure energy, kinetic energy and potential energy is constant along streamline for steady incompressible flow.

143. Consider a tank attached with an orifice of diameter d. If H is the head of the liquid above the centre of the orifice, the theoretical velocity of the discharged flow through the orifice is given by

(1) $\sqrt{gH}$ (2) $\sqrt{2\,gH}$

(3) $\sqrt{gd}$ (4) $\sqrt{2\,gd}$

143. Ans: (2)

Sol: As per Torricelli's law, velocity through orifice at bottom of the tank is given by

$V = \sqrt{2gH}$

Where

H = Head above orifice

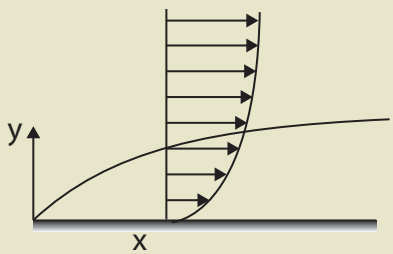
144. For a boundary layer flow over a flat plate with zero pressure gradient, if U is the free stream velocity, y is the coordinate perpendicular to the flow direction, and δ is the boundary layer thickness, at y = δ,

(1) $\frac{du}{dy} = 0$ (2) u = U

(3) Both (1) and (2) (4) None of the above

144. Ans: (3)

Sol:



As per definition of boundary layer thickness

at y = δ, u = 0.99U≈ U

As there is no variation in velocity beyond 'δ'

at y = δ, $\frac{du}{dy} = 0$

145. The equation, $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$ represents

(1) two-dimensional, compressible, continuity equation

(2) two-dimensional, incompressible, continuity equation

(3) two-dimensional, compressible, momentum equation

(4) two-dimensional, incompressible, momentum equation

145. Ans: (2)

Sol: $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$ represent 2D continuity equation for incompressible flow.

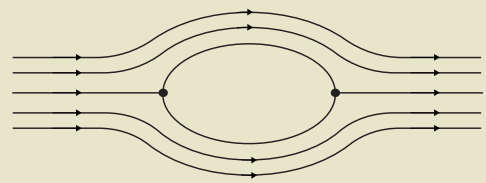
146. A Rankine oval body has stagnation point(s) at

(1) θ = 0 only (2) θ = π only

(3) θ = 0 and $\theta = \frac{\pi}{2}$ (4) θ = 0 and θ = π

146. Ans: (4)

Sol: For Rankine oval there are two stagnation points one on front and other at back side as shown in the figure below.



147. A Nozzle device is used to convert the

(1) total energy to pressure

(2) total energy to velocity

(3) kinetic energy to mechanical energy

(4) potential energy to kinetic energy

147. Ans: (2)

Sol: In nozzle area decreases, velocity increases and pressure decreases. Nozzle converts pressure energy into kinetic energy. Option (2) is most appropriate.

148. If θ is the blade angle at the outlet, then the maximum hydraulic efficiency of an ideal impulse turbine is

(1) (1 - cos θ) (2) (1 + cos θ)

(3) $\frac{(1-\cos\theta)}{2}$ (4) $\frac{(1+\cos\theta)}{2}$

148. Ans: (4)

Sol: The maximum wheel efficiency is given by

$$(\eta_w)_{max} = \frac{1 + K\cos\theta}{2}$$

Assuming K = 1

$$(\eta_w)_{max} = \frac{1 + \cos\theta}{2}$$

149. If D and d are the diameters of the runner and jet of the Pelton wheel respectively, the number of buckets on the runner is given by

(1) $30 + \frac{D}{d}$ (2) $30 + \frac{D}{2d}$

(3) $15 + \frac{D}{d}$ (4) $15 + \frac{D}{2d}$

149. Ans: (4)

Sol: Number of Buckets on wheel are given as per Taygun's empirical relation.

$$Z = 15 + 0.5\frac{D}{d}$$

150. The hydraulic efficiency of the Pelton wheel is maximum when the velocity of the wheel is

(1) twice the velocity of jet

(2) thrice the velocity of jet

(3) half the velocity of jet

(4) two-third's the velocity of jet

150. Ans: (3)

Sol: The condition for maximum hydraulic efficiency is

$$\frac{u}{V} = 0.5$$