ADMISSION TO MASTER'S DEGREE PROGRAM

ADVANCED ENGINEERING IN OIL AND GAS OFFSHORE INDUSTRY

The admission exam consists of two tests:

a) **Test 1: examination of candidates' admission files**
   - verify whether the faculty the candidate graduated from and the specialization of his/ her choice are compatible with the profile - masters degree domain.
   - Certificate of linguistic competency issued by the university that the candidate graduated from or a certificate issued by an approved institution or a multiple-choice exercise (quiz) of technical English knowledge passed by the candidate one day before the admission test, a test to be graded with ADMITTED / REJECTED.
   - The graduation exam (N1) exam is taken into account for the average admission at a rate of 70%.

b) **Test 2: multiple-choice exercise (quiz) from engineering subjects**
   - The test contains 15 items / questions from the following subjects:
     - Strength of Materials
     - Machine Elements
     - Thermotehnics
     - Fluid Mechanics
     - Heat Engines
     - Steam Generators
     - Hydropneumatic machines
     - Electrotehnics – Electrical Machines
     - Electronics– Electronic devices and circuits

   - The grade on the quiz test (N2) is taken into account in the calculation of the admission average on a rate of 30%.
   - The topics/ questions, chapters and bibliography are included in the appendix to this methodology

The admission average (AA) is calculated as follows:

$$AA=0,7\cdot N_1 + 0,3\cdot N_2$$

The places in the free-of-charge form of education (financed from the state budget) are dealt with in the order of the admission averages, provided those are at least 5,00 (five).

In the event that there are more equal averages for the last place, the penalty criteria are:
1. the general graduation average
2. grade on the written test (quiz).

Candidates who do not succeed for the tuition-free places can opt for tuition fees places for the same specialization.

ANNEX

SUGGESTED TOPICS FOR THE ADMISSION TEST

Note: Correct answers are marked. A single answer is correct.

Subject: STRENGTH OF MATERIALS

Chapters:
1. Geometrical Characteristics of Cross-sections,
2. Effort, stress-strain and deformation diagrams,
3. Simple stress and strain,
4. Compound stress and strain,
5. Calculus of vectors and rotations,
6. Statically undetermined systems.

Bibliography:
1. Emil M Oanţă, “Rezistenţa Materialelor - curs şi aplicaţii”, 422 pag A4, Editura Fundaţiei “Andrei Şaguna”, Constanţa, 2004, ISBN 973-8146-38-0
2. Emil M. Oanţă, Aplicaţii de Rezistenţa Materialelor, http://www.geocities.com/umc_p1223/Nav_Subiecte_RezMat.pdf, Constanţa, 2005
3. Gheorghe Buzdugan, "Rezistenţa materialelor", Editura Academiei RSR, Bucureşti, 1986

Suggested Topics:
1. In relation to the central axes, the static moments are:
   a) maximum;
   b) minimum;
   c) null;
   d) non-null.

2. Moments of inertia are measured in:
   a) mm^3;
   b) mm^4;
   c) mm^6;
   d) mm^5.

3. The straight trihedron is an axle system that:
a) has orthogonal axes, other information being irrelevant;
b) complies with the left hand rule;
c) when rotating the axis X to the axis Y along the shortest path (corresponding to an angle of 90°), the forward movement of the drill is opposite to the axis Z;
d) when rotating the axis Y to the axis Z along the shortest path (corresponding to an angle of 90°), the forward movement of the drill is in the direction of axis X.

4. If the cutting force varies linearly along the onterval, then the bending moment
a) varies hyperbolically;
b) varies parabolically;
c) varies linearly;
d) is constant.

5. For an inner joint, one of the groups of observations is true:

a) 1. the bending moment is null;
2. For a concentrated force placed in the joint, it must be clearly stated on which part of the joint it is actioning;
3. For a focused bending moment in a joint, it must be clearly stated on which part of the joint it is actioning.

b) 1. the bending moment is null only when the neighboring bars of the joint are not loaded;
2. A concentrated force placed in the joint can be reduced to any part of the joint when it is unloaded;
3. For a focused bending moment in a joint, it must be clearly stated on which part of the joint it is actioning.

c) 1. the moment of bending is null;
2. A concentrated force placed in the joint can be reduced to any part of the joint when it is unloaded;
3. For a focused bending moment in a joint, it must be clearly stated on which part of the joint it is actioning.

d) 1. the bending moment is null;
2. a concentrated force placed in the joint can be reduced to any part of the joint when it is unloaded;
3. for a focused bending moment positioned in a joint, it is not necessary to specify which part of the joint actions.

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6. The efforts which trigger stresses σ and τ are:

a) $\begin{cases} \sigma \leftarrow N, T_Y, T_Z \\ \tau \leftarrow M_X, M_Y, M_Z \end{cases}$

b) $\begin{cases} \tau \leftarrow T_Y, T_Z, M_X \\ \sigma \leftarrow N, M_Y, M_Z \end{cases}$

c) $\begin{cases} \sigma \leftarrow M_X, M_Y, M_Z \\ \tau \leftarrow N, T_Y, T_Z \end{cases}$

d) $\begin{cases} \tau \leftarrow T_Z, M_X, M_Y \\ \sigma \leftarrow N, T_Y, M_Z \end{cases}$

7. A linear state of tension is characterized only by the presence of .....stresses:

a) tangential;
b) normal;
c) normal and tangential;
d) main.

8. The linear deformation ε has the expression:

a) $\varepsilon = \Delta l \cdot l$;

b) $\varepsilon = \frac{\Delta l}{l^2}$;

c) $\varepsilon = \frac{l}{\Delta l}$;

d) $\varepsilon = \frac{\Delta l}{l}$.

9. The relation between ε_{tr} and ε is:

a) $\varepsilon_{tr} = \frac{\varepsilon}{\nu}$;

b) $\varepsilon_{tr} = \nu \cdot \varepsilon$;

c) $\varepsilon_{tr} = -\nu \cdot \varepsilon$;

d) $\varepsilon_{tr} = -\frac{\varepsilon}{\nu}$.

10. The expression of deformation to stretch, is:

a) $\varepsilon = \frac{N \cdot E}{A}$;

b) $\varepsilon = \frac{N \cdot A}{E}$;

c) $\varepsilon = \frac{N}{EA}$;

d) $\varepsilon = \frac{E}{N \cdot A}$.

11. Hooke's Law for tangential stress strain, is:

a) $\tau = \frac{G}{\gamma}$;

b) $\tau = \frac{G}{\Delta\varphi}$;

c) $\tau = G \cdot \Delta\varphi$;

d) $\tau = G \cdot \gamma$.

12. In the section of a circular cross-section bar, torsion-stressed, the tangential tensions are:

a) constant;
b) varies parabolically;
c) varies linearly;
d) null.

13. The expression of the tension caused by the pure and simple bending of the bars having sections with at least one axis of symmetry is:

a) $\sigma = M_y \cdot I_y \cdot z$;

b) $\sigma = \frac{M_y}{I_y} \cdot z$;

c) $\sigma = \frac{M_y \cdot I_y}{z}$;

d) $\sigma = \frac{M_y}{I_y} \cdot z^2$

14. Double bending is a strain by:
a) cutting forces and bending moments;
b) cutting forces and centric axial stresses;
c) bending moments in two orthogonal planes;
d) Bending moments at 45º.

15. The tangential stresses of the cutting and twisting forces are summed up:
a) in an algebraic manner;
b) in a vectorial manner;
c) cannot be added up;
e) on a case-by-case basis.

16. Physical measurements or voltage state parameters used to define resistance theories are:
a) tensions, deformations, specific potential energy;
b) displacements, rotations;
d) neutral axis, neutral fiber;
e) center of gravity, bending and sliding.

17. Vectors and rotations represent:
a) stresses;
b) deformations;
c) displacements;
e) forces and internal moments.

18. The canonical equation of the strain method is:
a) $\delta_{10} + \delta_{11} \cdot X_1 = 0$;
b) $\delta_{11} + \delta_{10} \cdot X_1 = 0$;
c) $X_1 + \delta_{10} \cdot \delta_{11} = 0$;
e) $\delta_{10} = \delta_{11} \cdot X_1$.

19. Dimensional analysis
a) deals with the comparative study of the dimensions of a cross section;
b) is used to verify the correctness of the calculation relations;
c) analyzes the dimensions in the longitudinal plane of a bar;
e) analyzes the general geometry of the physical bodies.

20. Select the group that contains only personalities from Strength of Materials and Elasticity Theory:
a) Mohr, Bohr, Juravschi, Bernoulli, Saint Venant;
b) Navier, Beti, Yeti, Poisson, Castigliano;
c) Beltrami, Young, Clapeyron, Wöhler, Mises;
e) Galileu, Goodman, Hooke, Steiner, Weimar.

Subject: MACHINE ELEMENTS

Chapters:

1. Materials, tolerances and adjustments
2. Removable assemblies (threaded assemblies, elastic assemblies)
3. Slip bearings, bearings
4. Mechanical transmissions (cylindrical gears, reducers)

Bibliography:

1. Gafiţanu M. ş.a., „Organe de maşini” vol. I şi II, Editura Tehnică, Bucureşti, 1983
2. Chişiu Al. ş.a., „Organe de maşini”, Editura Didactică şi Pedagogică, Bucureşti, 1981
3. Pavelescu D. ş.a., „Organe de maşini” vol. I, Editura Didactică şi Pedagogică, Bucureşti, 1985
4. xxx Note de curs la disciplina „Organe de maşini” de la orice universitate de inginerie mecanică sau electromecanică.

Suggested Topics:

1. The OLC35 material is:
   a) Rolled steel with a tensile strength of 35 MPa;
   b) Quality carbon steel with 35% carbon;
   c) Quality laminated steel with a carbon content of 0.35%;
   e) Improvement steel with a flow limit of 35 N / mm2.

2. The improvement applied to steels is:
   a) a thermal quenching in oil;
   b) a combined heat treatment, tempering followed by recovery;
   c) a cementitious treatment applied to alloyed steels;
   d) an enrichiment of the superficial layer of the carbon part.

3. The fit Φ38 H7/u6, with the diameter of the bore $\Phi 38^{+0,025}_{0}$ and the diameter of the shaft $\Phi 38^{0,076}_{0,060}$ is of the type:
   a) clearance fit;
   b) close fit;
   c) medium fit;
   d) maximum running fit.

4. The value of the maximum clearance in the fit Φ38 H7 ($^{+0,025}_{0}$) Φ38 R6 ($^{-0,050}_{-0,066}$) is:
   a) 0,075 mm;
   b) –0,075 mm;
   c) 0,091 mm;
   d) –0,045 mm.

5. What is a M20x1 notation for a thread?
   a) metric thread with outer diameter 20 mm and fine pitch of 1 mm;
   b) metric thread with average diameter of 20 mm and normal pitch of 1 mm;
   c) metric thread with a height of the nut 20 mm and a normal pitch of 1 mm;
   d) metric thread with internal diameter 20 mm and fine pitch of 1 mm.5.

6. The force screw for a mechanical jack can be built with a thread:
   a) metric triangular;
   b) triangular inches;
   c) Whitworth;
   d) trapezoidal.

7. The main strains of a screw thread are:
   a) crushing (contact pressure), bending, shearing;
   b) stretching, twisting;
   c) compression, buckling;
   d) fatigue.

8. A shaft transmits a power of 15 kW at a speed of 1000 rpm. The torque transmitted is:
   a) 187000 N - mm;
   b) 265 N - m;
   c) 143.25 N - m;
   d) 170.25 N - m.

9. The main stress in the spiral of a cylindrical helical spring is:
   a) compression;
   b) shearing;
   c) twisting;
   d) stretch;

10. The bearing cage is designed to:
   a) prevent impurities from reaching the rolling stock;
   b) to keep the running gear constant;
   c) ensure the maintenance of grease in the bearing;
   d) prevent the rotation of the bearing rings.

11. Choosing bearings for mechanical transmissions is based on:
   a) the static loading capacity;
   b) the dynamic loading capacity;
   c) the operating speed;
   d) the force it has to bear.

12. At a ball radial bearing of 6309, the diameter of the spindle shaft on which it can be mounted is:
   a) d = 55 mm;
   b) d = 50 mm;
   c) d = 40 mm;
   d) d = 45 mm;

13. For a radial bearing with hydrodynamic lubrication, the bearing coefficient is determined by the relationship $C_p = \frac{\eta \cdot \omega}{p_m \cdot \psi^2}$. If C_p is an adimensional measure, ψ is adimensional as well, ω is the angular velocity, p_m is a pressure [N/m^2], what type of units must be used to express the dynamic viscosity η [?]:
   a) cP (centipoise);
   b) ^oE (grade engler);
   c) Ns/m^2;
   d) a and b.

14. For gears with low to medium hardness (HB <3500 MPa), decommissioning is due to:

a) tearing of the teeth due to the bending request;
b) the phenomenon of pitting wear;
c) tooth tearing through fatigue;
d) seizing.

15. For hardened steel flanged gears (HB> 3500 MPa), teeth are de-energized:
a) due to bending fatigue at the base of the tooth;
b) due to pitting wear;
c) due to grip;
d) due to exfoliation.

16. A 2-speed cylindrical wheel reducer has on the input shaft a wheel with z_1=19 teeth; on the countershaft has the wheels z_2=76 teeth and z_3=20 teeth; and on the output shaft a wheel z_4=60 teeth. Which is the rotative speed of the output shaft, if the rotative speed of the input shaft is n_1=1450 rpm?
a) 100 rpm;
b) 112 rpm;
c) 121 rpm;
d) 135 rpm.

17. A straight toothed wheel gear has z_1=25 teeth and z_2=75 teeth, and the teeth module m=2.5 mm. The reference distance between the axles of the wheels is, in this case:
a) 110 mm;
b) 130 mm;
c) 135 mm;
d) 125 mm.

18. A wheeled gear has z_1=26 teeth, and when measured, its outer diameter resulted with the value d_a=70 mm. The teeth module is:
a) 2,5 mm;
b) 3 mm;
c) 3,5 mm;
d) 4 mm;

19. A mechanical transmission comprises: an electric motor (ME), a trapezoidal belt transmission (TC), a 2 speed (RT) speed reducer and a working machine (ML) with the following characteristics:
- The power required on the working machine P_{ML}=5 kW
- The gearbox has two gears, each with the output η_a=0,96, 3 pairs of bearings, each with the output η_l=0,98
- The belt transmission has the output η_{TC}=0,97.

How much power is required for the electric motor?
a) 5,2 kW;
b) 5,94 kW;
c) 6,25 kW;
d) 6,75 kW;

20. The hydrodynamic lubrication regime can be performed using the following types of lubricants:

a) consistent grease;
b) pressurized gases;
c) vegetable oils;
d) mineral oils.

Subject: THERMO-TECHNICS

Chapters:
1. Thermodynamic processes - Perfect gas
2. Transmission of heat
3. Fuels
4. Theoretical cycles of thermal machines

Bibliography:
1. Bazil Popa., „Termotehnică şi maşini termice”, Editura Tehnică, Bucureşti, 1980
2. Nicolae Leonăchescu, „Termodinamică”, Editura Didactică şi Pedagogică, Bucureşti, 1985
3. Tudor Darie, Tudor Cristina, „Termodinamică navală (Culegere de probleme)”, Editura AGIR, Bucureşti, 2000
4. Memet Feiza, Tudor Darie, „Termodinamică navală”

Suggested topics:
1. What is the difference between the thermodynamic parameter and the thermodynamic status parameter?
a) both one and the other define the energy level of the thermodynamic system;
b) both one and the other define the thermodynamic state of the thermodynamic system;
c) one is measured in the system of International units and the other in the MRS system;
d) one defines the thermodynamic system in relation to a reference system or other thermodynamic system, and the other defines the state of the thermodynamic system, the properties of the thermodynamic system.

2. Are simplifying hypotheses necessary to define the perfect gas thermodynamic system?
a) No, for current thermal machines;
b) Yes, because volume differences occur;
c) Yes, because there are differences in energy efficiency of simple transformations;
d) They are not important

3. Isothermal transformation is expressed by the relation:
a) $PT=ct$;
b) $PV=ct$;
c) $PV^n=ct$;
d) $RT=ct$.

4. The isocratic transformation is expressed by the relation:
a) $RT=ct$;

b) $\frac{T}{p} = ct$;
c) dT=0;
d) dp=0.

5. Adiab transformation is expressed by the relation:
a) $PV^k=ct$;
b) $PV^n=ct$;
c) $p^{\frac{1-n}{n}} \cdot T = ct$;
d) $PV^{n-1}=ct$.

6. The relation between the specific heat at p = ct. and V = ct. is:
a) $C_p-C_V=R$;
b) $C_p= (n-k) C_V$;
c) $C_V = \frac{k C_p}{k-1}$;
d) $C_p-C_V= (k-1) R$.

7. Thermodynamic functions can cause:
a) The energy potential of a thermodynamic system;
b) Thermo-dynamic potential of a thermodynamic system;
c) The thermal power of a thermodynamic system;
d) The output of thermal machines.

8. The coefficient of excess air in the case of combustion of fuel in combustion plants can be determined:
a) analytically;
b) graf-analytically;
c) experimentally using combustion triangles;
d) can not be determined.

9. The calculation of actual air required for combustion L_{aer} is calculated according to the theoretical air L_{aer}^0 with the relation (k – adiabatic coefficient; n – polytropic coefficient):
a) $L_{aer} = \alpha \cdot L_{aer}^0$;
b) $L_{aer} = k \cdot L_{aer}^0$;
c) $L_{aer} = V_{focar} \cdot L_{aer}^0$;
d) $L_{aer} = (n-k) \cdot L_{aer}^0$.

10. The piston compressor is used with several compression stages for:
a) the reduction of thermal losses;
b) the reduction of hydraulic losses;
c) obtaining discharge pressures greater than 10 bar and increasing the volumetric filling coefficient;
d) the reduction of mass losses.

11. For shipboard propulsion of large displacement vessels, internal combustion engines are used using the cycle:
a) m.a.s.;

b) m.a.c. slow;
c) m.a.c. fast;
d) the Bryton cycle.

12. The thermal efficiency of gas turbine installations depends on:
a) the compression ratio β of the compressor;
b) the dimensions of the combustion chamber;
c) the dimensions of fuel injection nozzles;
d) the fuel pressure at the entrance to the combustion chamber.

13. Van der Walls equation expresses the relation between:
a) P, V, T;
b) P, V, T as the volume and forces of intermolecular attraction;
c) P, V, T and vapor flow rate;
d) P, V, T and gravitational acceleration.

14. The titre of the vapors is expressed by the relation (m_v – vapour mass; m_l – liquid mass; t_v – vapour temperature; t_l – liquid temperature; V – volume; C – specific heat):

a) $x = \frac{m_v}{m_v + m_l}$;

b) $x = \frac{t_v}{t_v + t_l}$;

c) $x = \frac{V_v}{V_v + V_l}$;

d) $x = \frac{C_v}{C_v + C_l}$.

15. The relation between the vapor titres and the thermodynamics parameters of saturated vapor is [Y – the intensive thermodynamic parameter (v, h, n, s); Y' – for the liquid; Y" – for dry vapours]:

a) $x = \frac{Y - Y'}{Y'' - Y'}$;

b) $x = \frac{Y - Y'}{Y'' - Y'}$;

c) $x = \frac{Y' - Y''}{Y'' - Y}$;

d) $x = \frac{Y'' - Y'}{Y - Y'}$.

16. The titre of the dry saturated vapour is:
a) 0;
b) 1;
c) >1;
d) <1.

17. Relative humidity of the humid air φ, is given by the relation (p_B – barometric pressure; p_V – partial pressure of the water vapours in air; T – temperature for air and the water vapours in the air- water vapours mixture; d – content of air vapours; d_s – content of air vapours at a saturation status):

a) $\varphi = \frac{p_B + p_V}{p_V}$;

b) $\varphi = \frac{T_a}{T_a + T_V}$;

c) $\varphi = \frac{d}{d_s}$;

d) such a parameter is not defined.

18. Thermal conduction takes place:

a) between two solid bodies separated by a layer of air;
b) by the direct contact of two bodies;
c) between a fluid and a solid body through the currents;
d) energy transmission by means of electromagnetic waves.

19. The temperature logarithmic mean difference at heat exchangers is given by the relation (T'_m - the average temperature of the primary heat agent; T''_m - the average temperature of the secondary agent):

a) $\Delta T_{med} = \frac{\frac{\Delta T_{min}}{\Delta T_{max}}}{\ln(\Delta T_{max} - \Delta T_{min})}$;

b) $\Delta T_{med} = \frac{\Delta T_{max} - \Delta T_{min}}{\ln \frac{\Delta T_{max}}{\Delta T_{min}}}$;

c) $\Delta T_{med} = \frac{\frac{\Delta T_{max}}{\Delta T_{min}}}{\ln \frac{\Delta T_{min}}{\Delta T_{max}}}$;

d) $\Delta T_{med} = \frac{T'_m + T''_m}{2}$.

20. The Reynolds Criterion particularly characterizes:

a) Thermal convection;
b) Thermal radiation;
c) Conduction and thermal convection;
d) Does not characterize heat transfer.

Subject: FLUID MECHANICS

Chapters:

1. Properties of fluids
2. Equations of Ideal Fluid Movement
3. Statics of fluids
4. Moving real fluids
5. Theory of Similarity
6. Hydrodynamic profiles
7. Elements of Wave theory

Bibliography:

1. Petrea F., Dinu D., “Mecanica fluidelor”, Institutul de Marina Civila Constanta, 1994
2. Dinu D., “Hydraulics and hydraulic machines”, Editura Sigma Trading Metafora, 1999.

Suggested Topics:

1. The height of the wave is defined as the distance between:
   a) the Ox axis and the wave ridge;
   b) two wave taps;
   c) a wave ridge and a wave void;
   d) the Ox axis and the depth of water.

2. The modulus of elasticity of the fluids K is measured in:
   a) $N/m^{2;}$
   b) m^2/N;
   c) Kg/ms;
   d) ms/Kg.

3. The coefficient of proportionality between the frictional effort τ and the speed gradient dv / dy is called:
   a) kinematic viscosity;
   b) dynamic viscosity;
   c) coefficient of compressibility;
   d) modulus of elasticity.

4. In SI the kinematic viscosity is measured in:
   a) N/m;
   b) m^2/s;
   c) s/m^2;
   d) m/N.

5. $\frac{vl}{\upsilon}$ represent the criterion of similarity:
   a) Fr;
   b) Re;
   c) Eu;
   d) Sh.

6. Archimedes’ principle: A body immersed in a liquid is pushed from the bottom up with a force equal to:
   a) the weight of the displaced liquid volume;
   b) displaced fluid volume;
   c) mass of the displaced liquid volume;
   d) body weight.

7. For plane waves, the trajectories of the liquid particles are:
a) sine waves;
b) circles;
c) the ellipse;
d) the cosine.

8. In permanent movement (stationary):
   a) v = constant;
   b) v = v(x,y,z);
   c) v = v(x,y,z,t);
   d) p = constant.

9. In the case of floats, the metacentric height is:
   a) the distance between the meta center and the center of gravity;
   b) the distance between the center and the center of the hull;
   c) the distance between the center of gravity and the center of the hull;
   d) the distance between the meta center and the keel.

10. The piezometric slope is equal to the hydraulic slope in the case of movement:
   a) varied;
   b) permanent;
   c) uniform;
   d) rolling.

11. The equation for the power line is:
   a) $\frac{dx}{v_x} = \frac{dy}{v_y} = \frac{dz}{v_z}$;
   b) $\frac{dx}{\omega_x} = \frac{dy}{\omega_y} = \frac{dz}{\omega_z}$;
   c) $\omega_x = \omega_y = \omega_z = 0$;
   d) $\frac{v_x}{\omega_x} = \frac{v_y}{\omega_y} = \frac{v_z}{\omega_z}$.

12. In Bernoulli's equation for ideal fluids, $\frac{v^2}{2g} + \frac{p}{\gamma} + z = C$, the first term represents:
   a) the position load;
   b) piezometric load;
   c) loss of load;
   d) kinetic load.

13. In Bernoulli's equation for ideal fluids, $\frac{v^2}{2g} + \frac{p}{\gamma} + z = C$, the second term represents:
   a) the position load;
   b) piezometric load;
   c) loss of load;
   d) kinetic load.

14. In Bernoulli's equation for ideal fluids, $\frac{v^2}{2g} + \frac{p}{\gamma} + z = C$, the third term represents:
   a) the position load;
   b) piezometric load;
   c) loss of load;
   d) kinetic load.

15. The subtense of the profile is:
a) the distance between extrados and intrados;
b) the distance between the attack board and the flight deck;
c) equal to the length of the wing;
d) the distance between the median line and the intradose

16. The cloth is:
a) the distance between extrados and intrados;
b) the distance between the attack board and the flight deck;
c) equal to the length of the wing;
d) the distance between the median line and the intrados

17. The additional force that occurs when moving real fluids to the movement of ideal fluids is:
a) the mass force;
b) the inertia force;
c) the pressure force;
d) the viscosity force.

18. The absolute water pressure at a 5 m depth is:
a) 5 bars;
b) 1,5 bars;
c) 0, 5 bars;
d) 15 bars.

19. The relative water pressure at a 5 m depth is:
a) 5 bars;
b) 1,5 bars;
c) 0, 5 bars;
d) 15 bars.

20. The expression „*Any variation of pressure created at a certain point of an incompressible fluid is transmitted with the same intensity at any point in the mass of this fluid*" represents:
a) The law of Archimedes;
b) The principle of interconnecting vessels;
c) The Hydrostatic Paredox;
d) Pascal's principle.

Subject: HEAT ENGINES

Bibliography:

1. Buzbuchi. N., Stan, L. *Procese şi caracteristici ale motoarelor navale*, Colecţia Maşini Navale, Editura Nautica, ISBN 978-973-7872-78-4, 200 pag. A4, Constanţa, 2008
(Chapters 1, 2, 3, 4, 5, 6, 9, 10)

2. Buzbuchi. N., Stan, L**.** *Construcţia motoarelor navale şi a sistemelor auxiliare ale acestora*, Colecţia Maşini Navale, Editura Nautica, ISBN 978-973-7872-79-1, 350 pag. A4, Constanţa, 2008
(Chapters 1, 2, 3, 4, 6, 7, 9,10)

Suggested Topics:

1. According to the second principle of thermodynamics, the thermal efficiency of a cycle is:

a) The ratio between the amount of heat introduced and the mechanical cycle work;

b) The ratio between the mechanical work of the cycle and the amount of heat introduced;

c) The ratio between the amount of heat input and the exhaust;

d) The ratio between the amount of evacuated heat and the input.

2. The four-stroke engine piston carries four strokes during:

a) Each rotation of the crankshaft;

b) Each cycle of operation;

c) Making two motor cycles;

d) Each semi-rotation (180^{o}RAC) of the crankshaft.

3. In the four-stroke diesel engine, the intake valve opens:

a) Before p.m.i. and closes after p.m.e .;

b) After p.m.i. and closes after p.m.e .;

c) Before p.m.i. and closes before PM;

d) After p.m.i. and closes before p.m.e.

4. Which of the following conditions can simultaneously cause high combustion pressure and low flue gas temperature:

a) Incorrect fitting of the injection pump rack;

b) Excessive opening of the exhaust valve;

c) Fuel injection too high;

d) Too much engine load.

5. Calculating the amount of oxygen required to burn 1 kg of fuel is done using the relation:

a) $\nu_{O_2} = \frac{c}{12} + \frac{h}{4} + \frac{s}{32} + \frac{o}{32} \quad \left[\frac{kmol\,O_2}{kgcomb}\right]$;

b) $\nu_{O_2} = \frac{c}{12} + \frac{h}{2} + \frac{s+o}{32} \quad \left[\frac{kmol\,O_2}{kgcomb}\right]$;

c) $\nu_{O_2} = \frac{c}{12} + \frac{h}{4} + \frac{s}{32} - \frac{o}{32} \quad \left[\frac{kmol\,O_2}{kgcomb}\right]$;

d) $\nu_{O_2} = \frac{c}{12} + \frac{h}{2} + \frac{s - o}{32} \quad \left[\frac{kmol\,O_2}{kgcomb}\right]$.

6. Let a compression ignition engine operating on a mixed combustion cycle with a fuel whose chemical analysis indicates the following: c, h, o. During one cycle it is assumed that 1 kg of fuel is burned with the excess air α,and the quality of the gas exchange process is evaluated with the residual flue gas coefficient γ_r. The following parameters are considered to be known: pressure p_a, temperature T_a, the universal gas constant $\Re$ and the compression ratio ε. Under these conditions, the volumes of the mixture existing in the engine in the states a şi c shall be:

a) $V_a = \frac{\alpha}{0.21}\left(\frac{c}{12}+\frac{h}{4}-\frac{o}{32}\right)\frac{(1+\gamma_r)\Re T_a}{p_a}$; $V_c = \frac{\varepsilon}{\varepsilon-1}V_a$;

b) $V_a = \frac{\alpha}{0.79}\left(\frac{c}{12}+\frac{h}{4}-\frac{o}{32}\right)\frac{(1+\gamma_r)\Re T_a}{p_a}$; $V_c = \frac{1}{\varepsilon}V_a$;

c) $V_a = \frac{\alpha}{0.21}\left(\frac{c}{12}+\frac{h}{4}-\frac{o}{32}\right)\frac{(1+\gamma_r)\Re T_a}{p_a}$; $V_c = \frac{1}{\varepsilon}V_a$;

d) $V_a = \frac{\alpha}{0.21}\left(\frac{c}{12}+\frac{h}{4}-\frac{o}{32}\right)\frac{(1+\gamma_r)\Re T_a}{p_a}$; $V_c = \varepsilon V_a$.

7. After the cylinder shirring of a cylinder-chamber engine in the cylinder head, the new compression ratio:
a) depends on the value of overcharging pressure;
b) decreases;
c) stays constant;
d) increases.

8. Which of the following statements are valid for the turbocharging system:
a) the turbine speed is dependent on engine load;
b) the air is compressed into the supercharger air cooler;
c) the blower speed is given at engine speed;
d) The power absorbed by the blower varies with engine speed.

9. The direct measurement of effective engine power by avoiding the use of an imprecise mechanical efficiency is made by:
a) Planimetry of the indicated chart;
b) Measurement of hourly fuel consumption;
c) Measurement of torsional deformation of an intermediate shaft;
d) Determining the position of the injection pump drive system.

10. The charactersitic of maximum external power $P_{e\ ma}=f(n)$ is characterized by the following elements:
a) Obtaining when the injection pump rack is locked in the maximum flow position for a short period of time;
b) The length of the service life and the time interval between two successive maximum power regimes are set by the manufacturer and indicated in the engine operating documentation;
c) Most of the times the speed motors are specified and the maximum proportion that the motorcycle can have in the total running time of this mode;
d) All previous replies are valid.

11. As speed increases, the actual engine torque:
a) starts decreasing by increasing the engine own resistence;
b) it starts to grow with the improvement of the processes in the engine;
c) it starts to increase by decreasing the value of the strong torque;
d) all of the above answers are valid.

12. One of the methods of determining the indicated power of the engine is the use of the pimeter; mounted on the cylinder in operation, it gives the indication p_{mp}, as the

arithmetic mean of the average pressures on compression and expansion, $\overline{p}_c$ şi $\overline{p}_d$; then, by suspending the injection into the cylinder, the pressure indicated by the apparatus will be $\overline{p}_c$; taking into account that the indicated power is directly proportional to the average pressure indicated, the value of the latter will be:

a) $p_i = p_{mp} - \overline{p}_c$;
b) $p_i = 2(p_{mp} - \overline{p}_c)$;
c) $p_i = 2p_{mp} - \overline{p}_c$;
d) $p_i = p_{mp} - 2\overline{p}_c$.

13. The connecting rod-crank assembly is normally focused when:
a) the cylinder axis is not concurrent with the axis of rotation of the crankshaft;
b) the axis of the cylinder is concurrent with the axis of rotation of the crankshaft;
c) the axis of the cylinder is concurrent with the axis of rotation of the crankshaft and makes an angle of 45 ° with it;
d) the axis of the cylinder is concurrent with the axis of rotation of the crankshaft and makes an angle of 180 ° with it.

14. The underlying assumptions in kinematics and dynamics of engine mechanics are:
a) a stabilized operating mode of the engine;
b) a constant crankshaft angle;
c) both assumptions in a) and b);
d) both assumptions from a) and b), but only for the normal motor mechanism.

15. The acceleration of the piston is null where:
a) the piston speed is maximum;
b) the piston speed is minimal;
c) the piston speed is null;
d) when independent as to the piston speed.

16. When passing the engine from a gear characterized by turation n_1 to another one characterized by turation n_2, the ratio of the inertial forces of the rotating masses relative to an engine:
a) remains constant;
b) is equal to the speed ratio;
c) equals the cube of the speed ratio;
d) it is equal to the square of the turation ratio

17. In determining the ignition order of four-stroke engines with a cylindrical parcel number and a central plane of symmetry, the ignition possibilities are multiplied because:
a) the engine cycle is performed at 720^{o}RAC;
b) the number of cylinders is even;
c) there are pairs of cranks in phase two by two relative to the center of the crankshaft (central plane of symmetry);

d) the existence of the crank groups in the phase causes during the first rotation the reach of the inside dead point, for each possible two variants of the ignition order.

18. The area above the channel of the first segment and those between the segment channels is processed:

a) at different diameters, which increase in the direction of temperature reduction (from the piston head to the shell), in order to achieve the proper gambling avoidance and leak limitation;

b) at a constant height in diameter, to ensure the shape conjugated to the cylinder sleeve;

c) at different diameters, decreasing in the direction of temperature reduction (from the piston head to the shell), in order to achieve the proper gambling avoidance and leak limitation;

d) at different diameters, which increase in the direction of increasing the temperature (from the piston head to the jacket), to achieve the proper gambling avoidance and leak limitation.

19. Piston segments provide mutual sealing of the engine combustion chamber. For this, the segment:

a) develops an elastic pressure on its lateral face, the purpose of which is that its free diameter is greater than that in the mounted state;

b) develops a frictional force on the drum sleeve due to the fact that its free diameter is larger than the mounted one;

c) develops an elastic pressure on its lateral face, the purpose of which is that its free diameter is smaller than that in the mounted state;

d) it is free in the canal, which leads to the phenomenon of pulsation.

20. The piston head may be concave in order to:

a) decrease of air turbulence and improvement of mixture formation;

b) increase air turbulence and improving the formation of the mixture;

c) prevent post-carrying post-fuel Injection;

d) prolong combustion in expasion after the injection is complete

Subject: STEAM GENERATORS

Bibliography:

1. Bocănete Paul, Melinte Stelian, - *Caldari navale de abur, Teorie, construcţie şi exploatare,* Editura Gaudeamus, 2005

Chapter 1 Noţiuni fundamentale de termodinamică;

Chapter 2 Gaze reale. Vapori.

Chapter 3 Ciclul instalatiilor cu abur

Chapter 5 combustibili energetic

Chapter 6. Bilantul termic al caldarilor de abur

2. Bocănete Paul, *Turbine cu abur ,* Editura Dobrogea, 1996

Chapter 1. 2 tipuri de turbine cu abur

Chapter 1. 3 Teoria elementara a functionarii turbine cu abur

Suggested topics:

1. The amount of combustion air introduced into the furnace depends on:
   a) the nature of the fuel;
   b) the suction pressure of the gas fan;
   c) the air fan discharge pressure;
   d) the ignition temperature of the fuel.

2. The amount of heat emitted by the total combustion of one kilo of solid or liquid fuel or one m^3 of gaseous fuel is called:
   a) lower calorific power;
   b) superior calorific power;
   c) the enthalpy;
   d) physical heat of the fuel

3. The theoretical amount of air required to burn one kilogram of fuel is calculated according to:
   a) fuel density;
   b) the temperature at which combustion is carried out;
   c) the chemical composition of the fuel;
   d) the load of the boiler.

4. Which of the characteristic parameters of the auxiliary heat exchange surfaces of the boiler depends to a large extent on the thermal regime ?:
   a) the inner diameter of the tubes;
   b) the number of bends of the tube coils;
   c) outer diameter of the tubes;
   d) the thickness of the tube walls.

5. Which of the following fittings are specifically used on the boiler air supply routes:
   a) valves;
   b) registers;
   c) safety valves;
   d) taps.

6. With an action turbine, the discs are the support bracket for:
   a) mobile blades;
   b) sealing labyrinths at the turbine ends;
   c) nozzle;
   d) sealing labyrinths between the turbine steps.

7. When reducing the load of the boiler, which of the following is the correct maneuver?:
   a) reduce the amount of fuel, reduce the amount of air and then reduce the draft;
   b) the air flow is reduced;
   c) the fuel temperature is reduced;
   d) the water level in the boiler is reduced and the condenser pressure is monitored.

8. At the end of the condensation process, the titre is:
   a) x=0,85 - 0,9;
   b) x=0;

c) x=0,5;
d) x=1.

9. At the end of the vaporization process, the titre is:
a) x=0;
b) x=1.
c) x=0,85 - 0,9;
d) x=0,5;

10. At the action and reaction turbine:
a) the first steps are reactive and the last ones are active;
b) the first steps are active and the last ones reactive;
c) the first steps are active only if they are Curtis type and the latter are reactive;
d) there is no rule, each constructor chooses the solution depending on the use of the turbine.

Subject: HYDRO-PNEUMATIC MACHINES

Bibliografie:

1. Dumitru Dinu, Petrea Florea- *Masini hidropneumatice si pneumatic,* Editura IMC, Constanta, 1993

Chapter 2 Pompe si motoare hidraulice
Chapter 3 Masini pneumatic
Chapter 4 Aparatura de comanda si auxiliara
Chapter 5 Aparatura de masura

Suggested topics:

1. Which of the following terms is used to identify the pressure with which a liquid enters a pump:
a) suction height;
b) pump head;
c) discharge height;
d) total height.

2. In combating fire on electrical equipment the most effective extinguishing agent is:
a) spray water;
b) steam;
c) mechanical foam;
d) CO2.

3. To fill the refrigerant at the high-pressure side of an air-conditioning plant, you must enter the refrigerant by:
a) exhaust valve in the form of vapor;
b) the suction valve in the form of a liquid;
c) liquid filling valve;
d) vapor purge valve of the condenser.

4. To give maximum efficiency, two-stage air compressors are usually:
a) horizontally mounted;
b) never have filters mounted on the suction side;

c) are fitted with intermediate coolers;
d) always operate unloaded.

5. Axial piston pumps are provided with a hole in the drain housing in order to:
a) provide ventilation in case of accumulation of air in the installation;
b) drain the water accumulated in the pump before starting it;
c) help to completely remove the hydraulic oil from the plant before starting any repairs;
d) prevent damage caused by turbulence and overheating of oil accumulated in the pump body due to minor internal leaks.

6. Screw pumps are classified as:
a) cyclodextrin pumps;
b) non-leaking screw pumps;
c) single rotor screw pumps;
d) all of the above.

7. Specify which parameter characterizes the operation of the pump in the grid?
a) the flow rate or pumping capacity, which is the quantity of pumped fluid in the unit of time, measured at the pump discharge flange;
b) manometric pumping height (pumping pressure), which is the useful mechanical work transferred to the fluid by the pump rotor (increase of the fluid energy by the pump rotor);
c) the power required to drive the pump, which is the mechanical work transmitted to the pump in the unit of time consumed in order to flow the flow;
d) the flow or pumping capacity, which is the quantity of pumped fluid in the unit of time, measured at the pump discharge flange + the pumping pressure which is the useful mechanical work transferred to the fluid by the pump rotor (increasing the energy of the fluid by the pump rotor) + the power required to drive the pump, which is the mechanical work transmitted to the pump in the unit of time consumed to drive the flow.

8. The first operation performed after the pump is driven with the actioning motor is:
a) the free rotation of the rotor when operated manually;
b) the free rotation of the rotor starting and stopping the drive motor;
c) checking the direction of rotation of the pump;
d) checking the lubrication system of the bearings.

9. The procedure for checking the centering of a rust pump is as follows:
a) place the ruler perpendicular to the axis of the two shafts so that they rest on the generators of a semicouple. Perform four-point measurements at 90 degrees on the circumference of the coupling by manually rotating the subassembly;
b) place the ruler parallel to the axis of the two shafts so that it rests on the generator of a semicouple. Measure the two-point measurement at 180 degrees on the coupling circumference;
c) place the ruler parallel to the axis of the two shafts so that it rests on the generator of a semicouple. Perform four-point measurements at 90 degrees on the circumference of the coupling by manually rotating the subassembly;
d) place the ruler parallel to the axis of the two shafts so that it rests on the generator of a semicouple. Perform six-point measurements at 60 degrees on the circumference of the coupling by manually rotating the subassembly.

10. The purpose of a variable dredge used in a hydraulic system is:
a) to prevent the oil from flowing back to the operating devices;
b) to prevent overheating of the hydraulic pump;
c) to adjust the movement speed of the hatch covers at the closings / openings;
d) to limit the supply of oil to the unloaded hatch covers.

Subject: ELECTROTECHNICS –ELECTRIC MACHINES

Bibliography:

1. Al. Timotin, V. Hortopan - *Lectii de bazele electrotehnicii,* Bucuresti, EDP 1962
2. R. Radulet - *Bazele electrotehnicii, Probleme,* Bucuresti EDP, vol I 1970, vol II 1975
3. I. Antoniu, *Bazele Electrotehnicii*, Bucuresti, EDP, 1974
4. Bala C. *Masini Electrice* EDP Bucuresti 1982
5. Fransua Al. *Masini Electrice de actionari electrice* EDP Bucuresti 1978
6. Galan N. *Masini Electrice* EDP Bucuresti 1981
7. Gheorghiu IS, Fransua Al, *Tratat de Masini Electrice* EA Bucuresti 1981

Suggested topics:

1. The nominal transformation ratio is:
   a) the ratio of nominal and secondary voltage in idle operation;
   b) the ratio between secondary and nominal voltages when empty;
   c) the ratio of nominal and secondary voltage in overload operation;
   d) the ratio of secondary and rated voltage in overload operation.

2. The relation $L_{11} = \frac{w_1 \varphi_{11}}{i_1}$ represents:
   a) proper inductance;
   b) mutual inductance;
   c) dispersion inductance;
   d) useful inductance.

3. On the star grouping of the three-phase transformer:
   a) the line voltage is equal to phase voltage;
   b) the effective line voltage value is $\sqrt{3}$ times smaller than the effective value of the phase tension;
   c) the effective line voltage value is $\sqrt{3}$ times greater than the effective value of the phase tension
   d) the effective line voltage value is equal with the effective value of the phase tension;

4. Which of the electrical parameters of an electrical transformer remains unchanged:
   a) power;
   b) tension;
   c) the frequency;
   d) the number of phases.

5. At the ring switch of the transformer connection:
   a) The line current is equal to the phase current

b) The line current is $\sqrt{3}$ greater than the phase current;
c) The line current is $\sqrt{3}$ lesser than the phase current;
d) The line current is half the phase current

6. When the transformer is short-circuited:
a) winding currents have very high values;
b) winding currents have negligible values;
c) the idle current has high values;
d) winding currents have low values.

7. In engine mode, the asynchronous machine:
a) has a start resistance on the induced winding;
b) has a rotor coupled to a primary engine;
c) has a start resistance on the rotor;
d) has the induced coupled with a primary engine.

8. The reaction of the induced to a transformer is espressed by the relation:
a) $\theta_{\mu} = w_1 i_1 + w_2 i_2$;
b) $\theta_{\mu} = w_2 i_2$;
c) $\theta_{\mu} = w_1 \frac{du_1}{dt} + w_2 \frac{du_2}{dt}$;
d) $\theta_{\mu} = w_1 i_1 - w_2 i_2$

9. In the technical theory of the single-phase transformer:
a) useful and dispersive inductances are used;
b) iron losses are neglected;
c) overlapping effects are used;
d) magnetic saturation is not taken into account.

10. The output of the single-phase transformer:
a) depends on iron loss;
b) depends only on the active power;
c) depends only on reactive power;
d) also depends on active power and reactive power.

11. In engine mode, the asynchronous machine receives power from the grid and:
a) only transforms it into losses in the ferromagnetic core
b) converts it only into Joule losses
c) converts it into mechanical power
d) converts it into mechanical power and back into electrical power

12. Reducing the supply voltage of an asynchronous motor can not be performed by:
a) autotransformer supply
b) the star-delta connection of the stator winding
c) the parallel connection of the stator winding
d) fitting impedances in the stator circuit

13. When operating an asynchronous machine as an asynchronous motor, sliding s is in the field of:

a) $0 \langle s \langle 1$;
b) $-1 \langle s \langle 1$;
c) $s \rangle 1$;
d) $s \langle -1$

14. In engine mode, the asynchronous machine receives power from the grid and:
a) converts it into mechanical power
b) converts it only into Joule losses
c) converts it only into losses in the ferromagnetic core
d) converts it into mechanical power and again into electrical power

15. In asynchronous generator mode, the active power is:
a) negative;
b) positive;
c) equal to the reactive power;
d) 0.

16. For brake mode of the asynchronous machine, the rotor speed:
a) has an inverse sense of rotation as to the stator spin field
b) has the same meaning as the rotation direction as to the stator spin field
c) has an inverse sense of rotation as to the rotor spin field
d) has an inverse sense as to the direction of rotation of the spinning field of the secondary winding

17. What is the electrical charge?
a) It is the physical size that characterizes the state of electrification of the bodies.
b) They are material particles that make up an electric conductor.
c) It is a form of matter-specific matter and can exert forces and moments on the bodies.
d) It is the physical size dependent on the forces of attraction or rejection exerted when in the vicinity of another electric charge of a different value.

18. What is the state of electrical load of the bodies?
a) it represents the state of electrification of the bodies for which the electric charge q is different from zero.
b) it represents the state of electrification of the bodies for which the electric charge q equals zero.
c) it represents the state of electrification of bodies for which the electric charge q is neutral.
d) it represents the electrification state of the bodies for which the electric charge q is positive

19. Using Ohm's law, dividing the resistance to stress (E / R), we obtain:
a) current in A
b) voltage in volts
c) resistance in ohm
d) power in watts

20. What is Coulomb's theorem?
a) Coulomb measured by means of a voltage balance, the force of interaction between the charged bodies loaded with electric charge;

b) Coulomb has determined that any electric conductor gets heated;
c) According to Coulomb's theory, the sum of the currents entering a hub is equal to the sum of the currents coming out of the hub;
d) Coulomb established the direction of current flowing through a conductor located in a magnetic field, which is encoded by the intensity of the magnetic field H and the magnetic field induction B.

Disciplina: ELECTRONICS – ELECTRONIC DEVICES AND CIRCUITS

Suggested topics:

1. Figure 2.6 shows:

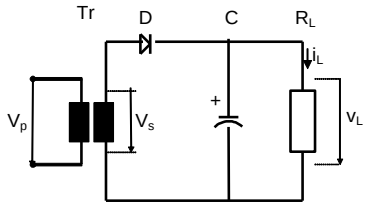


Figure 2.6

a) a mono-alternating rectifier with resistive load;
b) a double alternating rectifier with resistive load;
c) a mono-alternating rectifier with capacitive filter;
d) a double alternating rectifier with inductive-resistive load.

2. Figure 2.7 shows the waveforms characteristic of a:

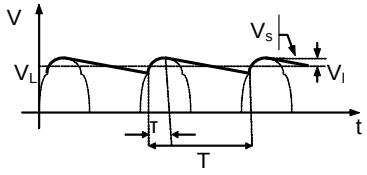


Figure 2.7

a) a mono-alternating rectifier with resistive load;
b) a double alternating rectifier with resistive load;
c) a mono-alternating rectifier with capacitive filter
d) a double alternating rectifier with inductive-resistive load

3. The value of the continuous component from the rectifier output shown in Figure 2.5 is

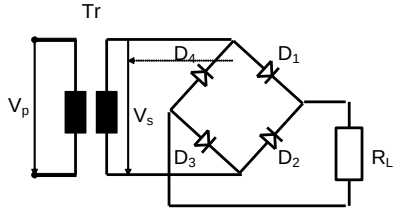


Figure 2.5

a) $V_L = \frac{2V_s}{\pi}$;

b) $V_L = \frac{V_s}{2\pi}$;

c) $V_L = \frac{V_s}{\pi}$;

d) $V_L = \sqrt{2}\frac{V_s}{\pi}$.

where

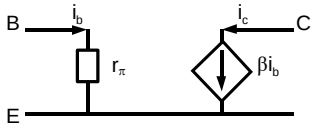
V_s - the value of the voltage amplitude in the secondary;

V_L - the value of the continuous component

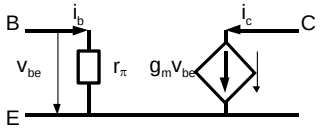
4. The collector of a bipolar transistor:
a) has the role of „collecting" the main stream of carriers circulating through the structure;
b) has the role of controlling the main flow of carriers circulating through the structure;
c) has the role of „generating" the main stream of carriers circulating through the structure;
d) does not have a specific role.

5. One of the mathematical models for the low signal quasi-static regime of a bipolar transistor is $i_c = g_m v_{be}$ şi $i_b = \frac{v_{be}}{r_\pi}$.
The corresponding equivalent scheme is shown in the noted figure:

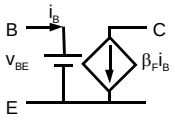
a)



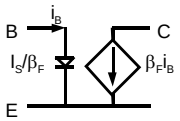
b)



c)



d)



6. Figure 3.11 shows a practical polarization circuit of a bipolar transistor. Equalizing the Thevenin divisor in the base we obtain the diagram in Figure 3.13. The equivalent diagram for the static mode of this circuit is:

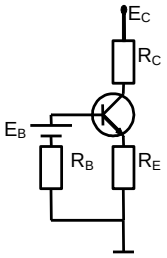
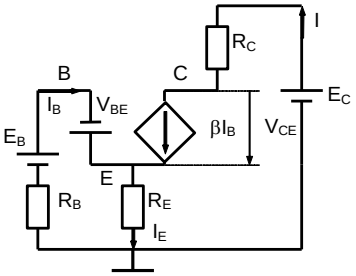
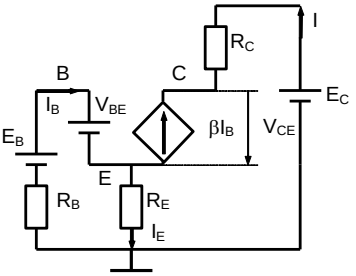


Figure 3.13

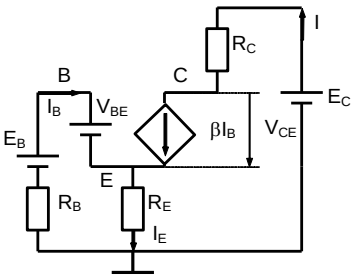
a) b)

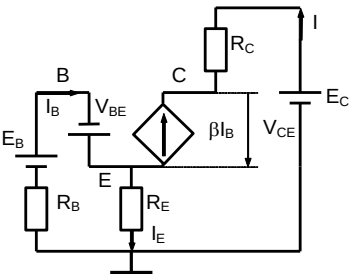


c)



d.)





7. Figure 8.3 shows the transfer feature of an operational amplifier. II. was used to note:

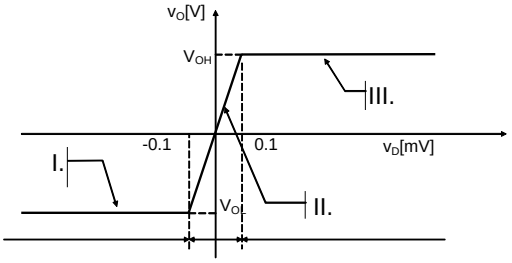


Figure 8.3
a) the negative saturation region;
b) the positive saturation region;
c) the linear region;
d) the normal active region.

8. The schematic diagram of an integration stage made using an operational amplifier is shown in Figure 8.8. The output voltage v_O has the expression:

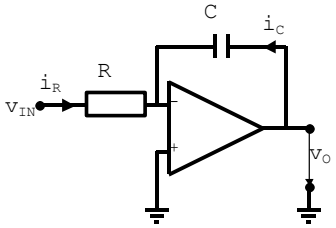


Figure 8.8

a) $v_O(t) = -RC\int_0^t v_{IN}(\xi)d\xi$

b) $v_O(t) = RC\int_0^t v_{IN}(\xi)d\xi$

c) $v_O(t) = -\frac{1}{RC}\int_0^t v_{IN}(\xi)d\xi$

d) $v_O(t) = \frac{1}{RC}\int_0^t v_{IN}(\xi)d\xi$

We shall consider $v_O(0)=0$

9. The quartz crystal used in electronics represents a small piece of polished crystal, with two of the opposite metallic sides. From an electrical point of view it behaves like a circuit whose equivalent scheme is shown in figure 11.10. The circuit has two natural resonance frequencies, one series and one parallel. The series frequency is determined by:

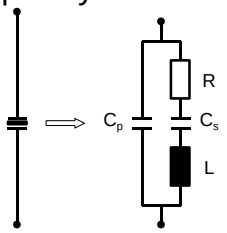


Figure 11.10

a) $\omega_s = \frac{1}{\sqrt{LC_s}}$;

b) $\omega_s = \frac{1}{\sqrt{L\frac{C_p}{C_s + C_p}}}$;

c) $\omega_s = \frac{1}{\sqrt{L\frac{C_s C_p}{C_s + C_p}}}$;

d) $\omega_s = \frac{1}{\sqrt{LC_p}}$.

10. Continuous voltage stabilizers are electronic circuits that normally interpose between the rectifier circuits and the consumer to provide a continuous and important constant voltage to the consumer. One of the reasons justifying their presence is:
a) The continuous voltage at the output of the rectifier varies depending on the value of the current being charged, in the sense that the continuous output voltage increases with the increase of the current flow rate;
b) the continuous voltage at the output of the rectifier varies depending on the alternating input voltage in the sense that the continuous output voltage decreases with the increase of the alternating input voltage;
c) Continuous voltage at the output of the rectifier varies according to the value of the current being charged, in the sense that the continuous output voltage increases with the increase of the current flow rate;
d) The continuous voltage at the output of the rectifier varies according to the dispersion of the parameters in the sense that the continuous output voltage increases with the increase

of the dispersion of the parameters of the active elements.