L-2/T-2/NAME **Date : 01/10/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2020-2021

Sub : **NAME 217** (Theoretical Ship Design)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

All the symbols have their usual meanings.

Assume reasonable values for missing data.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) How change in length, breadth and draft will affect the techno-economic performance characteristics of a ship. **(15)**

   (b) Explain how iterative procedure is used to satisfy the dimensional requirements of a ship. A 1000 DWT oil tanker ship has a speed of 12 knots. Estimate the length of the ship using Ayre formula and breadth and depth of the ship using Watson formula. **(20)**

2. (a) The following information is known for a basic General Cargo Ship and a similar new design: **(15)**

Particulars	Basic Ship	New Ship
LBP (m)	125	130
Br. Mld (m)	17	17.45
Depth Mld (m)	10	10.2
C_B (at SLWL)	0.725	0.780
Forward deck sheer (m)	2.9	3.5
Aft deck sheer (m)	1.37	1.56
Steel Weight (tonnes)	3000	---

   Estimate the steel weight of the new ship using the method of differences considering C_B corrections, scantling corrections and deck sheer corrections.

   (b) A basic oil tanker ship is 140 m LBP × 20 m Br.Mld with a final W&O weight of 800 tonnes. A new similar ship has an LBP of 138.5 m and a Br. Mld of 18.70 m. Estimate the W&O weight for the new design using proportional procedure. **(10)**

   (c) Data for a selected basic ship with Diesel machinery is as follows: **(10)**

   P_B = 4200 kW, displacement = 16373 tonnes, Service speed = 15 kt, Total machinery weight = 730 tonnes.

   A new similar design has displacement = 14733 tonnes, Service speed = 15.25 kt. If the new ship is twin screwed estimate the machinery weight (total) for the new design by the rate procedure.

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3. (a) What are the phases of Ship Design? Explain how the phases are conveniently illustrated in the design spiral as an iterative process working from owner's requirements to a detailed design. **(20)**

   (b) Towing tank test for a ship showed that when extrapolated to full size ship the P_{NE} value at 16.50 kt speed is 6100 kW. Determine the propulsive co-efficient and admiralty co-efficient required to give this service speed. **(15)**

   [Given, appendage allowances = 5%, weather allowances = 10%, ship's displacement = 32728 tonnes, shaft efficiency = 98%, QPC = 0.720].

4. (a) Explain the resistance components of bare hull in calm water with necessary figure. **(15)**

   (b) A full-scale ship is 140 m long and has speed = 15 knots, the model is 4.9 m long. The resistance is measured to 19 N in the model basin. Following the ITTC'57 approach, what is the predicted full-scale resistance? **(20)**

   The wetted surface of the full-scale ship is 3300 m^2. The density of sea water 1025 kg/m^3, that of fresh water 1000 kg/m^3, $\nu_m = 1.14 \times 10^{-6}$ m^2/s, for fresh water $\nu_s = 1.19 \times 10^{-6}$ m^2/s for sea water. Use a correlation co-efficient of $C_A = 0.0004$.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) According to the IMO standards for ship maneuverability, which criteria are to be complied of a satisfactory ship. **(18)**

   (b) What is ship rudder? What are the basic aspects to be considered in rudder design of ships? **(17)**

6. (a) What are the main economic criteria to be considered from viewpoint of marine problems? Draw a flow diagram of decision chart for choice of economic criteria in case marine problems. **(15)**

   (b) Consider the purchase of two ship navigation systems. Assume the annual interest rate is 12 percent. The capital cost, the annual maintenance and operating cost and the salvage value of these systems are shown below. Calculate the annual cost and present net value of these systems and which ship should you select, justify? **(20)**

System	1st Ship	2nd Ship
Capital cost	$ 110,000	$ 75,000
Annual maintenance and operating cost	$ 5,000	$ 10,000
Salvage values after 10 years	$ 10,000	$ 5,000

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7. (a) Discuss the pros and cons of rationally based structural design and rules-based design. Explain the strength analysis procedure of ship of global model and sub models with the help of flow diagram. **(15)**

(b) A rectangular barge is 60 m long and has a beam of 15 m. The weight distribution of the partially loaded barge is shown in Fig. for Q. No. 7(b). The barge is floating at rest in still water. Draw curves of loading, shearing force and bending moment, stating the maximum shearing force, and bending moment and position where they act. **(20)**

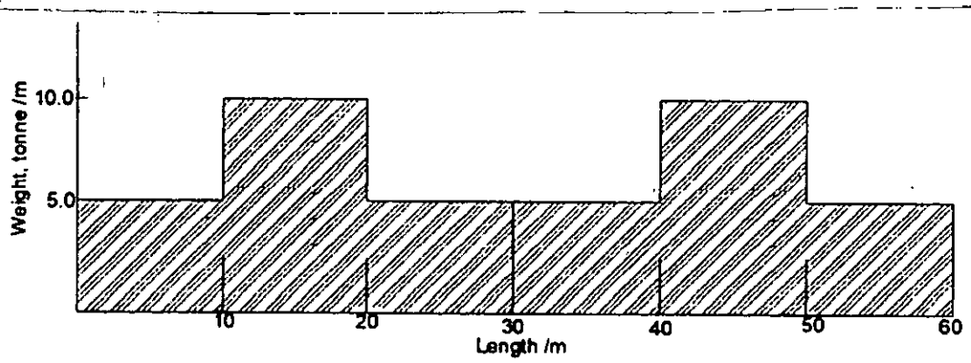

Figure for Question No. 7(b)

8. (a) Define Fresh Water Allowances (FWA). Deduce mathematical expressions of FWA in terms ship displacement, TPC, etc. **(15)**

(b) Calculate the minimum freeboard requirements considering correction for length, block coefficient and depth for the following ship in accordance with ICLL 66 regulations. **(20)**

Main particulars of the ship

Ship type: Dry cargo (B)

Length between perpendiculars, LBP: 120.00 m

Breadth, B: 20.00 m

Depth, D: 10.00 m

Load water length, LWL at 0.85: 125.00 m

Thickness of deck plating (t): 25 mm

Block coefficient at 0.85D: 0.722

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(For Question No. 8(b)

TABLE B. Freeboard Table for Type 'B' Ships

L [m]	f [mm]	L [m]	f [mm]	L [m]	f [mm]	L [m]	f [mm]	L [m]	f [mm]	L [m]	f [mm]	L [m]	f [mm]
24	200	81	905	138	2065	195	3185	252	4045	309	4726		
25	208	82	923	139	2087	196	3202	253	4058	310	4736		
26	217	83	942	140	2109	197	3219	254	4072	311	4748		
27	225	84	960	141	2130	198	3235	255	4085	312	4757		
28	233	85	978	142	2151	199	3249	256	4098	313	4768		
29	242	86	996	143	2171	200	3264	257	4112	314	4779		
30	250	87	1015	144	2190	201	3280	258	4125	315	4790		
31	258	88	1034	145	2209	202	3296	259	4139	316	4801		
32	267	89	1054	146	2229	203	3313	260	4152	317	4812		
33	275	90	1075	147	2250	204	3330	261	4165	318	4823		
34	283	91	1096	148	2271	205	3347	262	4177	319	4834		
35	292	92	1116	149	2293	206	3363	263	4189	320	4844		
36	300	93	1135	150	2315	207	3380	264	4201	321	4855		
37	308	94	1154	151	2334	208	3397	265	4214	322	4866		
38	316	95	1172	152	2354	209	3413	266	4227	323	4878		
39	325	96	1190	153	2375	210	3430	267	4240	324	4890		
40	334	97	1209	154	2396	211	3445	268	4252	325	4899		
41	344	98	1229	155	2418	212	3460	269	4264	326	4909		
42	354	99	1250	156	2440	213	3475	270	4276	327	4920		
43	364	100	1271	157	2460	214	3490	271	4289	328	4931		
44	374	101	1293	158	2480	215	3505	272	4302	329	4943		
45	385	102	1315	159	2500	216	3520	273	4315	330	4955		
46	396	103	1337	160	2520	217	3537	274	4327	331	4965		
47	408	104	1359	161	2540	218	3554	275	4339	332	4975		
48	420	105	1380	162	2560	219	3570	276	4350	333	4985		
49	432	106	1401	163	2580	220	3586	277	4362	334	4995		
50	443	107	1421	164	2600	221	3601	278	4373	335	5005		
51	455	108	1440	165	2620	222	3615	279	4385	336	5015		
52	467	109	1459	166	2640	223	3630	280	4397	337	5025		
53	478	110	1479	167	2660	224	3645	281	4408	338	5035		
54	490	111	1500	168	2680	225	3660	282	4420	339	5045		
55	503	112	1521	169	2698	226	3675	283	4432	340	5055		
56	516	113	1543	170	2716	227	3690	284	4443	341	5065		
57	530	114	1565	171	2735	228	3705	285	4455	342	5075		
58	544	115	1587	172	2754	229	3720	286	4467	343	5086		
59	559	116	1609	173	2774	230	3735	287	4478	344	5097		
60	573	117	1630	174	2795	231	3750	288	4490	345	5108		
61	587	118	1651	175	2815	232	3765	289	4502	346	5119		
62	601	119	1671	176	2835	233	3780	290	4513	347	5130		
63	615	120	1690	177	2855	234	3795	291	4525	348	5140		
64	629	121	1709	178	2875	235	3808	292	4537	349	5150		
65	644	122	1729	179	2895	236	3821	293	4548	350	5160		
66	659	123	1750	180	2915	237	3835	294	4560	351	5170		
67	674	124	1771	181	2933	238	3849	295	4572	352	5180		
68	689	125	1793	182	2952	239	3864	296	4583	353	5190		
69	705	126	1815	183	2970	240	3880	297	4595	354	5200		
70	721	127	1837	184	2988	241	3893	298	4607	355	5210		
71	736	128	1859	185	3007	242	3906	299	4618	356	5220		
72	754	129	1880	186	3025	243	3920	300	4630	357	5230		
73	769	130	1901	187	3044	244	3934	301	4642	358	5240		
74	784	131	1921	188	3062	245	3949	302	4654	359	5250		
75	800	132	1940	189	3080	246	3965	303	4665	360	5260		
76	816	133	1959	190	3098	247	3978	304	4676	361	5268		
77	833	134	1979	191	3115	248	3992	305	4686	362	5276		
78	850	135	2000	192	3134	249	4005	306	4695	363	5285		
79	868	136	2021	193	3151	250	4018	307	4704	364	5294		
80	887	137	2043	194	3167	251	4032	308	4714	365	5303		

Freeboards at intermediate lengths of ship shall be obtained by linear interpolation.

Freeboards for type A ships with length of between 365 metres and 400 metres should be determined by the following formula

$$f = -587 + 23L - 0.0188L^2$$

where f is the freeboard in mm. Freeboards for type A ships with length of 400 metres and above should be the constant value, 5605 mm.

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Regulation 29: *Correction to the Freeboard for Ships under 100 m in length*
The tabular freeboard for a Type 'B' ship of between 24 m and 100 m in length having enclosed superstructures with an effective length of up to 35 per cent of the length of the ship shall be increased by:

$$7.5(100-L)\left(0.35-\frac{E}{L}\right)mm$$

where L = length of ship in metres,
where E = effective length of superstructure in metres defined in Regulations 35.

Regulation 30 *- Correction for Block Coefficient (C_b)*

Where the block coefficient (C_b) exceeds 0.68, the tabular freeboard specified in Regulation 28 as modified, if applicable, by Regulations 27(8), 27(10) and Regulation 29 shall be multiplied by the factor (C_b + 0.68) /1.36

Regulation 31 *Correction for Depth*

- *(1). Where D exceeds L/15 the freeboard shall be increased by*

  (D - L/15) x R millimeters, where R is L/0.48 at lengths less than 120 meters and 250 at 120 meters length and above, or

- *(2). Where D is less than L/15 no reduction shall be made except in a ship with an enclosed superstructure covering at least 0.6 L amidships, with a complete trunk, or combination of detached enclosed superstructures and trunks which extend all fore and aft, where the freeboard shall be reduced at the rate prescribed in paragraph (1) of this Regulation.*

- *(3). Where the height of superstructure or trunk is less than the standard height, the reduction shall be in the ratio of the actual to the standard height as defined in Regulation 33.*

L-2/T-2/NAME **Date: 26/10/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2020-2021

Sub: **NAME 223** (Marine Hydrodynamics)

Full Marks: 210 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. A ship sailing at the phase boundary of sea water and air can be approximated as a ship moving through incompressible fluid at constant temperature. Assume, that a ship of 100.00 m is traveling at 15.00 Knot through a wave of reference period 6.2 sec. A numerical solver is being used to analyze the flow around the ship and it uses Navier Stokes equation for the purpose of solving it. However, the solver uses the dimensionless form of the equation. **(5+10+10+10=35)**

   Explain

   (a) Why the approximation, stated at the first sentence of the stem is correct?

   (b) Write down the Navier Stokes equation for an isotropic Newtonian fluid in their conservative, differential form.

   (c) Describe the mathematical process of transforming the Navier-Stokes equation for an isotropic Newtonian fluid in their conservative deferential form to the following form

$$\frac{\partial \vec{v}}{\partial t} + \left(\vec{v}^{\,T}\Delta\right)\vec{v} = \vec{f} - \frac{1}{p}\nabla P + \upsilon\Delta\vec{v}$$

   (d) Develop the mathematical equation, which the numerical solver uses, for the case stated in the stem. Take the gravitational constant to be 9.8/ms^{-2}, density of salt water at 15°C to be 1026.021 kg/m^3, atmospheric pressure 101325.00 Pa and kinematic viscosity of salt water at 15°C to be 1.1892×10^{-6} m^2/s.

2. (a) For an irrational flow part a circulating cylinder, write the equation for the stream function and discuss the possible stagnation points of the flow. **(10+18+7=35)**

   (b) How can the flow part a 'Rankine body' be developed from compositing elementary flows? Write the stream function for a Rankine body and also find the expression for length, profile and width of the body.

   (c) What is 'Magnus effect'?

3. (a) Deduce the equation for velocity distribution in an irrational vortex. Will this equation hold true for real fluids? Discuss **(15+15+5=35)**

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(b) Derive the ϕ - and ψ - function for a doublet; and sketch the equipotential lines, and streamlines for a doublet at the origin.

(c) What is 'added mass'?

4. (a) What are streamlines? Briefly discuss the characteristics of stream lines. **(10+15+10=35)**

(b) What are the characteristics of stream function and how are these characteristics used to define stream function? Elaborately explain.

(c) Determine the stream function for parallel flow with a velocity V inclined at an angle α to the x-axis.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

Assume reasonable values for missing data.

5. (a) Derive the expression of circulation in relation with the components of rotation about the normal to the surface, where the surface contains no singular point. State necessary assumptions and approximations. **(20)**

(b) What do you mean by residue of ω? Express the residue function for the case where singularity exists. **(5)**

(c) Using Blasius's theorem, for flow past a circular cylinder with circulation, show that the drag force is zero and the lift force is - pUK. **(10)**

6. (a) For parallel viscous flow between two fixed parallel plates, derive the expression **(17)**

$$u = \frac{1}{2\mu}.\frac{dp}{dx}\left(b^2 - y^2\right),$$ where the

symbols have their usual meanings.

(b) Derive the Karman - Prandtl equations for velocity distribution in turbine flow past smooth and rough boundaries. **(13)**

(c) What do you mean by shear velocity? Why it is important in the boundary layer theory? **(5)**

7. (a) Why boundary layer separation is important? Explain the way by which the growth in the boundary layer being restricted. Also, explain schematically why the line of boundary layer separation moves upstream to the equilibrium position. **(14)**

(b) Explain why Bernoulli equations are not strictly applicable to real fluid flow. **(6)**

Contd P/3

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Contd... Q. No. 7

(c) Distinguish between laminar, transition and turbulent boundary layer. How Reynold's number value can be used to define the different boundary layers? **(10)**

(d) Explain analytic functions with singular points. **(5)**

8. (a) Discuss the significance of $d\omega/dz$. **(10)**

(b) If $\omega = f(z)$, where $\omega = \phi + i\psi$ and $z = x + iy$, find the values of ϕ and ψ for the following functions of z and with neat sketch identify the flow patterns in the z-plane. **(15)**

(i) $\omega = m \ln \dfrac{z+a}{z-a}$

(ii) $\omega = U\left(z + \dfrac{a^2}{z}\right)$

(c) Schematically explain the transformation of flow past an ellipse. **(10)**

L-2/T-2/NAME **Date: 20/10/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2020-2021

Sub: **HUM 211** (Sociology)

Full Marks: 140 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) What are the underlying factors that contributed to the development of sociology as an independent discipline? **(10)**

   (b) Critically discuss the functionalist perspective of sociology. **(13 1/3)**

2. (a) What is meant by socialization? Explain primary socialization and anticipatory socialization with relevant examples. **(10)**

   (b) Explain H. M. Johnson's view of conditions of successful learning. **(13 1/3)**

3. (a) What is social stratification? Explain the caste system and class system of social stratification. **(10)**

   (b) What is meant by social mobility? Explain different types of social mobility. **(13 1/3)**

4. Write short notes on any **THREE** of the following: **(23 1/3)**

   (a) Ethnocentrism and cultural relativism.

   (b) Daniel Rosside's five class model of industrial society.

   (c) Social norms and social values.

   (d) Sociology is a categorical discipline and not a normative discipline.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Describe the socio-economic impact of globalization in Bangladesh. **(13 1/3)**

   (b) Illustrate the social impact of the British industrial revolution. **(10)**

Contd P/2

HUM 211/NAME

6. (a) Critically discuss the demographic transition theory of population. **(13 1/3)**

   (b) Summarize the salient features of an urban community. **(10)**

7. (a) What is human migration? Describe the forces that cause human migration. **(13 1/3)**

   (b) Demonstrate five major components of demography. **(10)**

8. Write short notes on any **THREE** of the following **(23)**

   (a) Natural hazards

   (b) Exposure

   (c) Adaptation

   (d) Resilient

L-2/T-2/NAME **Date: 16/10/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2020-2021

Sub: **EEE 261** (Electrical and Electronic Technology for Marin Engineers)

Full Marks: 210 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

Symbols have their usual meanings.

The figures in the margin indicate full marks

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE** questions.

1. (a) What is an infinite bus? Why the oncoming generator must have a higher frequency as compared to the running system to operate the generator in parallel? What are the other conditions for paralleling generators? **(3+3+4=10)**

(b) Explain the effect of increasing the (i) governor's set point and (ii) field current on a generator operating in parallel with an infinite bus with the help of house diagrams and phase diagrams. **(6+6=12)**

(c) During a short-circuit test, a Y-connected synchronous generator produces 100 A of armature current per phase at a field current of 2.5 A. At the same field current, the open-circuit line-voltage is measured to be 440 V. **(5+8=13)**

(i) Calculate the saturated synchronous reactance under these conditions.

(ii) If the armature resistance is 0.3 Ω per phase, and the generator supplies 60 A to purely resistive Y-connected load at this field current setting, determine the voltage regulation under these load conditions. The no-load line voltage is 440 V.

2. (a) Explain the generation of a rotating magnetic field in a synchronous machine. Show that the magnetic field will have the same magnitude of $1.5B_m$ at any time. **(15)**

(b) The following test data were taken on a 7.5-hp, four-pole, 208-V, 60Hz, design A, Y-connected induction motor having a rated current of 28 A. **(20)**

DC test:

$V_{DC} = 13.6$ V $I_{DC} = 28$ A

No-load test:

$V_T = 208$ V $I_A = 8.12$ A $I_B = 8.2$ A $I_C = 8.18$ A $P_{in} = 420$ W $f = 60$ Hz

Locked-rotor test:

$V_T = 25$ V $I_A = 28.1$ A $I_B = 28.0$ A $I_C = 27.6$ A $P_{in} = 920$ W $f = 15$ Hz

Determine the equivalent circuit parameters and sketch the per-phase equivalent circuit for this motor. Assume stator and rotor reactance have the same value.

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3. (a) Explain the starting problem of a synchronous motor. How can it be overcomed using Amortisseur windings? Use appropriate figures to explain. **(4+7=11)**

(b) From the phasor diagram of a synchronous motor undergoing change of field current, derive the sync motor V curve. Explain the under-excited and over-excited operation of synchronous motors. **(6+6=12)**

(c) A 208-V Y-connected synchronous motor is drawing 50 A at unit power factor from a 208-V power system. The field current flowing under these conditions is 2.7 A. Its synchronous reactance is 1.6 Ω and armature resistance can ignored. Assume a linear open-circuit characteristics. **(6+3+3=12)**

(a) Find V_ϕ and E_A for these conditions.

(b) Find the torque angle δ.

(c) What is the static stability power limit under these conditions?

4. (a) Derive the induction motor torque-speed characteristics. Draw the curve showing the characteristics regions and explain it briefly. **(10+5=15)**

(b) What is synchronous speed? Why an induction motor cannot operate at synchronous cannot operate at synchronous speed? Explain the methods for varying speed of an induction motor. **(5+5+10=20)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

Assume a reasonable value for any missing data.

5. (a) Explain briefly early effect of a BJT with its I-V characteristics. How is this effect included in BJT's signal model? **(6+4=10)**

(b) Consider the following Common Emitter amplifier. **(3+5+7=15)**

I. What is the function of the capacitor C_E?

II. Draw the equivalent π-model of the amplifier.

III. Find the expression of gain for this amplifier considering the early effect.

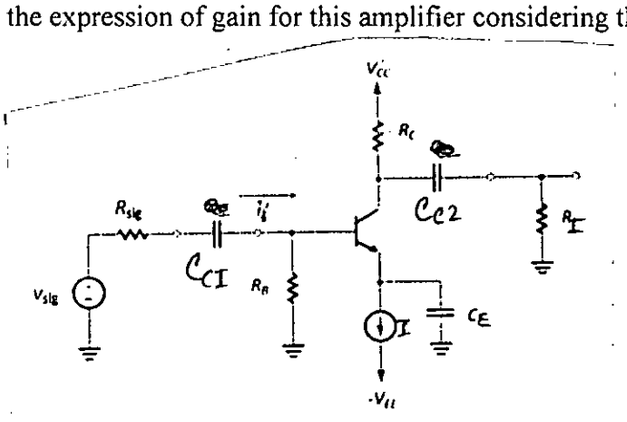

Figure for question 5(b)

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Contd... Q. No. 5

(c) Consider the following BJT biasing circuit. Find the maximum value of R_C so that the BJT remains in the active region. **(10)**

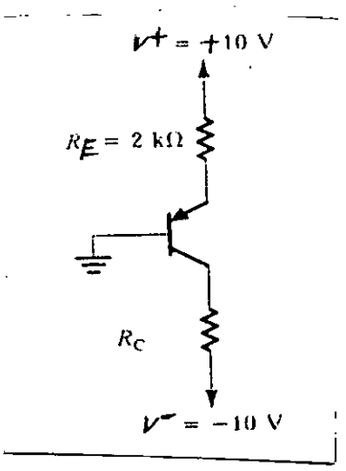

Figure for question 5(c)

6. (a) Draw the circuit diagram of a full-wave bridge rectifier and derive the PIV (Peak Inverse Voltage) for each diode. **(4+6=10)**

(b) For the circuit given in Figure for Q. 6(b), find the limit of output voltage v_0 for $-10 \leq v_I \leq 10$. Assume the diodes are ideal. Also draw the transfer characteristics of the circuit. **(13)**

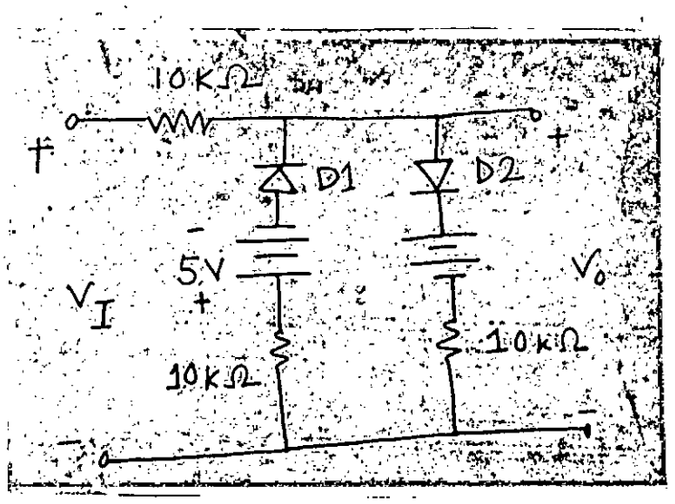

Figure for Q. 6(b)

(c) Draw the output waveform for the circuit given in Figure for Q 6(c). Assume diodes are ideal. **(12)**

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Contd... Q. No. 6(c)

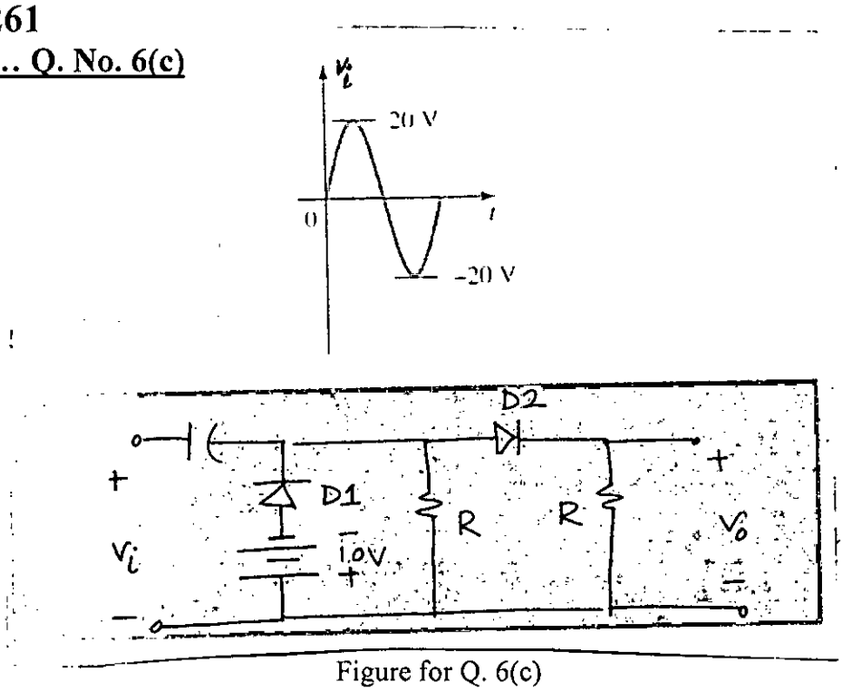

Figure for Q. 6(c)

7. (a) Explain briefly the different operation regions of an enhancement NMOS transistor with necessary graphs. **(10)**

(b) The NMOS and PMOS transistors in the circuit of Figure for Q 7(b) are matched with $k_n'\left(\frac{W_n}{L_n}\right) = k_p'\left(\frac{W_p}{L_p}\right) = 1mA/V^2$ and $V_{tn} = V_{tp} = 1V$. Assuming $\lambda = 0$ for both device, find the drain current i_{DN} and i_{DP} and the voltage v_0 for v_I = 0V, +2.5V and -2.5V. **(17)**

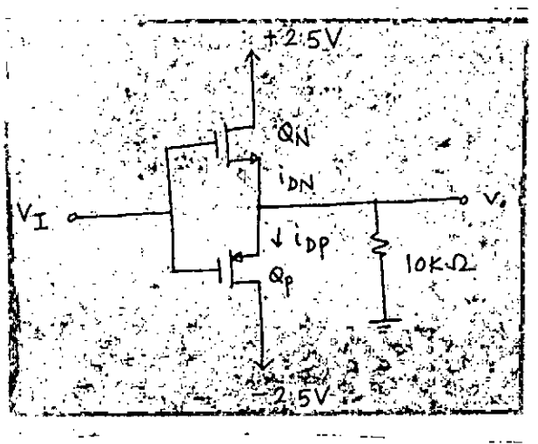

Figure for Q. 7(b)

(c) Consider a process technology for which L_{min} = 0.4μm, t_{ox} = 8 nm, μ_n = 450 cm^2/V-s, V_t = 0.7 V. Dielectric constant of SiO_2 is 3.9. **(8)**

(i) Find C_{ox}. What is the significance of this parameter?

(ii) Find k_n'

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8. (a) Describe briefly with necessary diagrams the two-transistor model of a Silicon Controlled Rectifier (SCR). **(12)**

(b) Consider a single-phase half wave controlled rectifier. If the input to this rectifier is $v_I(t) = V_m \sin(\omega t)$, derive the expression for the average value of output voltage for a resistive load. Assume that α is the firing angle. For what value of α, the rectifier will behave like an uncontrolled single phase half wave rectifier? **(8+2=10)**

(c) Consider the circuit in Figure for Q 8(c). Here, G is the gate trigger pulse and α is the firing angle. $v_I(t) = V_m \sin(\omega t)$ is the input signal. Draw the output voltage V_0 for $\alpha = 0, \frac{\pi}{6} and \frac{\pi}{3}$. **(13)**

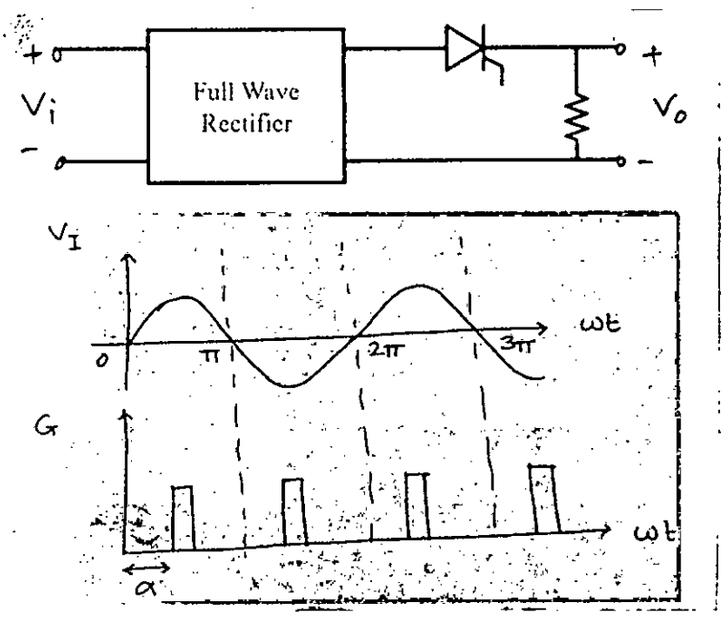

Figure for question 8(c)
